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N53 Hackballscross to Rassan

Environmental Report

Louth County Council

May 2021

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1. Introduction

Louth County Council (LCC) appointed Atkins to prepare an Environmental Report as part of the Part 8 Planning Application for the upgrade of the existing N53 route between Hackballscross to Rassan in County Louth.

The Louth County Development Plan 2015–2021 (LCC, 2015) earmarks the N53 for general improvements over the course of the plan. The overall aim of the scheme is to produce a safer route, which will adequately allow for an increase in traffic flow along this section of road.

The Emerging Preferred Route which was identified in 2019, has been further developed as part of the Preliminary Design Stage. The proposed scheme will commence at an appropriate tie-in point adjacent to Hackballscross in the Townland of Carrickastuck in Co. Louth and traverse west through the town lands of Annaghvacky and Rassan to tie-in to the existing engineered road cross section point in the Townland of Rassan. The scheme consists of the realignment of circa 3.3km of the existing N53 National Secondary Route. The proposed scheme location is presented in Figure 1-1. The proposed red-line development boundary and relevant preliminary design drawings are presented in Appendix 1.

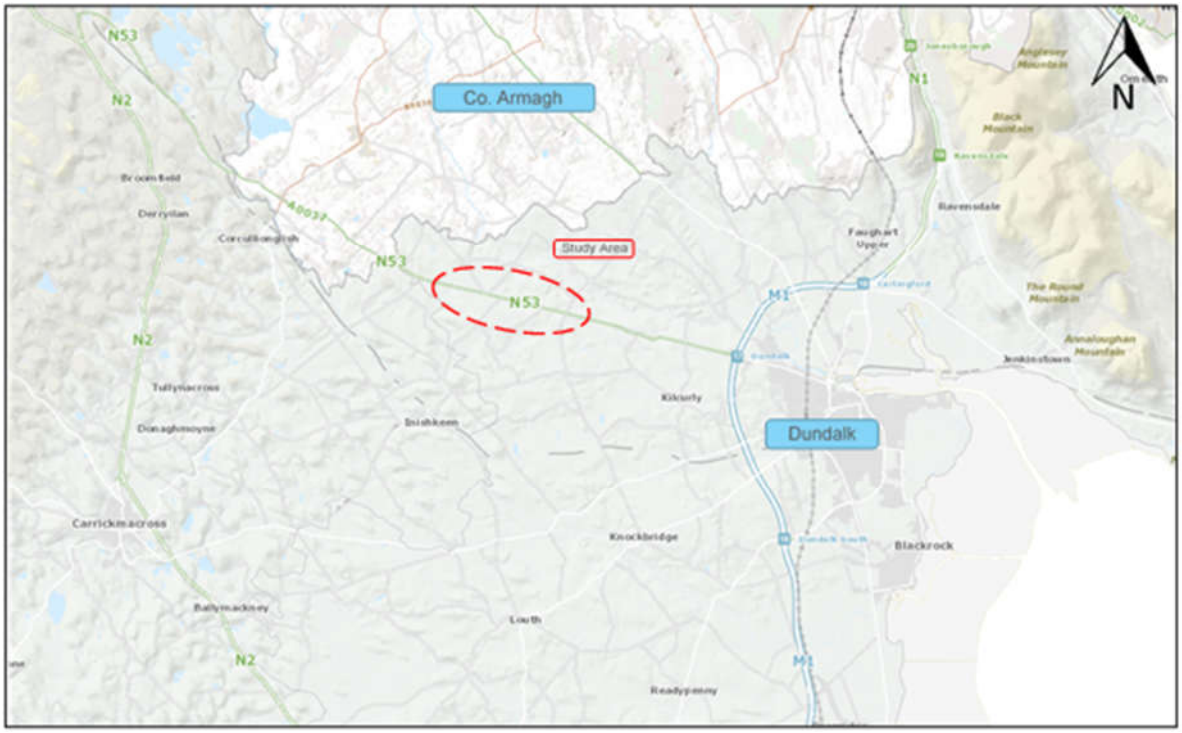


Figure 1-1 - Scheme Location

The existing N53 carriageway is a single carriageway, generally 6.0m wide with grass verge widths varying between 0.5m and 2.5m. The speed limit is generally 100km/h however reduces to 80km/h and 60km/h each side of, and through, Annaghvacky. There are no hard shoulders present, nor footways/cycleways, which creates an inherently hazardous environment for vulnerable road users such as pedestrians and cyclists. There is no formal surface water drainage system present and run off from the road surface simply runs along the edge of the carriageway and discharges into the nearest ditch. The uneven surface results in surface water ponding in certain areas during periods of heavy rainfall.

The route passes through a small crossroads at Annaghvacky which has a local shop and several residential properties. The N53 also caters for significant HGV volumes. By its nature, the National Secondary Route is a strategic traffic route from the northeast to the northwest and runs partly through Northern Ireland. However, the high number of local accesses and the rural environment within which it lies means there is a significant proportion of local traffic and slow-moving agricultural vehicles.

These factors, combined with those already mentioned, lead to unreliable journey times. In addition, road safety is a particular concern along the route given the poor alignment, mix of regional and local traffic, observed traffic speeds and the general lack of facilities / space for vulnerable road users. The

N53 Hackballscross to Rassan Scheme is classified as a Minor Project (< €20m) [Ref: TII Project Appraisal Guidelines Unit 2.0].

1.1. Purpose of this Report

This report has been prepared as part of the Part 8 application by Louth County Council in relation to the upgrade of the existing N53 route between Hackballscross to Rassan in County Louth. 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 Atkins (2021) EIA Screening Assessment (document reference; 5187353DG0114) prepared as part of the Part 8 Planning Application, 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 broadly informed through consideration of the following best practice guidance documents where relevant (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, Architectural and Cultural Heritage;
- Chapter 10 - Traffic;
- Chapter 11 - Ecology;
- Chapter 12 - Landscape and Visual;
- Chapter 13 - Agronomy; and,
- Chapter 14 - Population & Human Health.

1.3. Report Methodology

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

- All available information for the site (including topographic surveys, ecological surveys, geophysical survey, Ground Investigation Information (IGSL, 2021) and preliminary engineering information);
- Draft Louth County Development Plan 2021-2027 (Louth County Council, 2021);
- Environmental Protection Agency (EPA) Envision mapping (EPA, 2021);
- GSI Datasets Public Viewer and Groundwater web-mapping (GSI, 2021);

- Louth County Council Climate Change Adaption Strategy 2019-2024 (Louth County Council, 2014);
- Louth County Council Noise Action Plan 2018-2023 (Louth County Council, 2018);
- Louth County Development Plan 2015-2021 (Louth County Council, 2015);
- N53 Hackballscross to Rassan Flood Risk Assessment (document reference. 5187353DG0110) (Atkins, 2021);
- N53 Hackballscross to Rassan Option Selection Report (document reference: 5187353DG0033) (Atkins, 2020);
- National Biodiversity Data Centre Map Viewer (NBDC, 2021);
- National Monuments Service Historic Environment Viewer (NMS, 2021);
- National Parks and Wildlife Services Map Viewer (NPWS, 2021);
- National Road Authority (2005) Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes;
- National Road Authority (2006) A Guide to Landscape Treatments for National Road Schemes in Ireland;
- National Road Authority (2009) Guidelines for Assessment of Ecological Impacts of National Roads Schemes;
- Office of Public Works Flood Maps (OPW, 2021);
- Ordnance Survey Ireland (OSI) web-mapping (OSI, 2021);
- TII (2008) Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes;
- Transport Infrastructure Ireland (TII) National Strategic Noise Maps (TII, 2021); and,
- Wetlands Surveys Ireland – Map of Irish Wetlands (2021).

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 subconsultants between May 2017 and April 2021. These include but are not limited to ecological surveys, geotechnical surveys and geophysical surveys.

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 & Vibration; Air Quality; and Air Quality Impact Assessment on Ecological Sites), Philip Farrelly & Company (Agronomy), Rubicon Heritage (Archaeology, Architectural and Cultural Heritage) and Eamonn Byrne Landscape Architects (Landscape and Visual).

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 N53 at a regional and national level:

- Louth County Development Plan 2015 – 2021;
- Draft Louth County Development Plan 2021 – 2027;
- 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. Louth County Development Plan 2015 - 2021 (LCDP)

As outlined in the LCDP *'a modern, sustainable, safe transportation system is essential for the health of the* economy, environment and society. Such a system actively contributes to social inclusion and quality of life.' (LCC, 2015). The LCDP also recognises the importance of the national and regional primary road network through the county which provides commuter and intercity services.

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

- ***TC 1*** *– 'To fully capitalise on the transportation advantages which County Louth possesses through pursuing an integrated transport approach to development which facilitates access to a range of transport modes and provides genuine transport choice';*
- ***TC2*** *– 'To support the implementation of government transport policy as expressed in Transport 21, A Sustainable Transport Future – A New Transport Policy for Ireland 2009 - 2020, Spatial Planning and National Roads–Guidelines for Planning Authorities 2012, National Cycle Policy Framework 2009, Traffic Transport Assessment Guidelines 2014, Smarter Travel and other relevant policy documents which may evolve during the course of the Plan';*
- ***TC3*** *– 'To promote land use planning measures which aim for coordination and integration between land use and transport throughout the County, thereby maximising the potential of the County's transportation network and encouraging travel by public transport, walking and cycling';*
- ***TC4*** *– 'To encourage the provision of modes of transport which are accessible to all, including people with impaired mobility by reason of disability, age or care roles';*
- ***TC5*** *- 'To promote, in collaboration with the Department of Transport, Tourism and Sport (DTTS) and other relevant agencies and organisations, the expansion of the network of walking and cycling routes throughout the County';*
- ***TC6*** *- 'To adhere to the principles contained within the guidance document, Design Manual for Urban Roads and Streets (2013) Department of Transport, Tourism and Sport (DTTS)/ Department of the Environment, Community and Local Government (DECLG).;*
- ***TC 20 –*** *'To secure the implementation of the Council's Road Improvement Programme 2015 – 2021 as detailed in Tables 7.7, 7.8, and 7.9 in consultation and agreement with the Department of Transport and National Roads Authority subject to available funding and to keep free from development all lands identified for the construction and improvement of national, regional and local roads within the County. All proposed transport routes will be required to comply with the Habitats, EIA and SEA Directives'; and,*

- ***TC 24 –*** *'To promote the development of cycling by the provision of cycle routes in both rural and urban areas'.*

The key policies of the development plan in terms of environment are:

- ***ENV 3 –*** *'To promote and maintain the highest achievable standards of air, noise and water quality in the County';*
- ***ENV 6 –*** *'To implement the Louth County Council Noise Action Plan 2013-2018 in order to avoid, prevent and reduce the harmful effects, including annoyance, due to environmental noise exposure';*
- ***ENV 7 –*** *'To require that where new development is proposed within the limits of the noise maps for the designated sections of roads in the County, appropriate mitigation measures are undertaken so as to prevent harmful effects from environmental noise'; and,*
- ***ENV 27 –*** *'Development sites must be investigated for the presence of invasive alien species, which if present must be treated and/or eradicated in accordance with best practice'.*

The key policies of the development plan in terms of heritage are:

- ***HER 3*** *– 'To ensure that all proposed developments comply with the DECLG "Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities 2010';*
- ***HER 4 –*** *'The Local Authority will ensure that a screening for Appropriate Assessment (AA) on all plans and projects and or Stage 2 Appropriate Assessment (NIS/NIR) where appropriate , is undertaken to make a determination. Natura 2000 sites located outside of the County but within 15 km of the proposed development site should also be included in such screenings. All screening assessments submitted to the planning authority shall include a written statement indicating control methods proposed to prevent the spread of invasive species onto a Natura 2000 site';*
- ***HER 5 –*** *'Any plans or projects that would have a significant adverse impact (either individually or in combination with other plans and projects) upon the conservations objectives of any Natura 2000 site will not be permitted';*
- ***HER 10 –*** *'To afford protection to the landscapes and natural environments of the County, by permitting only those forms of development that are considered sustainable and do not unduly damage or take from the character of the landscape or natural environment';*
- ***HER 20 –*** *'To protect archaeological sites and monuments, underwater archaeology, and archaeological objects, which are listed in the Record of Monuments and Places (RMP), and to seek their preservation in situ (or at a minimum, preservation by record) through the planning process'; and,*
- ***HER 42 –*** *'To review and update the Record of Protected Structures to include all structures considered to be of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest when new information becomes available and to make additions and deletions as appropriate'.*

2.1.2. Draft Louth County Development Plan 2021 – 2027

The draft Louth County Development Plan 2021-2027 is due for adoption during Q4-2021. The draft plan supports the project under section 7.8 Strategic Roads as the *'Draft Plan promotes and supports a modal shift to more sustainable modes of transport it also recognises that improvements to the existing road infrastructure in the County are required in order to improve connectivity and support more balanced economic development. This will allow settlements to fulfil their economic potential'.* The progression of the N53 Hackballscross to Rassan Scheme will be supported in the Draft Plan and is listed as a National Road Project in Table 7.3 of the Draft Plan.

The key policies of the draft development plan in terms of transport infrastructure are:

- ***MOV 39 -*** *To protect the strategic transport function of national roads, including motorways through the implementation of the 'Spatial Planning and National Roads – Guidelines for Planning Authorities'; and,*
- ***MOV 39 -*** *To support major road and bridge improvement projects set out in Tables 7.3 and 7.4 and any other project identified by the Council or included in the Roads Programme by*

reserving the corridors, as and when they are identified, of any such proposed routes, free of development, which would interfere with the provision of such proposals.

2.2. Stakeholder Consultation

2.2.1. Utility and Service Providers

As part of the constraints study phase of the scheme all major service providers were contacted 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, Eir services and Irish Water services. Service conflicts have been identified and outline proposals for either protecting or diverting these services will be agreed with the service providers during the Detailed Design Phase.

2.2.2. Statutory Bodies

Consultations took place between Atkins, Louth County Council (LCC) and Transport Infrastructure Ireland (TII), which have been ongoing since January 2019.

Consultation took place between Atkins and the National Park Wildlife Services (NPWS) GIS department in regard to the presence of Annex I habitat; Transition mire and quaking bog [7140] within Annaghvacky West wetland site.

Consultation was carried out as required with relevant statutory bodies throughout the pre-planning stages of this scheme, including Teagasc advisors to compile information on agricultural enterprises within the Study Area at TII Project Management Guidelines (PMG) Phase 2 Option Selection.

2.2.3. Public Consultations

Three public consultations were held. Firstly, to display to the public the selected Study Area and any identified constraints (September 2017), followed by a public display of the Phase 2 Route Options (April 2019), and a third public consultation was carried out to display the Emerging Preferred Route (October 2019).

2.2.4. Landowners

Consultation has taken place with the various landowners whose lands will be impacted by the proposed scheme. Individual meetings with the design team and Philip Farrelly & Co. occurred with each agricultural land owner (where required). 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.

2.3. 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 appraise route options, and ultimately to identify a preferred route. Five route options were appraised under the following criterion; Economy, Safety, Environment, Accessibility, Integration and Physical Activity. Full details are presented in Atkins (2020) Report entitled *'N53 Hackballscross to Rassan Option Selection Report* (document reference; 5157353DG0033) published on LCC's website, 19th May 2020. The 'Brown' route emerged from the appraisal process as the emerging preferred route. Key engineering and environmental considerations associated with the preferred Route (Brown Route) are summarised below.

2.3.1. Engineering Considerations

- The proposed route will require 3no. mainline junctions;
- The proposed scheme will require 1no. subway structure;
- The proposed scheme will require attenuation ponds;

- The proposed scheme will require 2no. watercourse crossings; 2no. tributaries of the Castletown River; namely Annaghvacky Stream and Carrickastruck Stream; and,
- A Type 1 Single carriageway, as per Figure 2-1 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 have a total cut of 154,800m^3 of material, with ca. 157,200m^3 of fill required.
- **Water:** There are 2no. minor streams within the study area. These include the Annaghvacky Stream and Carrickastuck Stream. These streams are tributaries of the Castletown River which is located ca. 500m north of the study area. Shallow groundwater is likely to be encountered beneath the eastern portion of the proposed scheme and is connected to the Annaghvacky West Wetland, part of which is a designated Annex I Habitat. Potential impacts include impacts to groundwater levels and/ or groundwater quality in the vicinity of the wetland (and associated biodiversity impacts).
- **Archaeology, Architectural and Cultural Heritage:** There are no Protected Structures, Architectural Conservation Areas (ACAs), sites listed in the National Inventory of Architectural Heritage (NIAH), National Monuments, or sites subject to a preservation order within the vicinity of the proposed scheme.
- **Traffic:** The proposed scheme is anticipated to have a positive impact on road user safety and improve journey time savings.
- **Ecology:** The Carrickastuck Stream, Drumboat Stream and Inishkeen Stream which receive drainage from the proposed roadway flow into the Castletown River and/or Fane River which outfall into Dundalk Bay which is a Special Area of Conservation (SAC) (Site Code: 000455) / Special Protection Area (SPA) (Site Code: 004026) / Ramsar Site and proposed Natural Heritage Area (pNHA Site Code: 000455). The western portion of the proposed route passes adjacent to the Annaghvacky West Wetland site which has habitats with conformity to Annex I Habitat; transition mire and quaking bog, and potential impacts include those to groundwater levels or groundwater quality in the vicinity of the wetland site. The Annex I Annaghvacky West Wetland is located adjacent to the proposed scheme between approximately Ch. 700 and Ch. 1200. The proposed scheme does not intercept the Annex I Annaghvacky West Wetland.

  The proposed route directly intersects the south side of the Annaghvacky (Hackballscross) Wet Woodland, located between approximately Ch. 2700 and 2900 and there will be an estimated loss of 0.465ha. of this locally important habitat.
- **Landscape and Visual Amenity:** The proposed scheme will pass through undisturbed agricultural lands. There would be some disruption to local landform from cutting and filling required to fit this route into the landscape. There will be adverse effects on pasture / arable farmland, hedgerows and trees to accommodate proposed carriageways, embankments and cuttings.
- **Agronomy:** There are no significant impacts on the 20no. land parcels.
- **Noise and Vibration:** AWN have determined that once operational, the noise impact associated with the proposed road scheme will result in a negligible to moderate impact during the long term period at the assessment locations. A number of locations experience a positive noise impact as the proposed road scheme is at a greater distance than the existing road.
- **Air Quality and Climate:** AWN have determined that the air quality impact on the Annaghvacky West Wetlands (including Annex I habitat) as a result of the proposed road scheme is considered positive, localised, long-term and imperceptible.

Other potential environmental impacts considered, associated with the proposed scheme, include Material Assets (Chapter 7) and Population and Human Health (Chapter 14).

2.4. Details of the Proposed Scheme

Louth County Council (LCC) proposes to upgrade this section of the existing N53 route between Hackballscross and an area approximately 350m west of the N53, L7120 junction at Annaghvacky, and the section of the road within Rassan townland. The proposed scheme will be realigned between

these upgrade sections and 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 route will be designed to comply with the requirements of TII Publications. 1no. residential property with 2no. associated outbuildings will be demolished as part of the proposed scheme .

The proposed scheme, currently at the Preliminary Design Phase, has the following characteristics:

- Length of proposed mainline: 3.3 km;
- Percentage online / offline: approximately 900m online / 2,500m offline;
- Mainline cross-section: Type 1 Single Carriageway (as per TII's CC-SCD-00001);
- Number of mainline junctions: 3 No. Junctions;
- Side roads realigned (from west to east): L-7120, Link back to the existing N53 (junction at chainage 1955) and the LT-31253;
- Structures: 1 No. pedestrian subway; and,
- Townlands through which it travels: (from west to east): Rassan, Shanmullagh, Annaghvacky, Carrickastuck and Barronstown.

The type of road proposed to be constructed is a Type 1 Single Carriageway for the full length of the proposed route with the exception of chainage 3000 to Chainage 3350 (approx.) where the scheme transitions into a Type 2 Single Carriageway (to facilitate the tie-in with the existing N53 at Hackballscross). A typical cross-section for this type of Carriageway is shown in the Transport Infrastructure Ireland (TII) Standard Construction Details Drawing No. CC-SCD-00001 (TII, 2017) and is reproduced in Figure 2-1 (note that all dimensions presented in the figure are in millimetres).

Pedestrians and cyclists will be catered for by the scheme. Facilities will be provided to link such users between Annaghvacky and Hackballscross, via a section of the stopped-up N53 combined with a segregated path parallel to the proposed N53. Similarly, a pedestrian subway will be provided beneath the proposed mainline to facilitate a link between Annaghvacky and Shanmullagh (along the L7120 local road).

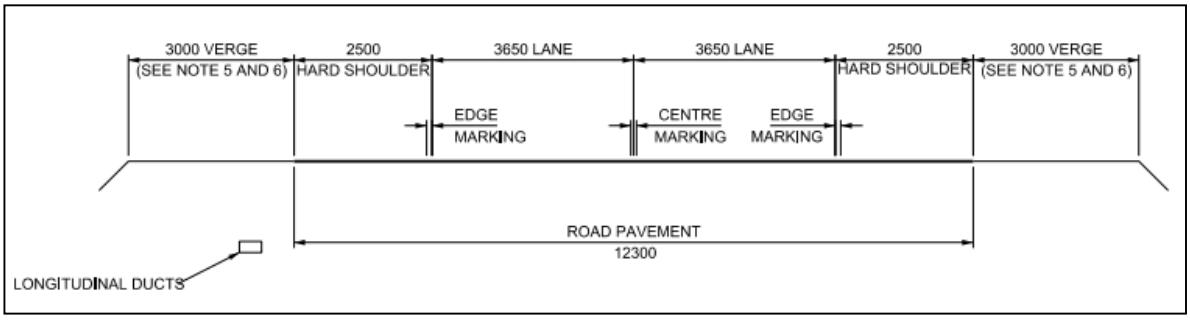


Figure 2-1 - Type 1 Single Carriageway (CC-SCD-00001)

Demolition works necessitated by the proposed scheme will be limited to 1No. House with 2No outbuildings (all of these buildings are the property of 1no. landowner).

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. Demolition works necessitated by the proposed scheme will be limited to 1no. House with 2no. outbuildings (all of these buildings are the property of 1no. landowner);
- 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 equipment including 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;
- There are numerous overhead ESB lines in the area of the existing N53 and the proposed scheme. South of Annaghvacky there is a 38kV overhead ESB line which will have to be diverted due to the new route. In addition to this a Medium voltage overhead to the South of the existing N53 will have to be redirected;
- There is an Eir cable which travels along the full length of the existing N53 and is joined by Eir services at junctions with L7120, L3117 and L7116. There is no existing public lighting provided along the length of the scheme;
- There is an existing watermain on the N53 for the entire length of the scheme. There are also mains on the L7120, L3117, L7116;
- 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 Heavy Good Vehicle (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;
- The subway structure 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 and safety barrier installations in accordance with TII Design Standards. 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.

Pedestrian subway

There is 1no. precast reinforced concrete pedestrian subway proposed (approx. Ch 1350) which will provide linkage for non-motorised users access only north-south on Shanmullagh Road. This will allow these users to traverse beneath the new mainline, thereby retaining the community connection from Shanmullagh to Annaghvacky.

Flood Risk Assessment

A Stage 1-Flood Risk Assessment (FRA) has been prepared (Atkins, 2021) (document reference 5187353DG0110) to establish whether a flood risk issue currently exists or may exist in the future. The FRA concluded that *' the proposed development while classified as a 'highly vulnerable development' as per the vulnerability classification in the planning guidelines is within Flood Zone C. Based on an examination of the data available, the FRA has demonstrated that the flood maps indicate a low risk of flooding to the proposed development. Therefore, a Stage 2 Flood Risk Assessment is not required and therefore the report shall be concluded at this point'*.

Drainage for the proposed scheme will include attenuation ponds, transverse sealed drains, filter drains and cut off drains.

Construction Site

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 proposed scheme. The Contractor will determine an appropriate location for the site compound in agreement with LCC. 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.

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 surplus 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 and disposed / recycled of at an appropriately licenced / permitted facility. Any remaining liquids are to be removed from site and disposed of at an appropriately licenced facility.

Site Compound

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 within the red-line site boundary. To ensure minimal impact on the local environment the location of the Contractors site compound should be determined with adherence to the following measures:

- The site compound shall be in a location away from private properties and domestic water supplies / private or public wells;
- The compound will be located away from sensitive areas such as watercourses, hedgerows / treelines which are considered important wildlife corridors and archaeological / architectural features). 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.
- The Contractor is to agree the location of the site compound with LCC and the site ecologist /environmental manager; and,
- The positioning of the site compound will be located so as to have no adverse impacts on the local environment during the demolition or construction phases.

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, LCC published their '*Climate Change Adaptation Strategy'* for 2019-2024 (LCC, 2019). The plan sets out the following goals;

- *'Climate change adaptations consideration are mainstream and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change';*
- *'Increased capacity for climate change resilient structural infrastructure is centred around the effective management of climate risk, informed investment decisions and positive contribution towards a low carbon society';*
- *'Sustainable policies and measures are devised influencing positive behavioural changes, supporting climate adaptation actions and endorsing approaches for successful transition to low carbon resilient society';*
- *'Fostering meaningful approaches to protect natural and key cultural assets through an appreciation for the adaptive capacity of the natural environment to absorb the impacts of climate change';*
- *'Empowered and cohesive communities with strong understanding of climate risk, increased resilience to impacts of climate change with capacity to champion climate action at local level';* and,
- *'Great understanding of risks and consequences of flooding and successful management of a co-ordinated approach to drainage and flooding.'*

The following key thematic areas have been identified by LCC as requiring action;

- Local Adaptation Governance and Business Operations;

- Infrastructure and Built Environment;
- Land use and Development;
- Drainage and Flood Management;
- Natural Resources and Cultural Infrastructure; and,
- Community Health and Wellbeing.

In developing this climate action plan LCC adapted a 5-step planning cycle which was initially based on the EPAs '*Local Authority Adaptation Strategy Development Guidelines'* and was subsequently aligned with the Local Authority Adaptation Strategy Development Guidelines 2018. The 5-step planning cycle is as follows;

1. Preparing the Ground;
2. Assessing the Adaptation Baseline;
3. Identifying Future Climate Impacts, Vulnerabilities and Risks;
4. Identifying, Assessing and Prioritising Adaptation Actions; and,
5. Drafting, Implementing and Monitoring the Strategy.

According to the Strategy '*Louth County Council has already surpassed its target of 33% reduction in its energy consumption by 2020 and has already achieved 42% reduction in energy consumption by the end of 2018.'*

3.3. Project Specific Climate Strategy

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

3.3.1. Flooding

A Stage 1 - Flood Risk Assessment (FRA) (Atkins, 2021) (document reference; 5187353DG0110) was completed to establish whether a flood risk issue currently exists with respect to the proposed scheme or may exist in the future. The FRA concluded that *'the proposed development while classified as a 'highly vulnerable development' as per the vulnerability classification in the planning guidelines is within Flood Zone C. Based on an examination of the data available, the FRA has demonstrated that the flood maps indicate a low risk of flooding to the proposed development. Therefore, a Stage 2 Flood Risk Assessment is not required and therefore the report shall be concluded at this point'*. The FRA (Atkins, 2021) states that the following recommendations are to be taken into consideration during the design and construction of the proposed development:

- Suitable Sustainable Urban Drainage systems (SuDS) are to be utilised within the proposed development to reduce surface water runoff and should be designed in accordance with TII Document Reference DN-DNG-03022 - Drainage Systems for National Roads;
- The proposed discharge of surface water drainage to existing networks and to ground, via infiltration, should be designed in accordance with best practice including the provision of pollution interceptors and sufficient treatment and be set at a maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater; unless otherwise agreed with Louth County Council;
- Existing land drains or ditches should be culverted or redirected to ensure that the natural flow of water is maintained;
- A maintenance regime for the SuDS systems is required and is to be considered as part of the overall drainage design for the proposed development. This will ensure both the design life of the SuDS systems, ongoing improved water quality and reduction of peak water runoff; and,
- A review of the final road alignment should be undertaken to determine if any culverts are required including applications for consent under Section 50 of the Arterial Drainage Act, 1945 with regards to the construction or alteration of any new or proposed bridges and/or culverts, where applicable.

3.3.2. Air Quality

Louth Climate Action Strategy 2019-2024 (LCC, 2019) sets out a number of actions which will help achieve their objective of a low carbon society, as follows;

- *'**Theme 1:** Local Adaptation Governance and Business Operations Goal: Climate change adaptations consideration are mainstream and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change.';*
- *'**Theme 2:** Infrastructure and Built Environment Goal: Increased capacity for climate change resilient structural infrastructure is centred around the effective management of climate risk, informed investment decisions and positive contribution towards a low carbon society.';*
- *'**Theme 3**: Land use and Development Goal: Sustainable policies and measures are devised influencing positive behavioural changes, supporting climate adaptation actions and endorsing approaches for successful transition to low carbon resilient society.';*
- ***'Theme 4**: Drainage and Flood Management Goal: Great understanding of risks and consequences of flooding and successful management of a co-ordinated approach to drainage and flooding.';*
- ***'Theme 5**: Natural Resources and Cultural Infrastructure Goal: Fostering meaningful approaches to protect natural and key cultural assets through an appreciation for the adaptive capacity of the natural environment to absorb the impacts of climate change';* and,
- *'**Theme 6**: Community Health and Wellbeing Goal: Empowered and cohesive communities with strong understanding of climate risk, increased resilience to impacts of climate change with capacity to champion climate action at local level.'*

A comprehensive environmental assessment was undertaken of the five route options during route selection stage. This assessment included the preparation of an air quality route selection assessment (AWN Consulting Ltd., 2019). 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 by applying the methodology of TII using the UK DMRB air dispersion model. The proposed route was given a preferred ranking in terms of air quality impact.

Due to annual traffic growth factors (as applied to all proposed national road development schemes) increased traffic flows (and accordingly carbon emissions) are anticipated. However, the need for this project is to improve the safety of the existing N53.

This project does provide an opportunity to help achieve the following LCC policies within the County Development Plan (2015):

- **TC 2** – '*To support the implementation of government transport policy as expressed in Transport 21, A Sustainable Transport Future – A New Transport Policy for Ireland 2009 -2020, Spatial Planning and National Roads–Guidelines for Planning Authorities 2012, National Cycle Policy Framework 2009, Traffic Transport Assessment Guidelines 2014, Smarter Travel and other relevant policy documents which may evolve during the course of the Plan.';*
- **TC 3** – '*To promote land use planning measures which aim for coordination and integration between land use and transport throughout the County, thereby maximising the potential of the County's transportation network and encouraging travel by public transport, walking and cycling*.';
- **TC 4** – '*To encourage the provision of modes of transport which are accessible to all, including people with impaired mobility by reason of disability, age or care roles.'*;
- **TC 5** - *'To promote, in collaboration with the Department of Transport, Tourism and Sport (DTTS) and other relevant agencies and organisations, the expansion of the network of walking and cycling routes throughout the County.'*; and,
- **TC 6** – *'To adhere to the principles contained within the guidance document, Design Manual for Urban Roads and Streets (2013) Department of Transport, Tourism and Sport (DTTS)/ Department of the Environment, Community and Local Government (DECLG).'*

Pedestrians and cyclists will be catered for by the scheme. Facilities will be provided to link such users between Annaghvacky and Hackballscross, via a section of the stopped-up N53 combined with a segregated path parallel to the proposed N53. Similarly, a pedestrian subway will be provided beneath the proposed mainline to facilitate a link between Annaghvacky and Shanmullagh (along the L7120 local road).

In addition, mitigation measures to reduce the risk of dust nuisance as detailed further in Chapter 4 – Air Quality of this report will be implemented during the construction phase of the proposed scheme.

3.3.3. Waste Management

The Contractor will be responsible for developing a site specific Detailed Construction & Demolition (C&D) Waste Management Plan (WMP) for the proposed scheme. The Contractor will incorporate all relevant mitigation measures presented in Chapter 7 - Material Assets. A core principle within the Detailed C&D WMP will be appropriate waste management via. the EU Waste Hierarchy of prevention, preparing for reuse, recycling, energy recovery and sustainable disposal. Further details are presented in Chapter 7 - Material Assets.

3.4. Summary

Due to annual traffic growth factors (as applied to all proposed national road development schemes) 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 proposed route has been selected taking account of the findings of an air quality route selection assessment (AWN Consulting Ltd., 2019);
- 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.

4. Air Quality

4.1. Introduction

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, 2021);
- Environmental Protection Agency Online mapping (EPA, 2021);
- Environmental Protection Agency Air Quality Data 'Air Quality Monitoring at Kilkitt, Co. Monaghan' (EPA, 2021). Available at http://www.epa.ie/air/quality/data/kt/;
- '*N53 Hackballscross to Rassan Option Selection Report for Air Quality'* prepared by AWN Consulting (2019); and,
- *N53 Hackballscross to Rassan Air Quality Impact Assessment on Ecological Sites'* prepared by AWN Consulting (2021).

4.2. 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. AWN Consulting have conducted an assessment of the potential air quality impacts as a result of the proposed scheme.

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 (Annex I Annaghvacky West Wetlands) is within the 2km area of influence, as it is located directly north and adjacent to the proposed scheme. Therefore the key focus of this air quality assessment is the Annex I Annaghvacky West Wetlands.

4.3. Air Quality

4.3.1. Assessment Methodology

Transport Infrastructure Ireland's (TII) document entitled "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*" (TII, 2011) provides guidance on the route selection assessment procedures in "Chapter 2 - Route Selection". The primary aspects of the assessment relate to existing ambient air quality, proximity of sensitive locations and a review of the overall significance of potential changes in air quality.

The objective at this stage is to indicate whether there are likely to be significant air quality impacts associated with the proposed scheme. In the current assessment, the number of residential properties within 50m of the edge of each route have been identified. Traffic data obtained for the opening year of 2023 has been used in the model as per the TII Guidelines (2011). The assessment of the proposed scheme has been carried out based on a calculation of the Index of the Overall Change in Exposure to NO_x and PM_{10}.

4.3.2. Baseline Air Quality

4.3.2.1. Air Pollution Sources

The major source of air pollution within the study area is road traffic, predominantly that from the existing N53. Air quality is variable and subject to significant spatial variation, with concentrations generally falling significantly with distance from major road sources. The highest levels of air pollution are experienced along the existing N53 with the remainder of the study area generally experiencing rural background concentrations of pollutants.

A review of IPPC/IED licences issued by the EPA for the region show that there are no IPPC/IED licenced facilities with emissions to the atmosphere within the study area for this project.

4.3.2.2. Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (World Health Organisation, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles (PM_{10} - $PM_{2.5}$) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

Dublin Airport Meteorological Station wind data are available for the period of 2014 - 2018. Dublin Airport Meteorological Station is located circa 70 km south of the proposed scheme, however, is considered the most representative of the conditions in the region of the proposed scheme due to its similar distance inland to the proposed scheme. Long-term hourly observations at Dublin Airport meteorological station provide an indication of the prevailing wind conditions for the region (Met Éireann, 2019). Results indicate that the prevailing wind direction is south-westerly to westerly in direction over the period 2014 – 2018, with a mean wind speed of approximately 5.5 m/s over the period.

4.3.3. Receiving Environment

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2019*" (EPA, 2020a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2020b).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2020b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed scheme is within Zone D (EPA, 2020b). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed scheme. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

NO_2 monitoring was carried out at two rural Zone D locations, Emo and Kilkitt and in the urban area, Castlebar (EPA, 2020a). The NO_2 annual average in 2019 for Castlebar was 8 µg/m^3. The rural Zone D locations of Emo and Kilkitt recorded results of 4 µg/m^3 and 5 µg/m^3 respectively in 2019. Long-term average concentrations measured at all Zone D locations were significantly lower than the annual average limit value of 40 µg/m^3. The average results over the last five years in Kilkitt and Emo suggests an upper average of no more than 3 µg/m^3 as a background concentration for a completely rural area. The annual average results over the last five years in Castlebar indicate an upper average concentration of no more than 8 µg/m^3. Based on the above information, a conservative estimate of the current background NO_2 concentration for the region of the proposed scheme is 6 µg/m^3.

Long term NO_X monitoring has been carried out at three Zone D locations in recent years: Castlebar, Kilkitt and Emo. Annual mean concentrations of NO_X at the monitoring sites over the period 2015 – 2019 ranged from 2 µg/m^3 for a purely rural area to 11 µg/m^3 for an urbanised area. These results suggest an upper average over the five year period of no more than 5 µg/m^3 as a background concentration for a rural area. Due to its rural nature, an estimate of the current background NO_X concentration in the region of the proposed scheme is 7 µg/m^3.

4.3.4. Sensitive Receptors

The number of receptors sensitive to air quality within 50m of the edge of the proposed scheme has been determined as per TII guidelines. Receptors for the purpose of this assessment are regarded as residential buildings, healthcare facilities, educational facilities, places of worship, sports and recreational facilities and shopping areas (TII, 2011). The impacts on sensitive ecosystems are discussed in Section 4.4. At this stage of the assessment no further distinction is made between different types of property. The results of this exercise were used for calculation of the Index of Overall Change in Exposure (see Section 4.3.5).

4.3.5. Calculation of the index of overall change in exposure

The calculation of the Index of Overall Change in Exposure allows a comparison of the overall air quality impact on people from each route option to be carried out. The Index is based on identifying the number of sensitive receptor locations (e.g. residential properties) within 50m of the edge of all road links that would experience a significant change in traffic from the proposed scheme. The change in emissions is influenced by changes in traffic flow, composition and speed. The analysis was carried out using the methodology of TII (TII, 2011) using the UK DMRB air dispersion model (UK DEFRA, 2007).

Pollution from traffic sources increases at low traffic speeds and during congested traffic conditions. An improvement in the road infrastructure is likely to improve traffic flow, relative to the current alignment. In addition, the number of receptors directly impacted by the proposed scheme will be less than the current route.

The proposed scheme has a NOx Exposure Index of 17,637 and a PM_{10} Exposure Index of 450. Detailed results of the analysis for the proposed scheme is provided in Table 4-3 and Table 44.

Table 4-1 - Detailed Results for NOx Assessment (Source: AWN, 2019)

Link	Average AADT (2023)		No. Receptors	Link Length (km)		NOx Emissions Rate (kg/yr)			Change in NO_x Emission Rate (kg/km/yr)	NO_x Score
	Do Nothing	Do Something	(0-50m)	Do Nothing	Do Something	Do Nothing	Do Something	Change In Emissions		
Proposed Scheme	0	7,592	14	0	3.35	0	4,220	4,220	1,260	17,637

Table 4-2 - Detailed Results for PM_{10} Assessment (Source: AWN, 2019)

Link	Average AADT (2023)		No. Receptors	Link Length (km)		PM_{10} Emissions Rate (kg/yr)			Change in PM_{10} Emission Rate (kg/km/yr)	PM_{10} Score
	Do Nothing	Do Something	(0-50m)	Do Nothing	Do Something	Do Nothing	Do Something	Change In Emissions		
Proposed Scheme	0	7,592	14	0	3.35	0	108	108	32	450

Tables 4-5 and 4-6 below detail the beneficial impact the proposed scheme will have on the receptors along the existing N53. The proposed scheme will have a beneficial impact as traffic will be diverted away from the majority of receptors along the existing alignment. The NOx and PM_{10} score are negative which indicates the beneficial impact (i.e. the lower the score the more beneficial the impact).

Table 4-3 - Detailed Results for NOx Assessment Showing Beneficial Impact of the proposed scheme on Existing N53 (Source: AWN, 2019)

Link	Average AADT (2023)		No. Receptors	Link Length (km)		NOx Emissions Rate (kg/yr)			Change in NO_x Emission Rate (kg/km/yr)	NO_x Score
	Do Nothing	Do Something	(0-50m)	Do Nothing	Do Something	Do Nothing	Do Something	Change In Emissions		
Existing N53 with the proposed scheme	8,567	1,804	29	3.3	3.3	4801	4,131	-670	-200	-5,814

Table 4-4 - Detailed Results for PM10 Assessment Showing Beneficial Impact of Route Options on Existing N53 (Source: AWN, 2019)

Link	Average AADT (2023)		No. Receptors	Link Length (km)		PM_{10} Emissions Rate (kg/yr)			Change in PM_{10} Emission Rate (kg/km/yr)	PM_{10} Score
	Do Nothing	Do Something	(0-50m)	Do Nothing	Do Something	Do Nothing	Do Something	Change In Emissions		
Existing N53 with the proposed scheme	8,567	1,804	29	3.3	3.3	123	106	-17	-5	-147

The results show that the proposed route will have the least negative impact on air quality as the least number of sensitive receptors are impacted by these alignments compared to the existing N53.

4.4. Air Quality Assessment of Potential Impacts to Annaghvacky West Wetlands (Annex I Habitat)

AWN Consulting (2021) have conducted an assessment of the potential air quality impact to the nearby ecological site (Annaghvacky West Wetlands) as a result of the proposed scheme. The proposed scheme passes directly to the south of the Annex I Annaghvacky West Wetlands, with the existing N53 alignment passing to the direct north of the Wetlands. Refer to Figure 4-1. Nitrogen oxides (NO_X) concentrations and the Nitrogen Dioxide (NO_2) dry deposition rate as a result of the existing N53 alignment and proposed scheme were calculated as part of this assessment to determine the potential for impact to the sensitive ecological site.

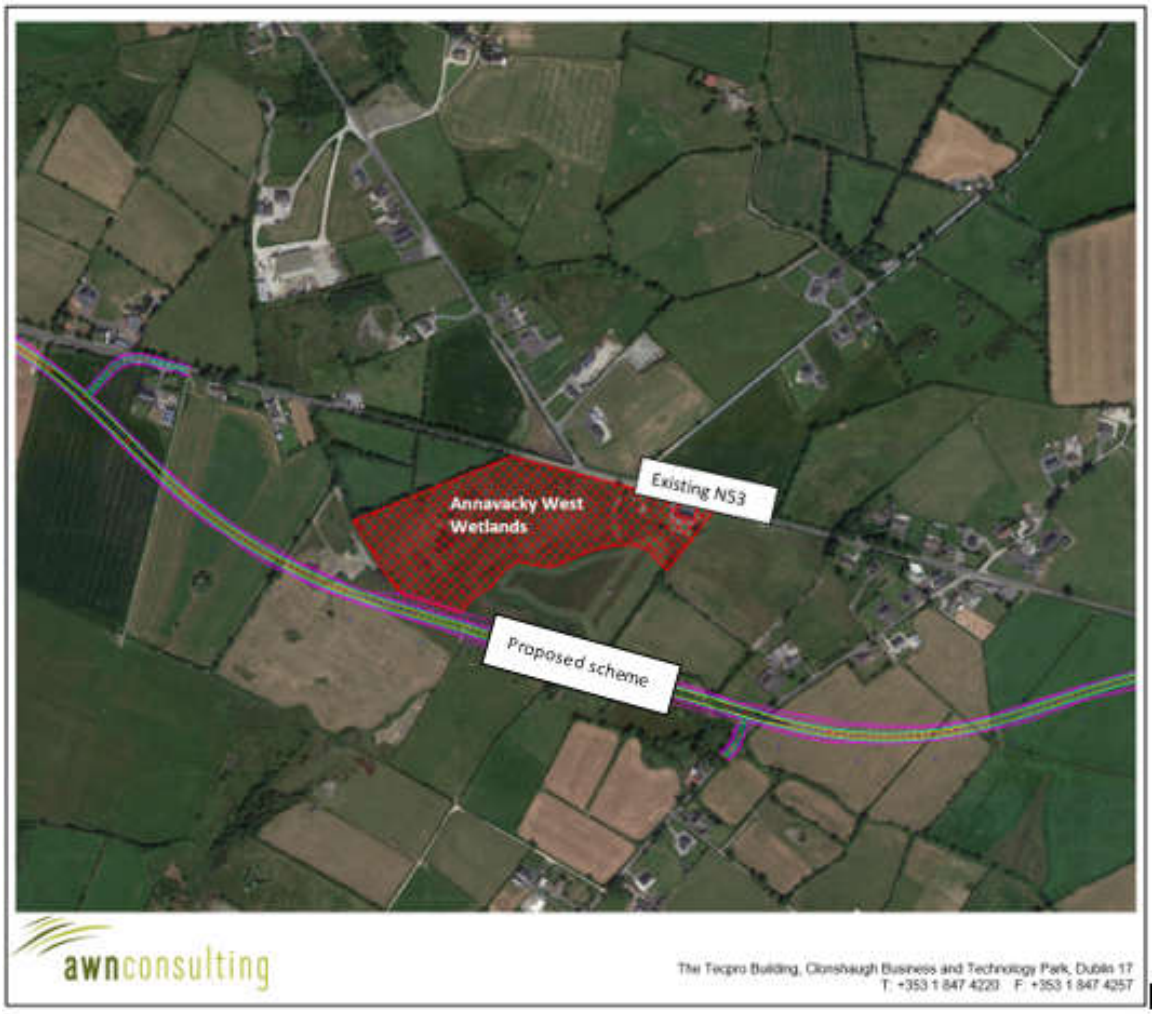


Figure 4-1 - Location and Context of Route Alignments (existing and proposed) & Ecological Site (i.e. Annaghvacky West Wetlands) (Source: AWN, 2021)

4.4.1. Air Assessment Methodology

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. Transport Infrastructure Ireland (TII) requires the Air Quality Specialist to liaise with an ecologist on schemes where there is a European protected site within 2km of the route. However, their guidance document '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*' (2011) states that as the potential impact of a scheme is limited to local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated site lies within 200m of the road centre line. Where these two requirements are fulfilled, the assessment involves a calculation of nitrogen oxides (NO_X) concentrations using the UK DMRB screening method (UK Highways Agency, 2007) as recommended by TII (2011). Only sites that are sensitive to nitrogen deposition should be included in the assessment.

The Annaghvacky West Wetlands is directly adjacent to a section of the existing N53 alignment and the proposed scheme passes to the south of the wetlands; there is therefore the potential for traffic emissions to impact the sensitive ecological site. An assessment of the impact with regards to nitrogen deposition was conducted as part of this assessment. Dispersion modelling and predictions were carried out at typical traffic speeds at this location. Ambient NO_X concentrations were predicted for the opening year of 2023 along a transect of up to 200m within the Wetlands in line with the UK Highways Agency (2007; 2019) and TII (2011) guidance. The road contribution to NO_2 dry deposition along the transect was also calculated using the methodology outlined in Appendix 9 of the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011).

The traffic data used in the modelling assessment is detailed in Table 4-7. Details on the annual average daily traffic (AADT), percentage heavy goods vehicles (%HGV), speeds and distance from the ecological site are included in the assessment.

Table 4-5 - Traffic Data used in Modelling Assessment (Source: AWN, 2021)

Road Link	Speed (kmph)	Do Nothing 2023		Do Something 2023	
		AADT	%HGV	AADT	%HGV
Existing N53	80	8,922	10.1%	1,770	9.1%
Proposed Scheme	100	0	0	7,190	10.4%

4.4.2. Assessment Criteria

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for various pollutants. The limit value in relation to NO_X has been used to determine the impact of the road realignment on the sensitive ecological site. Refer to Table 4-8.

Table 4-6 - Air Quality Standards Regulations (Source: AWN, 2021)

Pollutant	Regulation Note [1]	Limit Type	Value
Nitrogen Oxides (NOX)	2008/50/EC	Critical level for protection of vegetation	30 µg/m3 NO + NO2

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Appendix 9 of the TII guidelines (2011) state that where the scheme is expected to cause an increase of more than 2 µg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard of 30 µg/m^3, then the sensitivity of the habitat to NO_X should be assessed by the project ecologist. These criteria have been used in the current assessment.

In addition, Appendix 9 of the TII guidance also outlines published critical loads for nitrogen for specific sensitive habitats. Those in relation to mire, bog and fen habitats have been used for this assessment. The worst-case value of 10 Kg(N)/ha/yr for poor fen habitats has been used as a conservative approach in this assessment to determine the impact of nitrogen deposition.

4.4.3. Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality in Ireland 2019*" (EPA, 2020a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2020b).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2020b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed scheme is within Zone D (EPA, 2020b). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed scheme. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

NO_2 monitoring was carried out at two rural Zone D locations, Emo and Kilkitt and in the urban area, Castlebar (EPA, 2020a). The NO_2 annual average in 2019 for Castlebar was 8 µg/m^3. The rural Zone D locations of Emo and Kilkitt recorded results of 4 µg/m^3 and 5 µg/m^3 respectively in 2019. Long-term

average concentrations measured at all Zone D locations were significantly lower than the annual average limit value of 40 µg/m^3. The average results over the last five years in Kilkitt and Emo suggests an upper average of no more than 3 µg/m^3 as a background concentration for a completely rural area. The annual average results over the last five years in Castlebar indicate an upper average concentration of no more than 8 µg/m^3. Based on the above information, a conservative estimate of the current background NO_2 concentration for the region of the proposed scheme is 6 µg/m^3.

Long term NO_X monitoring has been carried out at three Zone D locations in recent years: Castlebar, Kilkitt and Emo. Annual mean concentrations of NO_X at the monitoring sites over the period 2015 – 2019 ranged from 2 µg/m^3 for a purely rural area to 11 µg/m^3 for an urbanised area. These results suggest an upper average over the five year period of no more than 5 µg/m^3 as a background concentration for a rural area. Due to its rural nature, an estimate of the current background NO_X concentration in the region of the proposed scheme is 7 µg/m^3.

Background concentrations for the opening year of 2023 have been calculated using the current estimated background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

4.4.4. Impact Assessment

Both the existing N53 alignment and the proposed scheme alignment are within 200m of a section of the Annaghvacky West Wetland. Refer Figure 4-1.

The NO_X emissions resulting from traffic associated with this section of the N53 and proposed scheme have been calculated and are detailed in Table 4-9 below. Ambient NO_X concentrations have been predicted for the opening year of 2023 as per the UK Highways Agency (2007; 2019) and TII (2011) guidance. Concentrations are predicted along a transect of up to 200m within the Wetlands. The road contribution to NO_2 dry deposition along the transect is also given and was calculated using the methodology of TII (2011).

The predicted annual average NO_X concentration within the Wetlands is in compliance with the limit value of 30 µg/m^3. Concentrations are at most 55% of the annual limit value within the Wetlands site including background levels in the do nothing (i.e. existing N53) scenario, this decreases to 50% for the do something scenario (proposed scheme). This decrease is likely due to the proposed scheme alignment being slightly further from the Wetlands site than the existing alignment, the majority of traffic is proposed to transfer to the proposed scheme therefore reducing traffic on the existing N53 which is closer to the Wetlands site.

The proposed scheme will decrease NO_X concentrations by a maximum of 1.59 µg/m^3 and overall concentrations are well below the limit value of 30 µg/m^3, therefore, the proposed scheme will not significantly impact NO_X concentrations within the Annaghvacky West Wetlands site. By moving the traffic further from the Wetlands, there is an overall improvement in NO_X concentrations.

The contribution to the NO_2 dry deposition rate along the 200m transect within the Annaghvacky West Wetlands is also detailed in Table 4-9. The change in the maximum NO_2 dry deposition rate is a decrease of 0.087 Kg(N)/ha/yr. This is well below the critical load for poor fen habitats of 10 – 20 Kg(N)/ha/yr (TII, 2011).

Overall, the air quality impact on the Annaghvacky West Wetlands as a result of the proposed scheme alignment is considered positive, localised, long-term and imperceptible.

Table 4-7 - Assessment of NOX Concentrations and NO2 Dry Deposition Impact on the Annaghvacky West Wetlands (Source: AWN, 2021)

Distance to Road (m)	NO_X Concentration (µg/m^3) Note 1			NO_2 Dry Deposition Rate Impact
	Do Nothing	Do Something	Change in NOx Concentration	Kg N ha^{-1} yr^{-1}
4	16.48	14.90	-1.59	-0.087
14	14.66	13.13	-1.53	-0.084
24	12.82	11.75	-1.07	-0.06
34	11.49	10.71	-0.78	-0.043
44	10.51	9.92	-0.59	-0.033
54	9.76	9.30	-0.46	-0.026
64	9.18	8.81	-0.37	-0.021
74	8.72	8.42	-0.30	-0.017
84	8.35	8.11	-0.24	-0.013
94	8.06	7.87	-0.19	-0.011
104	7.82	7.68	-0.15	-0.009
114	7.64	7.53	-0.11	-0.006
124	7.50	7.43	-0.07	-0.004
134	7.40	7.36	-0.04	-0.003
144	7.33	7.32	-0.01	-0.001
154	7.28	7.29	0.01	0.001
164	7.27	7.25	-0.01	-0.001
174	7.24	7.21	-0.03	-0.002
184	7.20	7.16	-0.04	-0.002
194	7.16	7.03	-0.13	-0.007

Note 1Based on a background NOx concentration of 7 µg/m^3 in 2023 and a background NO_2 concentration of 5.1 µg/m^3 .

4.5. Potential General Air Quality Impacts during 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 in section 4.7.

4.6. Potential General Air Quality Impacts during Operational Phase

There are 14no. air sensitive building receptors (including residential, commercial and industrial buildings) which may be permanently impacted by increased NO_X and PM_{10} exposure during the operational phase (AWN, 2019). However current baseline air quality is deemed to be good on a regional scale within the vicinity of the proposed scheme (EPA, 2021). The proposed scheme is located in a rural setting and aside from the existing section of the N53, there are no other significant sources of NO_X and PM_{10} in the area.

4.7. Recommendations (including Mitigation Measures)

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 if 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.

5. Noise & Vibration

5.1. Introduction

This report assesses the potential noise impacts associated with the construction and operational phases relating to the proposed scheme and assesses the requirements and opportunities for noise mitigation.

5.2. Methodology

In order to assess the noise impact of the proposed road development, the following methodology has been adopted:

- Baseline noise monitoring has been undertaken in the vicinity of the proposed road development in order to characterise the existing noise environment;
- A review of the most applicable standards and guidelines in order to set a range of acceptable noise criteria for the construction and operational phases of the proposed road development;
- Predictive calculations relating to construction phase impacts have been undertaken at the nearest sensitive locations to the development site based on British Standard BS5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1 – Noise (2009 +A1 2014);
- Operational noise levels at the closest noise sensitive locations to the proposed road development during the opening and future assessment years have been predicted in terms of the accordance with guidance set out in Calculation of Road Traffic Noise (CRTN) and the relevant conversion methodologies prescribed by TII for calculating road traffic in terms of the Lden parameter;
- Noise levels associated with the construction and operational phases have been reviewed against relevant standards and guidelines for noise to determine the potential impacts with both phases, and;
- A schedule of mitigation measures is proposed where required or practicable, to reduce the identified potential noise impacts associated with the proposed development.

5.3. Assessment Criteria

5.3.1. Operational Phase

5.3.1.1. Louth County Council Noise Action Plan (2018 - 2023)

The Louth County Council Noise Action Plan (NAP) 2018 – 2023 relates to the management of environmental noise in accordance with the Environmental Noise Directive (END) (2002/49/EC). The purpose of the NAP is to manage and reduce, where necessary, environmental noise through the adoption of the action plans.

The NAP does not include any local guidelines relating to noise criteria from new roads developments. Section 2.1.4 of the plan refers to the Transport Infrastructure Ireland (TII) Guidelines for the Treatment of Noise and Vibration in National Road Schemes.

In Section 3 Description of the Action Planning area, the action plan summarises the onset assessment levels relating to road traffic which are prescribed by the EPA. The proposed onset levels, for assessment of noise management and or mitigation measures due to exposure to road traffic noise are set as follows:

- >57 dB Lnight; and,
- >70 dB Lden

Where locations are identified to be exposed to traffic noise levels above these thresholds during the noise mapping process, they will form part of a priority decision support matrix which takes into account factors such as the noise exposure level, type of noise receptor, the type of noise source and the number of people affected. It enables a number of different factors to be examined and facilitates the assessment of the relative importance of each. Noise mitigation or management is then considered where necessary, feasible and cost effective.

5.3.1.2. Criteria for National Road Projects

There are no statutory guidelines or standards for noise in Ireland applicable for new or existing road schemes. As referred to within the Louth County NAP, for new national roads in Ireland, it is standard practice to adopt the traffic noise design goal contained within the TII document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004) and Guidance contained within the TII's Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (2014). Both documents note the use of a traffic noise design goal of 60 dB Lden (free field residential façade criterion i.e. without the influence of building reflections).

The following three conditions must be satisfied under the TII guidelines in order for noise mitigation to be provided:

a. the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60 dB Lden;
b. the relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road scheme in place, and;
c. the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

The 2014 Good Practice Guide recognises that "*in some cases the attainment of the design goal may not be possible by sustainable means*". The guidance also notes that the benefit gained by the insertion of a barrier is limited and notes that caution should be exercised specifying substantial screening where small benefits (<3 dB) are only achieved, given a change of 3 dB(A) *"is the smallest change that would give a reliable difference in public response*".

Similarly, it may not always be practicable to achieve the design goal of 60 dB Lden due to a variety of constraints, particularly for properties along existing trafficked roads, where access to properties is required directly onto roads, and/or where the alignment is in close proximity to residential buildings which bound the upgraded sections of existing regional roads.

5.3.1.3. Evaluation of Impacts

In the absence of any Irish guidelines or standards relating to describing the effects associated with changes in road traffic noise levels, reference has been made to the UK's Design Manual for Roads and Bridges (2020) LA 111 Sustainability & Environmental Appraisal, Noise and Vibration Rev 2 (DMRB Noise and Vibration 2020 document). This document provides magnitude rating tables relating to changes in road traffic noise. The document suggests that during the year of opening (the short-term period), the magnitude of impacts between the Do-Minimum and the Do-Something scenarios are likely to be greater compared to the longer term period when people become more habituated to the change.

AWN Consulting (2021) have conducted a noise assessment to assess the proposed scheme. Table 5-1 summarises the classification of magnitude of impacts relating to traffic changes which are assessed against the "Short-term" period, i.e. the year of opening in accordance with the DMRB guidance.

Table 5-1 - Classification of Magnitude of Short-term Noise Impacts (Source: AWN, 2021)

Change in Noise Level, dB	Short Term Magnitude of Impact
Less than 1 dB	Negligible
1.0 to 2.9	Minor
3 to 4.9	Moderate
Greater than or equal to 5.0	Major

Further consideration of the magnitude of change, noise levels are determined for the long-term period. For this assessment year (design year 2038), a 3 dB change is the smallest that is considered perceptible. Table 5-2 summarises the likely impact associated with defined changes in traffic noise levels between the Do-minimum and Do-something scenarios during the long-term period.

Table 5-2 - Classification of Magnitude of Long-term Noise Impacts (Source: AWN, 2021)

Noise Change, dB	Magnitude of Impact
Less than 3	Negligible
3.0 to 4.9	Minor
5 to 9.9	Moderate
Greater than or equal to 10	Major

5.3.2. Construction Phase

The TII guidance document specifies noise levels that it typically deems acceptable in terms of construction noise. These limits are set out in Table 5-3.

Table 5-3 - Maximum Recommended Noise Levels at the Façade of Nearby Dwellings during Construction (Source: AWN, 2021)

Days & Times	LAeq (1hr) dB	LAmax dB(A)
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60	65
Saturday 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30hrs	60	65

With regards to construction vibration, the TII guidelines outline the following limits in respect of ensuring that no cosmetic damage occurs to buildings in the vicinity of construction works.

Table 5-4 - Allowable vibration during road construction in order to minimise the risk of building damage (Source: AWN, 2021)

Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of:		
Less than 10Hz	10 to 50Hz	50 to 100Hz
8mm/s	12.5mm/s	20mm/s

5.4. Receiving Environment

The proposed road scheme commences west of Hackballscross and stays along the existing road alignment for approximately 1.2km before turning offline in a south-westward direction. As it bypasses the centre of Annaghvacky, it continues with an orientation approximately parallel to the existing N53 for ca. 500m before it heads in a northwest direction to tie back in with the existing N53.

5.4.1. Baseline Noise Survey

A baseline noise study has been undertaken within the study area in order to provide a context of the typical noise environment and to determine the main contributors to the existing environment. The surveying was completed in December 2020 in accordance with relevant guidance and standards including:

- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, 2004);
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII, 2014);

- Calculation of Road Traffic Noise Shortened Measurement Procedure (CRTN 1988); and
- ISO 1996-2: 2017 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2 Determination of sound pressure levels.

5.4.2. Survey Locations

Survey locations were chosen to represent noise levels at the closest noise sensitive locations to the proposed scheme. The survey comprised two unattended monitoring stations and five attended monitoring locations along the length of the proposed scheme and at properties along existing roads in the vicinity. The monitoring positions are described in Table 5-5 and illustrated in Figure 5-1.

Table 5-5 - Noise Survey Locations (Source: AWN, 2021)

Location	Survey Type	Description of Survey Location
UN1	Unattended	Within rear garden house on south side of existing N53
UN2		Within field to southwest of house along western side of L7120
AT1	Attended	Along driveway to house on north side of existing N53 at the west end of the scheme
AT2		Along lane by house on the east side of L7120
AT3		In driveway by house on north side of existing N53
AT4		At entrance to field, in line with house at junction with local road to south of existing N53
AT5		In lane next to Hackballscross Garda Station

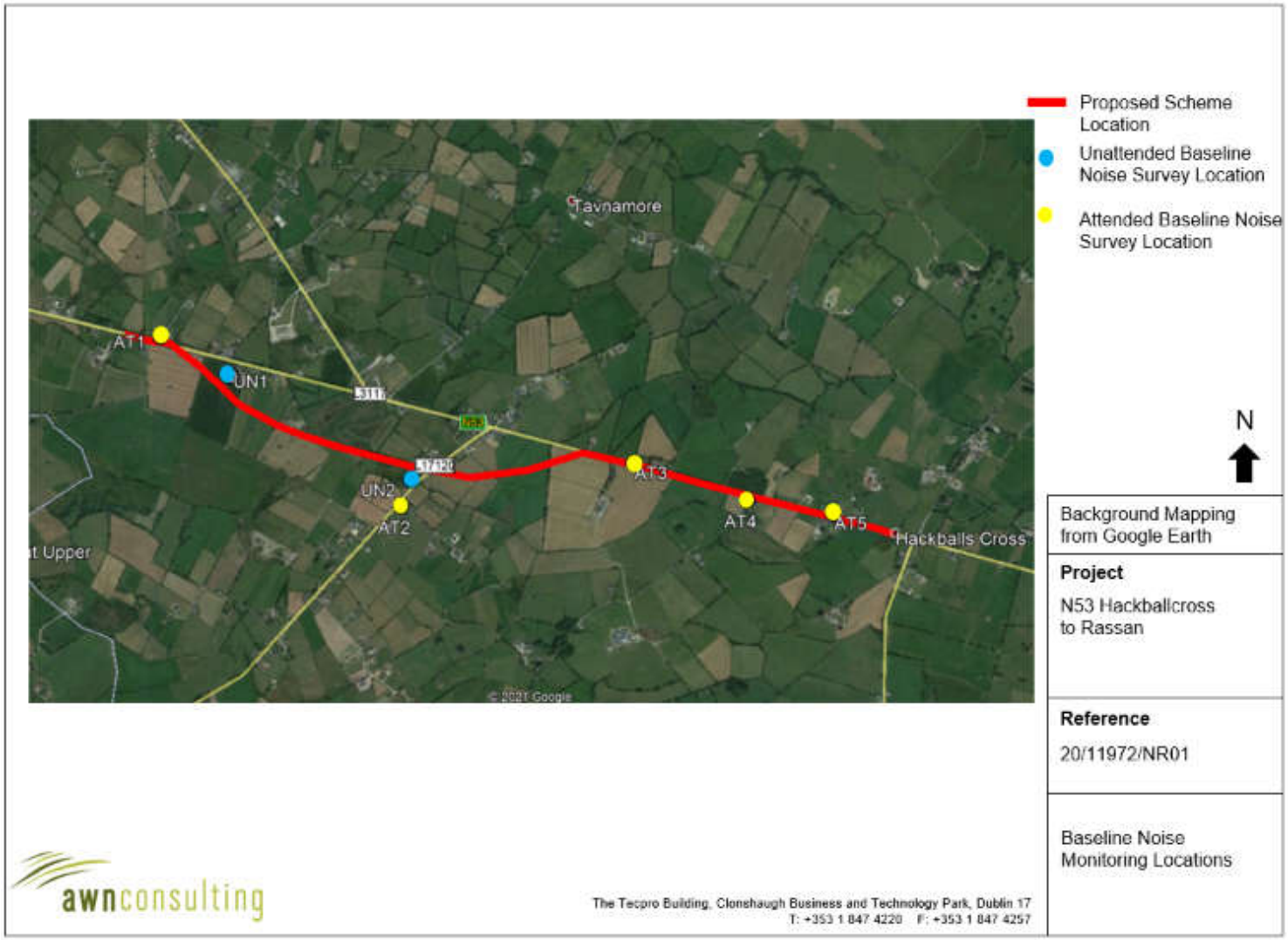


Figure 5-1 - Baseline Noise Survey Locations (Source: AWN, 2021)

5.4.2.1. Survey Periods

Attended surveys were undertaken during the following periods:

- AT1 to AT5 on 3rd December 2020 (between 10:30 to 15:15hrs).

Unattended surveys were undertaken during the following periods:

- UN1 between 10:15hrs on 3rd December; to 12:30hrs on 4th December 2020.
- UN2 between 10:30hrs on 3rd December; to 12:15hrs on 4th December 2020.

5.4.2.2. Unattended Noise Survey Procedure

The unattended noise surveys (UN1 & UN2) were conducted using Rion NL52 Sound Level Meters with Environmental Outdoor Kits. The measurement apparatus was calibrated before and after the survey using a Brüel & Kjær Type 4231 Sound Level Calibrator. The results were saved to the instrument memory for later analysis.

The Lden value from this monitoring data set is derived directly from the measured LAeq, values and using the following formula:

Where:

- L_{day} is the A-weighted long-term average sound level as defined in ISO 1996 (2017) Description, measurement and assessment of environmental noise. Part 2: Determination of sound pressure levels, determined over all of the day periods of a year. This is defined as the period between 07:00 and 19:00hrs;
- $L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. This is defined as the period between 19:00 and 23:00hrs; and
- L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2:2017, determined over all the night periods of a year. This is defined as the period between 23:00 and 07:00 hrs.

The average sound levels are based on the L_{Aeq} parameter. This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The time period T in this instance is 1 hour i.e. $L_{Aeq,1hr}$.

5.4.2.3. Attended Noise Surveys

Attended measurements were performed using a Rion NL52 Sound Level Meter. Measurements were conducted at five survey locations on a cyclical basis. Sample periods were 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

The survey work was conducted in accordance with the short-term measurement procedure as specified in the TII noise guidance documents. When surveying traffic noise, the acoustical parameters of interest are the LAeq(T), LA10(T) and LA10(18hour), expressed in terms of decibels (dB) relative to 2x10-5Pa.

The value of LA10(T) is the noise level exceeded for just 10% of the time over a representative time period within a sample hour period. LA10(18hour) is the arithmetic average of the values of LA10(T) for each of the one-hour periods between 06:00 and 24:00hrs. LA10(18hour) is the parameter typically used for the purposes of assessing traffic noise.

The shortened measurement procedure involves a method whereby LA10(18hour) and Lden values are obtained through a combination of measurement and calculation as follows:

Noise level measurements are undertaken at the chosen location over three consecutive hours between 10:00 and 17:00hrs;

- The duration of the sample period during each hour is selected to encompass sufficient traffic flows to ensure reliable results;
- The LA10(18hour) for the location is derived by subtracting 1 dB from the arithmetic average of the three hourly sample LA10 values, i.e.

  LA10(18hour) = ((∑LA10(15 minutes)) ÷3) – 1 dB; and
- The derived Lden value is calculated from the LA10(18hour) value, i.e.

  Lden = 0.86 x LA10(18hr) + 9.86 dB.

5.4.2.4. Survey Parameters

The survey results are presented in terms of the following parameters.

$L_{Aeq,T}$ is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value. T relates to the sample duration.

$L_{A10,T}$ is the A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic. T relates to the sample duration.

5.4.2.5. Results of Noise Surveys

Tables 5-6 and 5-7 summarise the results of the baseline noise survey. Full survey results for the unattended surveys conducted at Locations UN1 and UN2 are graphed in Appendix 5.1.

The results of the survey have indicated the existing noise environment at locations in the vicinity of the proposed scheme and set back from existing local and regional roads were measured in the order of 53 dB Lden. Noise levels at monitoring locations close to or along existing roads to the east and west of the proposed scheme were measured in the range of 59 to 61 dB Lden.

Road traffic, local estate activities and general suburban ambient sources all contributed to the ambient noise levels. The range of noise levels measured is considered typical of the environment under assessment.

Table 5-6 - Baseline Attended Noise Survey Results (Source: AWN, 2021)

Survey Location Reference	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)		Calculated $L_{A10,18hr}$ dB	Calculated L_{den}, dB	Description of Noise Environment
		L_{Aeq}	L_{A10}			
AT1	10:41	72	76	76	75	Road traffic on existing N53 dominated noise environment. During the first measurement a car engine idling at the lane entrance for a short period. Birdsong and aircraft were also occasionally audible.
	12:18	73	77			
	15:20	74	79			
AT2	11:02	48	50	52	55	Traffic on the existing N53 was clearly audible. A distant generator related to the ground investigation works was audible during the first measurement period. Other noise sources included occasional vehicle movements on the L7120.
	12:37	56	57			
	14:01	52	53			
AT3	11:22	77	81	80	79	Road traffic on existing N53 dominated noise environment. During lulls in traffic flow birdsong was audible.
	12:55	77	81			
	14:26	77	82			
AT4	11:39	68	73	73	73	Road traffic on existing N53 dominated noise environment. During lulls in traffic flow dog barking and birdsong were audible. During the first measurement period, plant noise and voices from the ground investigation team were audible.
	13:13	69	74			
	14:43	68	74			
AT5	11:57	69	74	73	73	

	13:30	69	74			Road traffic on existing N53 dominated noise environment. During lulls in traffic flow dog barking and birdsong were audible. Distant plant noise from the ground investigation team was audible.
	15:00	70	74			

Table 5-7 - Baseline Unattended Noise Survey Results (Source: AWN, 2021)

Survey Location Reference	Date	Measured Noise Levels (dB re.2x10^{-5}Pa)			Measured L_{den}, dB	Description of Noise Environment
		L_{day}	$L_{evening}$	L_{night}		
UN1	3 - 4 December 2020	60	60	55	63	Road traffic along existing N53.
UN2	3 - 4 December 2020	55	54	56	55	Distant road traffic along N53, light traffic on L7120.

5.4.3. Noise Impact Assessment

5.4.3.1. Operational Phase

Noise Model

A computer-based prediction model has been prepared in order to quantify the traffic noise level associated with the operational phase of the proposed link road. This section discusses the methodology behind the noise modelling process and presents the results of the modelling exercise.

Brüel & Kjær Type 7810 Predictor

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, Brüel & Kjær Type 7810 Predictor, calculates traffic noise levels in accordance with CRTN and TII guidance.

Prediction of Traffic Noise

Noise emissions during the operational phase of the project have been modelled using Predictor in accordance with CRTN and with the application of the relevant conversion factors as detailed in the TII Guidance. The CRTN method of predicting noise from a road scheme consists of the following five elements:

1. divide the road scheme into segments so that the variation of noise within this segment is small;
2. calculate the basic noise level at a reference distance of 10 metres from the nearside carriageway edge for each segment;
3. assess for each segment the noise level at the reception point taking into account distance attenuation and screening of the source line;
4. correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment, and;
5. combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road scheme.

Input to the Noise Model

The noise model was prepared using 3D road alignment drawings, topographical data, Ordnance Survey mapping and traffic flow data supplied by MHL & Associates. Table 5-8 summarises the traffic flow volumes used for the opening and design year impact assessments for the following scenarios.

- Year 2019 – Do Minimum Scenario;
- Year 2023 – Do Minimum Scenario – N53 Realignment not built;
- Year 2023 – Do Something with N53 Realignment;

- Year 2038 – Do Minimum Scenario – N53 Realignment not built; and,
- Year 2038 – Do Something with N53 Realignment

The speed limit along the length of the proposed N53 Realignment is modelled at 100 km/h.

Table 5-8 - Traffic Volumes used for Noise Impact Assessment (Source: AWN, 2021)

Road Link	2019 Baseline	Do Nothing 2023	Do Something 2023	Do Nothing 2038	Do Something 2038	DS 2038 % HGV
	AADT	AADT	AADT	AADT	AADT	
N53 East	8340	8776	8779	9949	9940	12%
Old N53 J2 - J3 (Brown[1] N53 J1)	8340	8869	8872	10042	10047	12%
Old N53 J4 - J5	8564	9011	1839	10226	2084	11%
Old N53 J5 - J6	8493	8922	1770	10126	2002	12%
N53 West	6906	7255	7260	8238	8252	12%
Brown N53 J1- J2	--	--	7144	--	8081	12%
Brown N53 J3	--	--	7257	--	8249	12%

The AADT values have been broken into 24 hourly periods using the TII standard diurnal profiles. The hourly noise predictions were conducted in accordance with Method A of the TII guidelines.

Model Calibration

A road model for the existing adjacent roads was developed using the AADT values provided for the year 2019. Road traffic noise levels were calculated at the baseline unattended noise monitoring positions. The results of the model were used to compare the modelled noise levels against the baseline noise survey data.

The calculated Lden results for each of the survey locations are summarised in Table 5-9.

Table 5-9 - Calculated noise levels versus Baseline (Source: AWN, 2021)

Baseline Location	Measured Noise Level, dB Lden	Calculated Noise Level, dB Lden	Difference
UN1	63	62	1 dB
UN2	55	54	1 dB

The results of the calibration exercise indicate a strong correlation (1 dB) between noise levels measured during the baseline survey and those calculated using the 2019 traffic flows at both locations UN1 and UN2.

Variations will always occur between results recorded during a baseline survey and those calculated due to other sources in the environment in addition to the short period over which the surveys are undertaken compared to the calculated noise level which represents a long term average.

Impact Assessment Model

Free-field traffic noise levels have been predicted at 43no. properties in the vicinity of the proposed road improvement scheme. The noise assessment locations are displayed in Appendix 5.2. In certain cases, two receptors have been located at a single dwelling, for example at H05, where H05a is placed at the façade facing the existing road and H05b is placed at the rear of the house facing the proposed road, thus there are a total of 53no. assessment locations in the noise model.

[1] Note Brown refers to proposed scheme alignment.

Model Results

The results of the traffic noise predictions are presented in Table 5-10 for the opening year (2023) and the design year (2038). The results are compared against the three TII criteria for determining the requirement for noise mitigation. These are re-iterated below for clarity:

a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60 dB Lden;

b) the relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road scheme in place, and;

c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

The associated magnitude of change in road traffic between the Do Minimum and Do Something scenarios are presented for the short-term period for the year of opening and for the long term period for the design year.

Table 5-10 - Assessment of Traffic Noise Levels for Opening and Design Years (Source: AWN, 2021)

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H01	61	61	Yes	No	Yes	No	Negligible	62	62	Yes	No	Yes	No	Negligible
H02	66	66	Yes	No	Yes	No	Negligible	66	67	Yes	Yes	Yes	Yes	Negligible
H03	62	59	No	No	Yes	No	Moderate Positive	62	60	No	No	Yes	No	Negligible
H04	71	62	Yes	No	Yes	No	Major Positive	71	63	Yes	No	Yes	No	Moderate Positive
H05a	65	56	No	No	Yes	No	Major Positive	65	57	No	No	Yes	No	Moderate Positive
H05b	51	63	Yes	Yes	Yes	Yes	Major	51	64	Yes	Yes	Yes	Yes	Major
H06a	71	53	No	No	Yes	No	Major Positive	71	54	No	No	Yes	No	Major Positive
H06b	58	58	No	No	Yes	No	Negligible	58	59	No	Yes	Yes	No	Negligible
H07a	71	53	No	No	Yes	No	Major Positive	71	53	No	No	Yes	No	Major Positive
H07b	61	57	No	No	Yes	No	Moderate Positive	61	57	No	No	Yes	No	Minor Positive
H07c	61	57	No	No	Yes	No	Moderate Positive	61	58	No	No	Yes	No	Minor Positive
H08	74	56	No	No	Yes	No	Major Positive	74	57	No	No	Yes	No	Major Positive
H09a	65	60	No	No	Yes	No	Major Positive	65	61	Yes	No	Yes	No	Minor Positive
H09b	65	59	No	No	Yes	No	Major Positive	65	60	No	No	Yes	No	Moderate Positive
H10	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H11	67	61	Yes	No	Yes	No	Major Positive	67	62	Yes	No	Yes	No	Moderate Positive

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H12	70	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H13	68	61	Yes	No	Yes	No	Major Positive	68	62	Yes	No	Yes	No	Moderate Positive
H14	70	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H15	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H16	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H17	73	65	Yes	No	Yes	No	Major Positive	73	66	Yes	No	Yes	No	Moderate Positive
H18a	73	64	Yes	No	Yes	No	Major Positive	73	65	Yes	No	Yes	No	Moderate Positive
H18b	73	64	Yes	No	Yes	No	Major Positive	73	65	Yes	No	Yes	No	Moderate Positive
H18c	63	58	No	No	Yes	No	Major Positive	63	59	No	No	Yes	No	Minor Positive
H19	66	60	No	No	Yes	No	Major Positive	66	61	Yes	No	Yes	No	Moderate Positive
H20	56	56	No	No	Yes	No	Negligible	56	57	No	Yes	Yes	No	Negligible
H21	55	56	No	Yes	Yes	No	Minor	55	57	No	Yes	Yes	No	Negligible
H22	50	60	No	Yes	Yes	No	Major	50	61	Yes	Yes	Yes	Yes	Major
H23a	50	63	Yes	Yes	Yes	Yes	Major	50	64	Yes	Yes	Yes	Yes	Major
H23b	50	65	Yes	Yes	Yes	Yes	Major	50	66	Yes	Yes	Yes	Yes	Major
H24a	48	59	No	Yes	Yes	No	Major	49	59	No	Yes	Yes	No	Major
H24b	53	63	Yes	Yes	Yes	Yes	Major	53	64	Yes	Yes	Yes	Yes	Major

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H25	57	55	No	No	Yes	No	Minor Positive	57	56	No	No	Yes	No	Negligible
H26	56	54	No	No	Yes	No	Minor Positive	57	55	No	No	Yes	No	Negligible
H27	66	59	No	No	Yes	No	Major Positive	66	60	No	No	Yes	No	Moderate Positive
H28a	68	60	No	No	Yes	No	Major Positive	68	61	Yes	No	Yes	No	Moderate Positive
H28b	69	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H29	72	65	Yes	No	Yes	No	Major Positive	72	66	Yes	No	Yes	No	Moderate Positive
H30	69	59	No	No	Yes	No	Major Positive	69	60	No	No	Yes	No	Moderate Positive
H31	75	67	Yes	No	Yes	No	Major Positive	75	68	Yes	No	Yes	No	Moderate Positive
H32	57	55	No	No	Yes	No	Minor Positive	57	56	No	No	Yes	No	Negligible
H33	75	69	Yes	No	Yes	No	Major Positive	75	70	Yes	No	Yes	No	Moderate Positive
H34	73	72	Yes	No	Yes	No	Minor Positive	74	73	Yes	No	Yes	No	Negligible
H35	58	58	No	No	Yes	No	Negligible	58	59	No	Yes	Yes	No	Negligible
H36	66	67	Yes	Yes	Yes	Yes	Minor	66	68	Yes	Yes	Yes	Yes	Negligible
H37	74	74	Yes	No	Yes	No	Negligible	74	75	Yes	Yes	Yes	Yes	Negligible
H38	69	70	Yes	Yes	Yes	Yes	Minor	70	71	Yes	Yes	Yes	Yes	Negligible
H39	72	73	Yes	Yes	Yes	Yes	Minor	73	74	Yes	Yes	Yes	Yes	Negligible
H40	72	73	Yes	Yes	Yes	Yes	Minor	73	74	Yes	Yes	Yes	Yes	Negligible
H41	65	65	Yes	No	Yes	No	Negligible	65	66	Yes	Yes	Yes	Yes	Negligible

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H42	50	57	No	Yes	Yes	No	Major	51	58	No	Yes	Yes	No	Moderate
H43	51	60	No	Yes	Yes	No	Major	51	60	No	Yes	Yes	No	Moderate

The results of the assessment indicate that during the opening year 2023, a total of eight locations satisfy the TII requirement for noise mitigation. Eight assessment locations are likely to experience a major change in noise level during the short-term period (≥5 dB). Four of these locations, H22, H24a, H42 and H43, are also likely to experience a major change in noise level, but as the predicted noise level remains within 60 dB Lden, the criteria for mitigation are not met. Five locations are likely to experience a minor change in traffic noise (>1 to <3 dB).

During the design year 2038, a total of 12no. assessment locations satisfy the TII requirement for noise mitigation. A total of 6no. assessment locations are likely to experience a major change in noise level during the long term period (≥10 dB).

However, four locations are likely to experience a minor reduction in road noise levels. 21 locations are likely to experience a moderate reduction in road noise levels and three locations are likely to experience a major reduction in road noise.

For all other properties, the calculated traffic noise level is below 60 dB Lden, or does not increase the pre-existing traffic noise level by more than 1 dB or increased traffic noise is not directly related to the proposed development.

The mitigation measures proposed to reduce operational noise levels are set out in Section 5.6.

5.5. Construction Phase

Noise levels associated with construction may be calculated in accordance with methodology set out in BS5228 2009 + A1 2014: Part 1. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. It is often not possible, however, to conduct detailed prediction calculations for the construction phase of a project. This is due to the fact that the programme for construction works has not been established in detail. Under such circumstances, best practice involves the consideration of appropriate mitigation measures to ensure construction activities do not exceed the recommended noise criteria as set out in Table 3 in Section 3.2 of BS 5228-1.

A variety of items of plant will be in use, such as excavators, loaders, dumper trucks, generators in addition to vehicular movements to and from the site that will make use of existing roads. Due to the nature of the activities undertaken on a road construction site, there is potential for generation of high levels of noise in close proximity to the works.

BS5228:2009 +A1 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise sets out typical noise levels for items of construction plant. Table 5-11 lists the sound power levels of the plant used for calculation of the expected noise level at various distances from the roadway. Construction noise calculations have been conducted at distances of 10 to 80m from the works for the main work phases. The calculations assume that plant items are operating for 66% of the time and that all plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario.

Table 5-11 - Typical Construction Plant Sound Power Noise Levels (Source: AWN, 2021)

Plant Item (BS5228 Ref.)	Sound Power Level, dB(A) re 10-12 W
Wheeled loader C2.26	107
Tracked excavator (loading dump truck) (C2.19)	105
Dozer (C.2.13)	106
Dump Truck Tipping fill (C2.30)	107
Articulated dump truck (dumping rubble) (C1.11)	108
Tracked excavator (C2.21)	99
vibration rollers (C5.20)	103
Asphalt Paver & Tipping Lorry (C.5.31)	105
Diesel Generator (C4.76)	89
Road Rollers (C5.19)	108

Tables 5-12 to 5-14 set out the predicted noise levels during various phases of road construction at distances of 10m to 80m from the proposed works.

Table 5-12 - Indicative Construction Noise Calculations during Site Clearance and Preparation (Source: AWN, 2021)

Site Clearance & Preparation	Calculated $L_{Aeq,T}$ at distance from road (m)			
	10m	25m	50m	80m
Wheeled loader (C2.26)	76	65	58	53
Tracked excavator (loading dump truck) (C2.19)	75	63	56	51
Dozer (C.2.13)	73	64	57	52
Dump Truck (C2.30)	75	65	58	53
Combined L_{Aeq}	81	71	63	58

Table 5-13 - Indicative Construction Noise Calculations during Excavation and Fill Works (Source: AWN, 2021)

Excavation / Fill / Grading Works	Calculated $L_{Aeq,T}$ at distance from road (m)			
	10m	25m	50m	80m
Articulated dump truck (dumping rubble) (C1.11)	76	66	59	54
Wheeled loader (C2.26)	75	65	58	53
Tracked excavator (loading dump truck) (C2.19)	73	63	56	51
Dozer C.2.10	74	64	57	52
Dump Truck Tipping fill (C2.30)	75	65	58	53
Combined L_{Aeq}	82	72	64	59

Table 5-14 - Indicative Construction Noise Calculations During Road Works (Source: AWN, 2021)

Road Works	Calculated $L_{Aeq,T}$ at distance from road (m)			
	10m	25m	50m	80m
Tracked excavator (C2.21)	67	57	50	45
Dump Truck (C2.30)	75	65	58	53
vibration rollers (C5.20)	71	61	54	49
Asphalt Paver & Tipping Lorry (C.5.31)	73	63	56	51
Diesel Generator (C4.76)	57	47	40	35
Road Rollers (C5.19)	76	66	59	54
Combined L_{Aeq}	81	71	63	58

The results of the assessment have indicated that at distances of beyond 50m from the works, the construction daytime noise limit of 70 dB LAeq can typically be complied with for the scenarios assessed. At distances of up to 25m from the works, there is potential for the noise criterion to be exceeded in the absence of noise mitigation. A small number of properties along the eastern end of the proposed road development are within 25m of the proposed works, hence the use of a range of best-practice mitigation measures such as those set out in Section 5.6 will be employed to ensure the construction noise limits are not exceeded along the length of the scheme.

5.6. Mitigation Measures

5.6.1. Operational Phase

In order to reduce operational noise levels along the length of the proposed scheme mitigation measures through the use of acoustic screening have been included. The mitigation measures detailed here are based on the current scheme design.

In the first instance, a low-noise road surface giving a reduction in noise levels of 2.5 dB(A) with respect to stone mastic asphalt is recommended for the full length of the scheme. This measure addresses the need to provide noise mitigation for the houses at the east end of the scheme where barriers are not practicable. To address remaining requirements for mitigation a set of barriers is also proposed.

Barriers can take the form of proprietary acoustic screens, solid block walls, earth berms or other solid structures. The barriers chosen should be solid, with no gaps at the base or between vertical joints and should have a minimum surface mass of 10 kg/m^2. All barriers shall achieve the performance specified in I.S. EN 1793 – 1:1998, I.S. EN 1793-2:1998, I.S. EN 1973-3:1998, I.S. 1794-1:2003 and I.S. EN 1794-2:2003.

Table 5-15 summarises the location and extent of screening requirements for noise mitigation. The extent of noise mitigation measures proposed is illustrated in Figures 5-2 and 5-3.

Table 5-15 - Extent of Noise Mitigation Required During Operational Phase (Source: AWN, 2021)

Barrier Reference	Location(s) requiring Mitigation	Barrier Details	Side of Road	Barrier Height (m)
NB01	H05b	From Chainage 230 to 480	North	2.0 m above road level
NB02	H22, H23a & H23b	From Chainage 1190 to 1610	North	2.5 m above road level Absorptive side facing road
NB03	H24b	From Chainage 1190 to 1350, rounding corner on junction	South	2.5 m above road level Absorptive side facing road

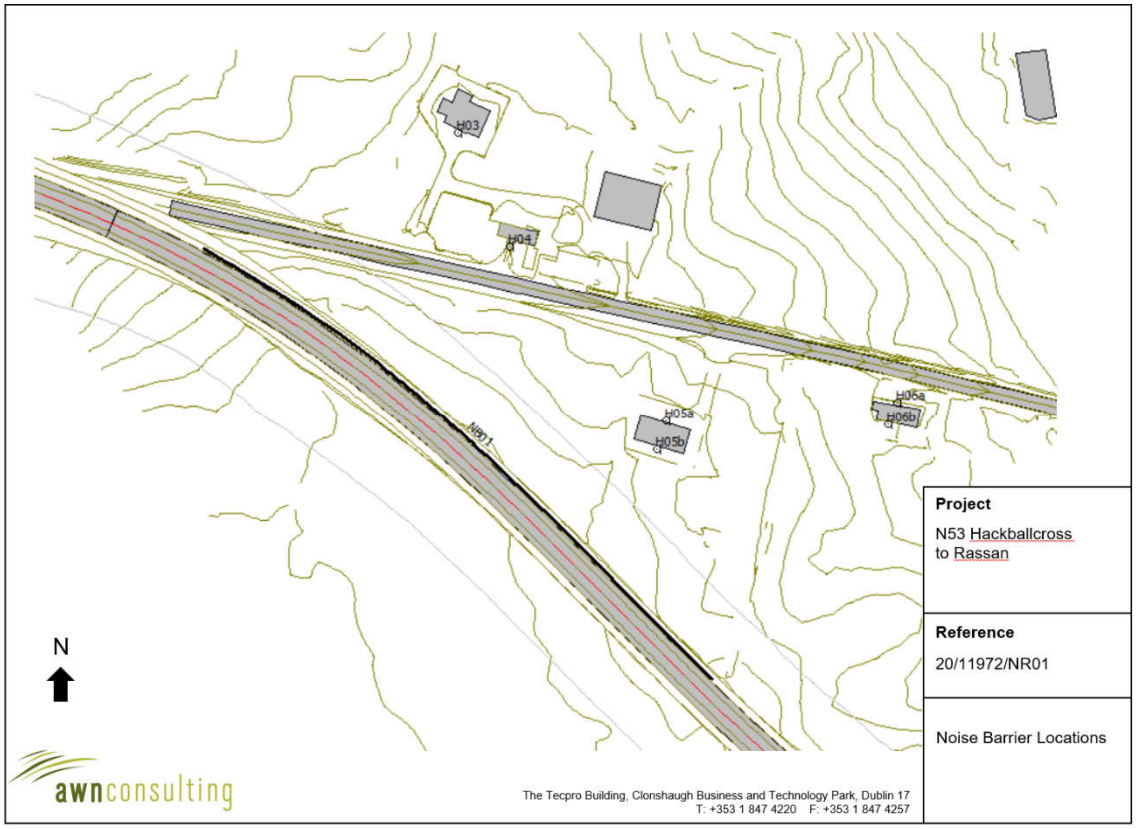


Figure 5-2 - Proposed Noise Barrier Locations – NB01

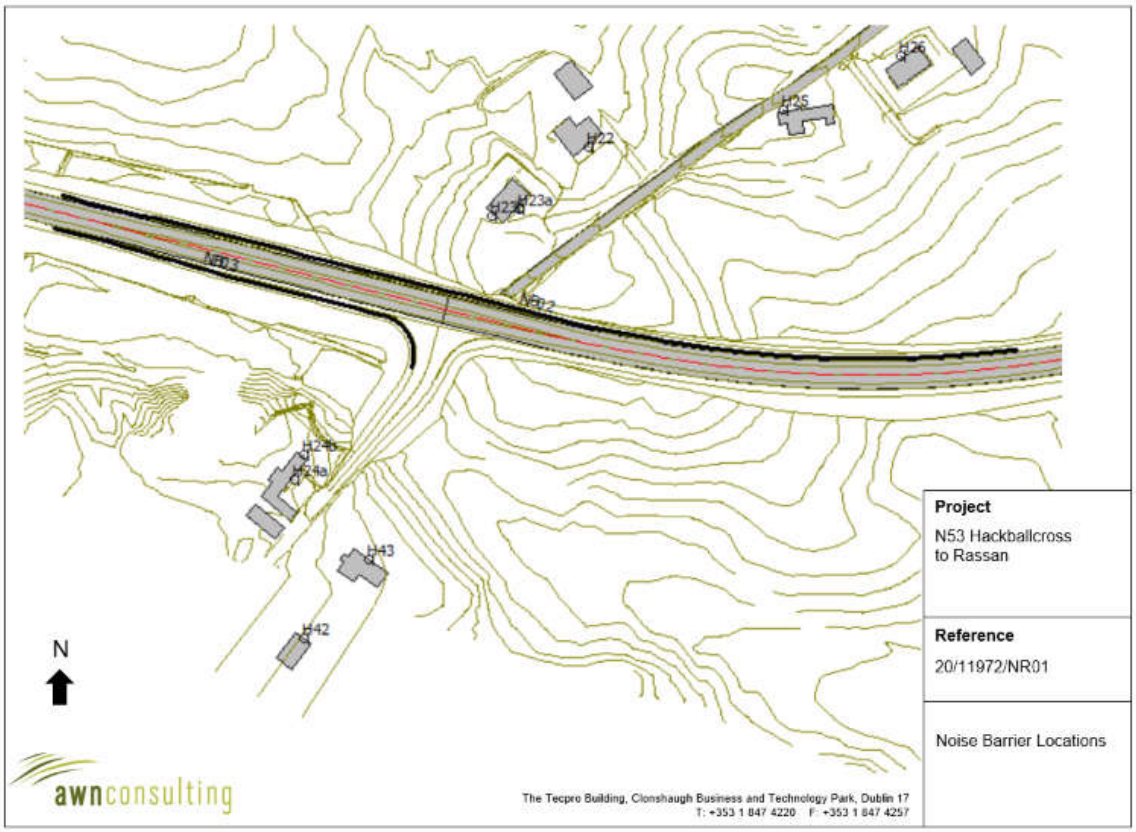


Figure 5-3 - Proposed Noise Barrier Locations – NB02 and NB03

5.6.2. Construction Phase

The contract documents will clearly specify the construction noise criteria included in this chapter which the construction works must operate within. The Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228-2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 and 2 and the Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; and,
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

During the course of the construction programme, the contractor will be required to manage the works to comply with the limits detailed in Table 5-3 of this report. The following sections provide outline guidance on measures to control construction noise, in accordance with BS 5228 2009+A1 2014 Parts 1 and 2.

5.6.2.1. Selection of Quiet Plant

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

For static plant such as compressors and generators used at work areas such as construction compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where possible.

The contractor will evaluate the choice of excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative lower noise generating equipment that would economically achieve, in the given ground conditions, equivalent structural/ excavation/ breaking results, these will be selected to minimise potential disturbance.

5.6.2.2. General Comments on Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise.

Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant will be switched off when not in use and not left idling;
- For percussive tools such as pneumatic concrete breakers or tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed and erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction;
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights;

- Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/ areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation;
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact;
- Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary, and;
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

5.6.2.3. Screening

Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source.

BS 5228 -1:2009+A1 2014 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 10 kg/m2 will give adequate sound insulation performance. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver.

5.6.2.4. Working Hours

Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:30hrs Saturday.

Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority. This permission, if granted, can be withdrawn at any time should the working regulations be breached.

5.7. Residual Impact

5.7.1. Operational Phase

The residual impacts of the proposed scheme have been assessed taking into account the recommended noise mitigation measures. Table 5-16 presents the residual noise impacts taking into account the proposed mitigation measures for noise.

Table 5-16 - Assessment of Traffic Noise Levels for Opening and Design Years, with Mitigation (Source: AWN, 2021)

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H01	61	60	No	No	Yes	No	Minor Positive	62	60	No	No	Yes	No	Negligible
H02	66	64	Yes	No	Yes	No	Minor Positive	66	65	Yes	No	Yes	No	Negligible
H03	62	55	No	No	Yes	No	Major Positive	62	56	No	No	Yes	No	Moderate Positive
H04	71	57	No	No	Yes	No	Major Positive	71	57	No	No	Yes	No	Major Positive
H05a	65	51	No	No	Yes	No	Major Positive	65	51	No	No	Yes	No	Major Positive
H05b	51	58	No	Yes	Yes	No	Major	51	58	No	Yes	Yes	No	Moderate
H06a	71	50	No	No	Yes	No	Major Positive	71	51	No	No	Yes	No	Major Positive
H06b	58	55	No	No	Yes	No	Moderate Positive	58	56	No	No	Yes	No	Negligible
H07a	71	50	No	No	Yes	No	Major Positive	71	50	No	No	Yes	No	Major Positive
H07b	61	54	No	No	Yes	No	Major Positive	61	55	No	No	Yes	No	Moderate Positive
H07c	61	54	No	No	Yes	No	Major Positive	61	55	No	No	Yes	No	Moderate Positive
H08	74	54	No	No	Yes	No	Major Positive	74	54	No	No	Yes	No	Major Positive
H09a	65	60	No	No	Yes	No	Major Positive	65	61	Yes	No	Yes	No	Minor Positive
H09b	65	59	No	No	Yes	No	Major Positive	65	60	No	No	Yes	No	Moderate Positive
H10	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H11	67	61	Yes	No	Yes	No	Major Positive	67	61	Yes	No	Yes	No	Moderate Positive

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H12	70	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H13	68	61	Yes	No	Yes	No	Major Positive	68	62	Yes	No	Yes	No	Moderate Positive
H14	70	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H15	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H16	71	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H17	73	65	Yes	No	Yes	No	Major Positive	73	66	Yes	No	Yes	No	Moderate Positive
H18a	73	64	Yes	No	Yes	No	Major Positive	73	65	Yes	No	Yes	No	Moderate Positive
H18b	73	64	Yes	No	Yes	No	Major Positive	73	65	Yes	No	Yes	No	Moderate Positive
H18c	63	57	No	No	Yes	No	Major Positive	63	58	No	No	Yes	No	Moderate Positive
H19	66	60	No	No	Yes	No	Major Positive	66	61	Yes	No	Yes	No	Moderate Positive
H20	56	54	No	No	Yes	No	Minor Positive	56	55	No	No	Yes	No	Negligible
H21	55	54	No	No	Yes	No	Minor Positive	55	54	No	No	Yes	No	Negligible
H22	50	55	No	Yes	Yes	No	Major	50	56	No	Yes	Yes	No	Moderate
H23a	50	57	No	Yes	Yes	No	Major	50	58	No	Yes	Yes	No	Moderate
H23b	50	59	No	Yes	Yes	No	Major	50	59	No	Yes	Yes	No	Moderate
H24a	48	56	No	Yes	Yes	No	Major	49	57	No	Yes	Yes	No	Moderate

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H24b	53	60	No	Yes	Yes	No	Major	53	60	No	Yes	Yes	No	Moderate
H25	57	53	No	No	Yes	No	Moderate Positive	57	54	No	No	Yes	No	Minor Positive
H26	56	52	No	No	Yes	No	Moderate Positive	57	53	No	No	Yes	No	Minor Positive
H27	66	59	No	No	Yes	No	Major Positive	66	60	No	No	Yes	No	Moderate Positive
H28a	68	60	No	No	Yes	No	Major Positive	68	61	Yes	No	Yes	No	Moderate Positive
H28b	69	62	Yes	No	Yes	No	Major Positive	70	63	Yes	No	Yes	No	Moderate Positive
H29	72	64	Yes	No	Yes	No	Major Positive	72	65	Yes	No	Yes	No	Moderate Positive
H30	69	58	No	No	Yes	No	Major Positive	69	58	No	No	Yes	No	Major Positive
H31	75	66	Yes	No	Yes	No	Major Positive	75	66	Yes	No	Yes	No	Moderate Positive
H32	57	53	No	No	Yes	No	Moderate Positive	57	53	No	No	Yes	No	Minor Positive
H33	75	67	Yes	No	Yes	No	Major Positive	75	67	Yes	No	Yes	No	Moderate Positive
H34	73	70	Yes	No	Yes	No	Moderate Positive	74	70	Yes	No	Yes	No	Minor Positive
H35	58	57	No	No	Yes	No	Minor Positive	58	57	No	No	Yes	No	Negligible
H36	66	65	Yes	No	Yes	No	Minor Positive	66	65	Yes	No	Yes	No	Negligible
H37	74	73	Yes	No	Yes	No	Minor Positive	74	73	Yes	No	Yes	No	Negligible
H38	69	68	Yes	No	Yes	No	Minor Positive	70	68	Yes	No	Yes	No	Negligible

Ref.	Opening Year 2023		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required?	Magnitude of Change Short term	Design Year 2038		TII Condition for Noise Mitigation Satisfied?			Additional Mitigation Required ?	Magnitude of Change Long term
	Predicted Noise Level							Predicted Noise Level						
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H39	72	71	Yes	No	Yes	No	Minor Positive	73	72	Yes	No	Yes	No	Negligible
H40	72	71	Yes	No	Yes	No	Minor Positive	73	71	Yes	No	Yes	No	Negligible
H41	65	63	Yes	No	Yes	No	Minor Positive	65	64	Yes	No	Yes	No	Negligible
H42	50	55	No	Yes	Yes	No	Major	51	55	No	Yes	Yes	No	Minor
H43	51	57	No	Yes	Yes	No	Major	51	58	No	Yes	Yes	No	Moderate

The assessment has determined that with the inclusion of the recommended noise mitigation measures, traffic noise levels associated with the proposed road combined with traffic along the adjacent surrounding roads are sufficiently reduced such that the three TII conditions for noise mitigation are not triggered at the noise assessment locations during both assessment years.

The related potential noise impacts during the two assessment years are summarised in the following sections.

5.7.1.1. Year of Opening

During the opening year 2023, a major change in noise levels will be experienced in the short term at six locations. The Do Something traffic noise levels calculated at these properties are below 60 dB Lden. The residual noise level is within the traffic noise design goal and no further mitigation is required.

It should be noted that there are locations with a reduction in noise levels, as set out below:

- 11 locations with a minor reduction in noise levels;
- 5 locations with a moderate reduction in noise levels, and
- 29 locations with a major reduction in noise levels.

5.7.1.2. Design Year

During the design year 2038, a moderate change in noise levels will be experienced in the short term at seven locations. The Do Something traffic noise levels calculated at these properties are of the order of 60 dB Lden. The residual noise level is within the traffic noise design goal and no further mitigation is required.

A negligible change in noise levels will be experienced in the long-term at 12 locations. The Do Something traffic noise level calculated at these properties are in the range of 53 to 73 dB Lden. The locations with the noise levels at the higher end of this range are those along the section of the existing road which forms part of the proposed scheme.

It should be noted that there are locations with a reduction in noise levels, as set out below:

- 5 locations with a minor reduction in noise levels;
- 22 locations with a moderate reduction in noise levels, and
- 6 locations with a major reduction in noise levels.

5.7.2. Construction Phase

During the construction phase of the project there will be short term moderate to major impacts on nearby residential properties, depending on the distance from the works, due to noise emissions from site traffic and other activities. The application of noise limits, restricted hours of operation, along with implementation of appropriate noise control measures, will be implemented in order to control noise emissions to within the noise limits for this phase.

5.8. Conclusion

AWN Consulting Limited (AWN) have been commissioned to conduct a noise impact assessment of the proposed N53 Hackballscross to Rassan Scheme.

A baseline noise survey was undertaken to measure existing traffic noise levels at the closest properties within the study area. The results of the baseline survey confirm that properties along the existing road network experience traffic noise levels above 60 dB Lden. At properties located along the alignment of the proposed scheme, ambient noise levels are below 60 dB Lden and are influenced by traffic along surrounding roads and local traffic movements and environmental sources (bird song, foliage rustle etc.).

Road traffic noise levels were predicted at 53no. assessment locations within the study area using the projected traffic flows for the two assessment years. It was determined that mitigation is required to reduce traffic noise levels at 12no. locations.

Noise mitigation in the form of noise barriers, as specified in Section 5.6, has been proposed and modelled to reduce traffic noise levels to below the TII design goal of 60 dB Lden. With the proposed barriers in place, calculated noise levels are reduced for both assessment years to within the design goal at the relevant assessment locations, with the exception of a small number of locations at the Hackballscross end of the scheme. At these locations however, a negligible change in noise levels is predicted.

The assessment has determined that once operational, the noise impact associated from the proposed scheme will result in a negligible to moderate impact during the long term period at the assessment locations.

A number of locations are expected to experience a positive noise impact as the proposed road scheme is at a greater distance than the existing road.

Indicative worst-case calculations have been made to estimate the range of likely noise levels during the construction phase of the project. The construction noise impact will be short term moderate at the majority of locations assessed, with a major impact at locations within 25m of the works. However, as the works will progress along the route, the greatest construction noise impacts will be limited in duration. The application of noise limits, restricted hours of operation, along with implementation of appropriate noise control measures will control construction noise at assessment locations.

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, and a geotechnical ground investigation contract along the route of the proposed scheme.

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

- Geological Survey of Ireland (GSI) webpage using the online mapping tool (GSI, 2021);
- Ordnance Survey of Ireland (OSI) webpage to assess the surface topography, landforms and historic mapping (OSI, 2021);
- Window sample and borehole logs for exploratory ground investigation works (IGSL, 2021);
- IGSL Ltd (2021) '*N53 Hackballscross to Rassan Ground investigation Report – Factual';*
- Louth County Council (LCC) Development Plan 2015-2021;
- Atkins (2020) '*N53 Hackballscross to Rassan Option Selection Report'* (document reference; 5157353DG0033);
- Atkins (2021) '*N53 Hackballscross to Rassan Phase 3 Design Report'* (document reference; 5157353DG0106); and,
- Philip Farrelly and Co. (2019) '*Agronomy and Agricultural Appraisal Report'*.

6.1. Receiving Environment

On a regional scale, the proposed scheme is underlain primarily by till derived from Lower Palaeozioc sandstones and shales with minor portions of alluvium and peat. Bedrock underlying the proposed scheme comprises calcareous red-mica greywacke of the Clontail Formation (GSI, 2021). Based on site-specific data presented in the Ground Investigation Report (IGSL Ltd., 2021), the scheme is generally underlain by topsoil or Made Ground, with silt / clay encountered to a maximum depth of ca. 3.6 mbgl, and gravel encountered to a maximum depth of ca. 5.3 mbgl (with peat encountered in localised areas to a maximum depth of ca. 1.8 mbgl). Rockhead was encountered at depths of between ca. 0.5 to 7.3 mbgl along the scheme. Bedrock generally comprises thickly to thinly bedded, dark greenish blue, fine-grained sandstone (interbedded with siltstone); and thinly bedded to structureless, green, fine-grained siltstone/mudstone.

No karst features are recorded directly along the proposed scheme. No evidence of karst (i.e. voids, infill cavities, extensive fracturing / weathering) was identified in the site-specific data presented in the Ground Investigation Report (IGSL Ltd., 2021). There are no reported Geological Heritage Sites along the proposed scheme. The closest reported Geological Heritage Area is Moylan Lough (Site Code: MN014), located 8.5km south west of the proposed scheme (GSI, 2021).

Historical land-use beneath the proposed scheme is agricultural in nature. Localised areas of small-scale historical features including a cist, barrow, souterrain, ringfort and enclosure are located to the south of the proposed scheme.

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 surrounds.

There are no IPPC / IED licenced facilities or EPA licenced waste facilities within the general vicinity of the proposed scheme with the closest IEL licenced facilities (2no.) located in Inniskeen, Co. Monaghan ca. 3.5km south of the scheme (EPA, 2021).

6.1.1. Potential Constraints

It is estimated that ca. 154,800m^3 of material will be excavated during the construction of the proposed scheme. The total fill volume (earthwork fill and capping) is anticipated to be ca. 157,200m^3. The ca. total land take area is 18.4ha. with an additional ca. 4.9ha required temporarily for disposal of unsuitable material. Excavated material will be reused onsite where possible, as detailed further in the Chapter 7 - Material Assets within this report. Final anticipated waste soils volumes will be determined during the detailed design stage of the project.

Rock outcrops / shallow bedrock can be difficult to engineer and require increased effort to excavate and are therefore a potential constraint. Shallow bedrock is reported by GSI (2021) to be present beneath the proposed scheme, and areas of bedrock outcrop have been identified within close proximity of the scheme.

According to the GSI (2021), groundwater vulnerability rating in the vicinity of the proposed scheme is predominantly *'extreme'* with small areas of '*high'* and '*rock at or near surface or karst'* intercepted throughout the scheme. This indicates that bedrock and accordingly groundwater is shallow in this area and therefore extremely vulnerable to potential contamination. Groundwater levels are discussed in detail in Chapter 8 – Water.

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 6no. main embankment areas along the route, with the largest extending to heights of approximately 4.4m with the deepest being ca. 6.7m. The maximum depth of excavation is anticipated to be ca. 6.7m bgl. No major structures are proposed during the construction of the proposed scheme other than 1no. subway 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 in Section 6.3 below.

6.2.2. Operational phase

A number of potential risks to local soils and 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 (including Mitigation Measures)

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).

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 site 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 access, and haulage roads will be clearly defined;
- In the unlikely 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 an 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 Detailed 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, no significant impacts are anticipated with respect to land, soils and geology from the proposed scheme.

7. Material Assets

Existing services within the proposed scheme extent include ESB, Irish Water and EIR services. Both the ESB 38kV and medium voltage overhead lines will be diverted as part of the proposed scheme. Details of existing utilities within the vicinity of the proposed scheme are summarised in Table 7-1 below.

Table 7-1 Summary of Service Conflicts and Proposals

Utility Provider	Service Conflicts and Proposals
EIR	Eir Services on existing N53, L7120, L3117 and L7116.
ESB	38kV overhead South of the Existing N53 to be redirected. Medium Voltage Overhead South of the existing N53 to be redirected.
Irish Water	There is an existing watermain on the N53 for the entire length of the scheme. There are also lines on the L7120, L3117, L7116.
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.

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.).

7.1. Waste Management

The maximum excavation depth is anticipated to be approximately 6.7m. In addition to excavated soils, the construction phase of the development will generate waste such as construction and demolition (C&D) waste, and Mixed Municipal Waste (MMW), along with recyclables such as plastic wrapping, wooden pallets, paper and/or waste electrical and electronic equipment (WEEE). C&D waste will also be generated during the demolition works proposed as part of the scheme (limited to 1no. House with 2no. outbuildings, these buildings are owned by 1no. landowner).

The Contractor will prepare a site specific Detailed 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 waste, 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 (2018)[3]. Soils testing will be required, the results of which should inform the preparation of a waste classification tool (in order to determine the appropriate List of Waste (LoW) code)

[2] https://www.dccae.gov.ie/documents/Final%20C%20and%20D%20Guidelines%20-%2022%20June%20%202006.pdf
[3] https://www.epa.ie/pubs/reports/waste/stats/wasteclassification/2019%20%20FULL%20template.pdf

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.

All waste streams will be managed in accordance with the following key objective from the Louth County Development Plan 2015-2021 (LCC, 2015): -

EnCo 30 '*To support the recycling of building materials on development sites*.'

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

7.2. Impact Assessment

7.2.1. Construction Phase

There will be a requirement to relocate utility services as outlined in Section 7.1 within the proposed scheme. There are numerous overhead ESB lines in the area of existing N53 and the proposed scheme. South of Annaghvacky there is a 38kV overhead ESB line which will have to be diverted due to the new route. In addition to this a medium voltage overhead line to the South of the existing N53 will have to be redirected. Any residual risks associated with utility diversions will be further developed at the detailed design stage.

7.3. Recommendations (including Mitigation Measures)

- The Contractor should undertake pre-demolition surveys for all properties and infrastructure scheduled for demolition including asbestos surveys if required;
- A Project specific Detailed 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'* and '*The Management of Waste from National Road Construction Projects*' (TII, 2017), in advance of commencing the works, as the proposed scheme will likely exceed the relevant thresholds for the preparation of such plans;
- A detailed Demolition Plan shall be prepared by the appointed Contractor and included as an integral part of the Project specific Detailed 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;
- All waste soils / material removed from site will need to be classified in accordance with EPA guidelines (2018). Soils testing will be required, the results of which should inform the preparation of a waste classification tool (in order 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 will be segregated and removed from site for disposal or recycling, in accordance with all relevant Waste Management Legislation; and,
- All waste-related control measures set out in Chapter 6 – Land, Soils and Geology will apply during the construction phase.

7.4. Summary

Taking account of the waste management controls which will apply to the construction phase of the proposed scheme, waste generation 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 assessment has been completed in accordance with relevant best practice EIAR guidance from the Institute of Geologists of Ireland (IGI, 2013), albeit it is noted that this report is not an Environmental Impact Assessment Report (EIAR).

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, 2021);
- Environmental Protection Agency (EPA) web mapping (www.epa.ie) (EPA, 2021);
- Office of Public Works (OPW) National Flood Hazard mapping web site (OPW, 2021);
- Water Framework Directive Ireland web mapping (http://www.wfdireland.ie/ (WFDI, 2021);
- National Biodiversity Data Centre (NBDC) Map Viewer (NBDC, 2021);
- Ordnance Survey of Ireland (OSI), Map Viewer (OSI, 2021);
- National Parks and Wildlife Service (NPWS) Map Viewer (NPWS, 2021); and
- '*N53 Hackballscross to Rassan Ground Investigation Report, Factual Report'* (IGSL Ltd., 2021).

The ground investigation for the proposed scheme was carried out by IGSL Ltd. (IGSL) between November 2020 and April 2021 in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007), BS 5930:2015, and BS 1377 (Parts 1 to 9) (IGSL, 2021). Areas investigated included onsite and offsite locations (targeted investigation undertaken within the Annex I wetland habitat). Full details of the ground investigation are presented in the '*N53 Hackballscross to Rassan Ground Investigation Report – Factual'* prepared by IGSL (2021).

8.1. Receiving Environment

8.1.1. Flood Risk Screening

A review of the OPW flood maps (OPW, 2021) did not identify any areas mapped as liable to flooding or any historical flooding events. A Stage 1-Flood Risk Assessment (FRA) has been prepared (Atkins, 2021) (document reference 5187353DG0110) to establish whether a flood risk issue currently exists or may exist in the future. The FRA concluded that *''the proposed development while classified as a 'highly vulnerable development' as per the vulnerability classification in the planning guidelines is within Flood Zone C. Based on an examination of the data available, the FRA has demonstrated that the flood maps indicate a low risk of flooding to the proposed development. Therefore, a Stage 2 Flood Risk Assessment is not required and therefore the report shall be concluded at this point'.*

8.1.2. Hydrology

The proposed scheme is located within the Castletown WFD Subcatchment (EPA, 2021). On this basis, the key surface water feature in the vicinity of the scheme is the Castletown River located ca. 500m north. There are 2no. minor streams within the vicinity of the proposed scheme and this catchment; the Annaghvacky Stream and Carrickastuck Stream (EPA, 2021). Both streams are tributaries of the Castletown River. Refer to Figure 8.1. The Castletown River flows in a general easterly direction and discharges to Dundalk Bay. Dundalk Bay is a Special Area of Conservation (SAC) (Site Code: 000455) and Special Protection Area (SPA) (Site Code: 004026).

On a regional scale, the Castletown River, has been assigned '*Good'* river water quality status in accordance with the Water Framework Directive (WFD) for the 2013 to 2018 period (EPA, 2021). The section of the Castletown River within the vicinity of the proposed scheme has been identified as being under '*Review'* with regards to the risk of failing to meet the relevant WFD objectives by 2027.

Both the Annaghvacky Stream and Carrickastuck Stream are classified as having '*Good'* water quality status for the 2013 to 2018 period, but are classified as being under '*Review'* with regards to the risk of failing to meet the relevant WFD objectives by 2027. Both streams flow into the Castletown River which in turn flows into Dundalk Bay SAC/SPA (EPA, 2021).

There are 2no. ditches in the vicinity of the proposed scheme. A ditch with standing water is located at the south side of the Annaghvacky West wetland site at Ch. 950 (north side of scheme alignment). A second ditch with standing water is located at Ch. 1200 (south side of the alignment). There are no significant reported abstractions from surface water in the vicinity of the proposed scheme.

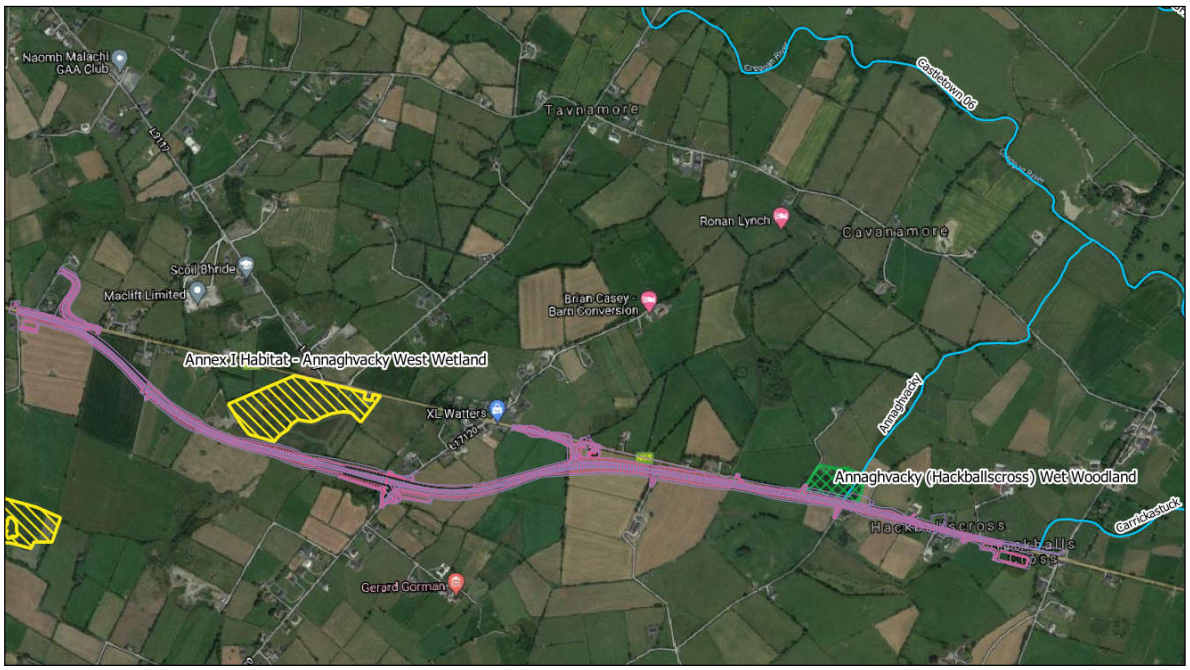


Figure 8-1 Surface Water Features in the general vicinity of the Scheme (Source: EPA, 2021)

8.1.3. Hydrogeology

The proposed scheme is located within the Louth Groundwater Body (GWB). The groundwater flow regime associated with this GWB is expected to be limited, with flow primarily through fractures and the weathered bedrock zone, with short flow paths and primary discharge to local rivers and streams (GSI, 2004). Regional groundwater chemistry is reported to be non-calcareous (GSI, 2004). Groundwater quality within the Louth GWB was classified as having '*Good'* status for the 2013 to 2018 monitoring and is '*Not At Risk'* of failing to meet the relevant Water Framework Directive objectives by 2027.

The greywacke bedrock of the Clontail Formation underlaying the proposed scheme and surrounding area is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones 'Pl'. Refer to Figure 8-2. Groundwater vulnerability along the length of the route ranges from 'high' to 'extreme' and '*rock at or near surface or karst',* with a minor portion in the vicinity of the southern portion of the proposed scheme identified as '*moderate'*, indicating that on a regional scale bedrock is shallow and generally within 5m of the ground level. Refer to Figure 8-3. These groundwater classifications indicate that the bedrock is very vulnerable to potential contamination (GSI, 2021).

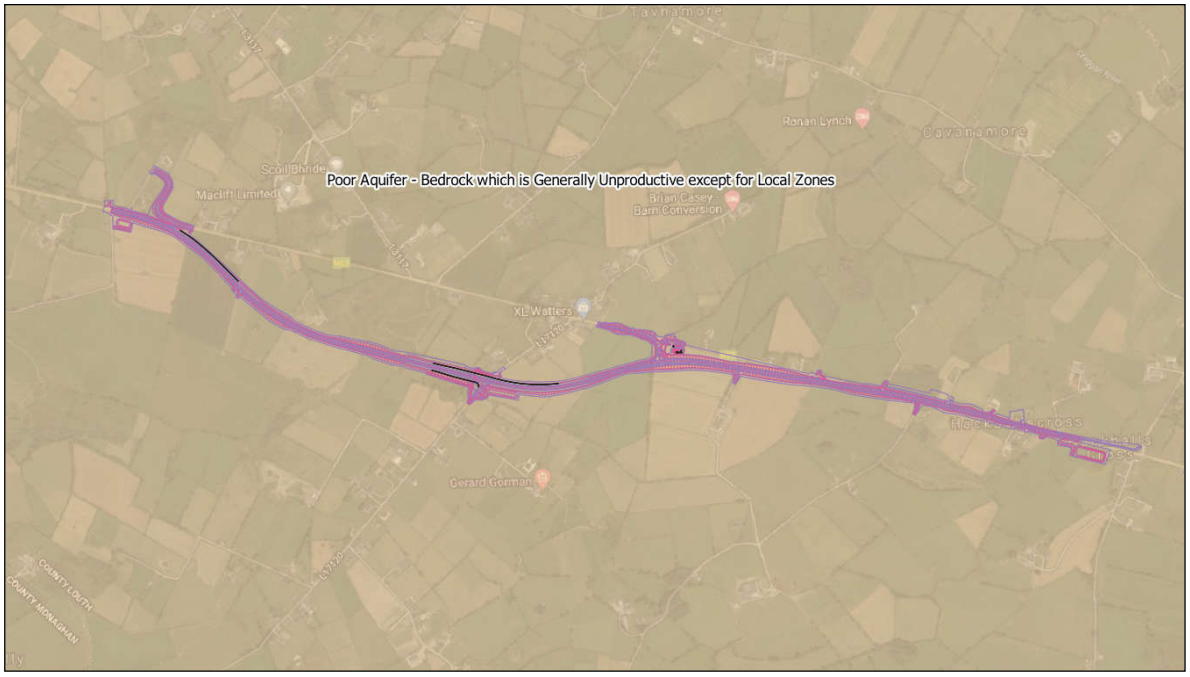


Figure 8-2- Bedrock aquifer beneath the general vicinity of the scheme (Source: GSI, 2021)



Figure 8-3- Groundwater vulnerability in the general vicinity of the scheme (Source: GSI, 2021)

There are two ponds in the vicinity of the northern portion of the proposed scheme located within the area of cut raised over peat which are identifiable on the historical 6-inch map (1837 – 1842) and 25-inch map (1888 – 1913) (OSI, 2021). It is unknown if these are associated with unmapped surface water features but are likely formed by depressions within the peat and representative of the water level within the peat soils.

Site-specific data presented in the Ground Investigation Report (IGSL Ltd., 2021) was reviewed to determine the potential for groundwater to be encountered and potentially impacted during the construction phase of the proposed scheme. Beneath the proposed scheme, perched water strikes

(albeit slow to moderate ingress is noted) were encountered at general depths of between 0.6 and 1.9 mbgl, generally within peat /clay / silt layers. Shallow groundwater strikes were encountered within saturated gravel layers, at general depths of between 0.6 and 5.9 mbgl. Groundwater strikes within the bedrock aquifer beneath the proposed scheme were encountered occasionally, within sandstone bedrock at a general depth of 7 mbgl, and within mudstone bedrock at a general depth of 9 mbgl. In summary perched water and shallow groundwater levels beneath the general vicinity of the proposed scheme appear to be shallow (0.6 – 5.9 mbgl) whilst groundwater levels within the sandstone / siltstone bedrock aquifer appear to be deeper (7 - 9 mbgl).

Regionally groundwater flow direction is anticipated to follow topography in a general easterly direction towards the Irish Sea. On a local scale groundwater is likely to discharge to the closest identified rivers / streams, and generally follow topography. There are seven registered wells within the area, however there are no reported Public Supply Source Protection Areas, Group Water Schemes or commercial or industrial groundwater abstractions. It is assumed that all residential properties within the vicinity of the proposed scheme are likely supplied by unregistered private wells for drinking water use (GSI, 2021; EPA, 2021).

8.1.4. Groundwater Dependant Terrestrial Ecosystems (GWDTE)

A Groundwater Dependant Terrestrial Ecosystem (GWDTE), Annaghvacky West Wetland, is located adjacent to the proposed scheme, between ca. Ch. 700 and Ch. 1200 as shown in Figure 8-4. Ground conditions in the vicinity of the wetland, as well as the proposed scheme were assessed as part of the ground investigation works undertaken (IGSL, 2021). Relevant exploratory locations are also presented in Figure 8-4.

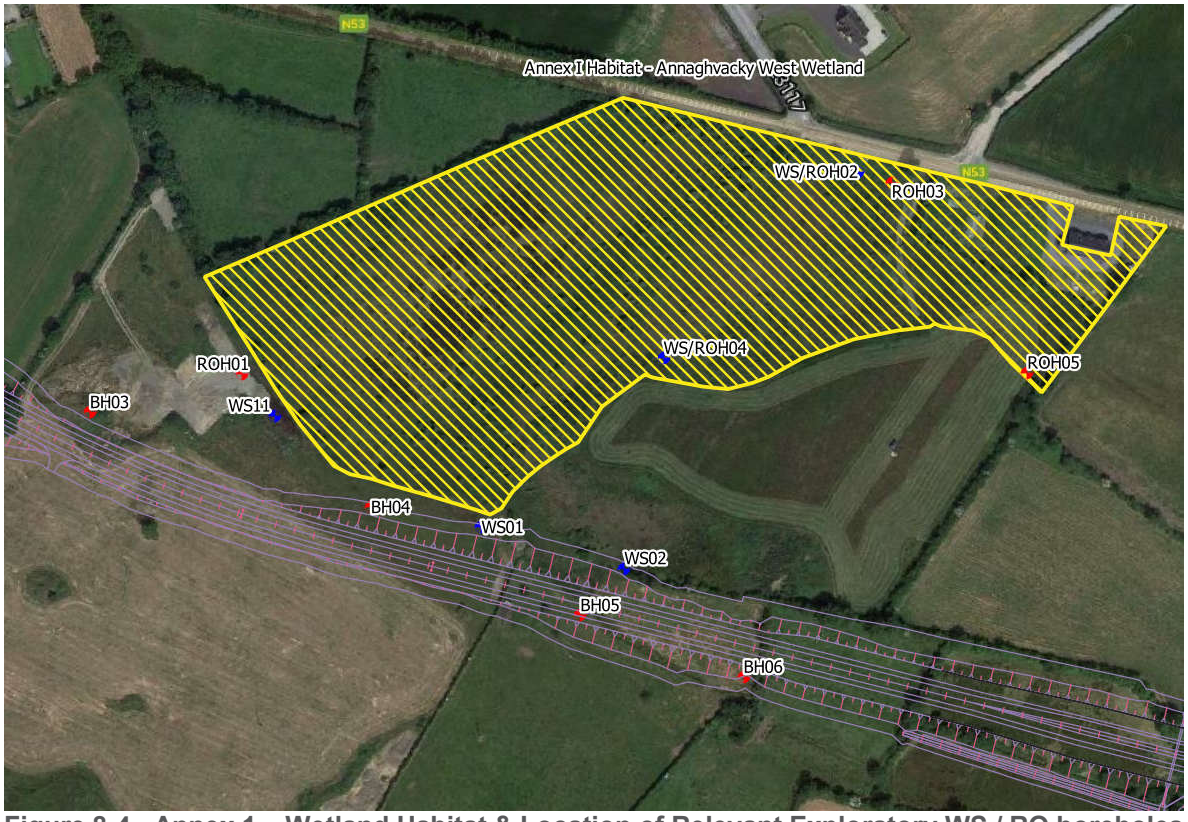


Figure 8-4– Annex 1 – Wetland Habitat & Location of Relevant Exploratory WS / RO boreholes

This wetland consists of transition mire, wet heath, cutover bog and scrub habitats and is noted by Wetland Surveys Ireland to be of County importance. Areas of this wetland site have recently been designated by the Department of Heritage Culture and the Gaeltacht in '*The Status of EU Protected Habitats and Species in Ireland Habitat Assessments Report'* (2019) as Annex I Habitat -Transition Mire and quaking bog [7140] and as such areas of this wetland habitat are now considered to be of international conservation value. While the scheme has been carefully designed to ensure that the

Annex I wetland habitat is not intercepted by the proposed route, it will run immediately adjacent to and south of the Annex I Annaghvacky West Wetlands.

Therefore a detailed hydrogeological review has been undertaken in order to determine the following:

- any surface water / groundwater linkages to the Annex I Annaghvacky West Wetland;
- to develop a site-specific conceptual site model (CSM) for this particular area of the proposed scheme; and,
- to identify any design measures / monitoring works which may need to be implemented during the construction or operational phases of the proposed scheme.

8.1.4.1. Surface water / Groundwater Linkages

As shown in Figure 8.1, no significant rivers/streams are present in the vicinity of the wetland habitat. There are 2no. drainage ditches in the vicinity as previously discussed. A ditch with standing water is located at the south side of Annaghvacky West wetland site (at Ch. 950, north side of the proposed alignment) while the second ditch with standing water is located at Ch. 1200 (south side of the proposed alignment). Site-specific data presented in the Ground Investigation Report (IGSL Ltd., 2021) was reviewed to determine the potential for groundwater to be impacted as a result of the proposed scheme. In summary, three key groundwater zones have been identified beneath the vicinity of the proposed scheme and the Annex I Annaghvacky West Wetland:

- Perched water zone and shallow groundwater zone (0.6 – 5.9 mbgl) within the saturated soil / gravel zone; and,
- Groundwater zone (7 - 9 mbgl) within the sandstone / siltstone bedrock aquifer.

Based on groundwater level monitoring (7no. events carried out between February and April 2021) static groundwater levels specifically beneath the Annex I Annaghvacky West Wetland, and also beneath the adjacent proposed route (between Ch. 700 and Ch. 1200) are generally within 0.5m of the existing ground level in this area. Recorded static groundwater levels in mbgl and mOD are presented in Table 8-1.

Table 8-1 Recorded Static Groundwater Levels in the vicinity of Annex I Annaghvacky West Wetland

Location Ref.	Borehole Depth	mOD	Water monitoring to the ground level																									
			19.11.20		26.11.20		03.12.20		11.12.20		05.01.21		29.01.21		19.02.21		25.02.21		05.03.21		16.03.21		26.03.21		01.04.21		08.04.21	
			Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD	Depth (mbgl)	mOD
WS01	2.60	84.22	0.00	84.22	-0.08	84.14	-0.04	84.18	-0.02	84.20	-0.08	84.14	+0.04	84.26	+0.04	84.26	-0.01	84.21	-0.12	84.10	0.00	84.22	-0.10	84.12	-0.19	84.03	-0.23	83.99
WS02	1.50	84.38	0.00	84.38	0.00	84.38	-0.05	84.33	0.00	84.38	0.00	84.38	+0.15	84.53	+0.05	84.43	0.00	84.38	+0.02	84.40	+0.05	84.43	0.00	84.38	0.00	84.38	-0.08	84.30
WS11	2.00	84.21	+0.02	84.23	-0.02	84.19	-0.02	84.19	-0.02	84.19	0.00	84.21	+0.14	84.35	+0.14	84.35	+0.08	84.29	+0.02	84.23	+0.07	84.28	-0.04	84.17	-0.05	84.16	-0.10	84.11
WS/ROH02	2.80	84.51							+0.04	84.55	0.00	84.51	+0.05	84.56	+0.02	84.53	+0.04	84.55	+0.02	84.53	+0.06	84.57	+0.02	84.53	+0.02	84.53	-0.07	84.44
WS/ROH04	1.80	84.17							+0.06	84.23	+0.04	84.21	+0.15	84.32	+0.06	84.23	+0.05	84.22	0.00	84.17	+0.09	84.26	+0.03	84.20	-0.02	84.15	-0.06	84.11
BH03	9.75	89.56									-4.32	85.24	-3.17	86.39	-3.17	86.39	-4.02	85.54	-4.66	84.90	-4.00	85.56	-4.76	84.80	-4.90	84.66	-5.03	84.53
BH04	4.69	85.29									-0.56	84.73	-0.12	85.17	-0.12	85.17	-0.37	84.92	-0.73	84.56	-0.38	84.91	-0.76	84.53	-0.84	84.45	-0.87	84.42
BH05	7.93	84.43																					-0.33	84.10	-0.44	83.99	-0.54	83.89
BH06	8.94	85.01																					-0.76	84.25	-0.83	84.18	-0.88	84.13
ROH05	7.77	85.91																					-0.37	85.54	-0.47	85.44	-0.52	85.39
ROH03	7.52	85.95																					-0.84	85.11	-0.89	85.06	-0.98	84.97
ROH01	10.42	84.79																					-0.61	84.18	-0.61	84.18	-0.63	84.16

It is unlikely that the bedrock aquifer will be intercepted at this location. Therefore, the focus of this assessment will be the perched water zone and shallow groundwater zone. Static groundwater levels (mOD) for the perched water / shallow groundwater zone (within peat / clay / silt / gravel layers) are presented in Figure 8-5.

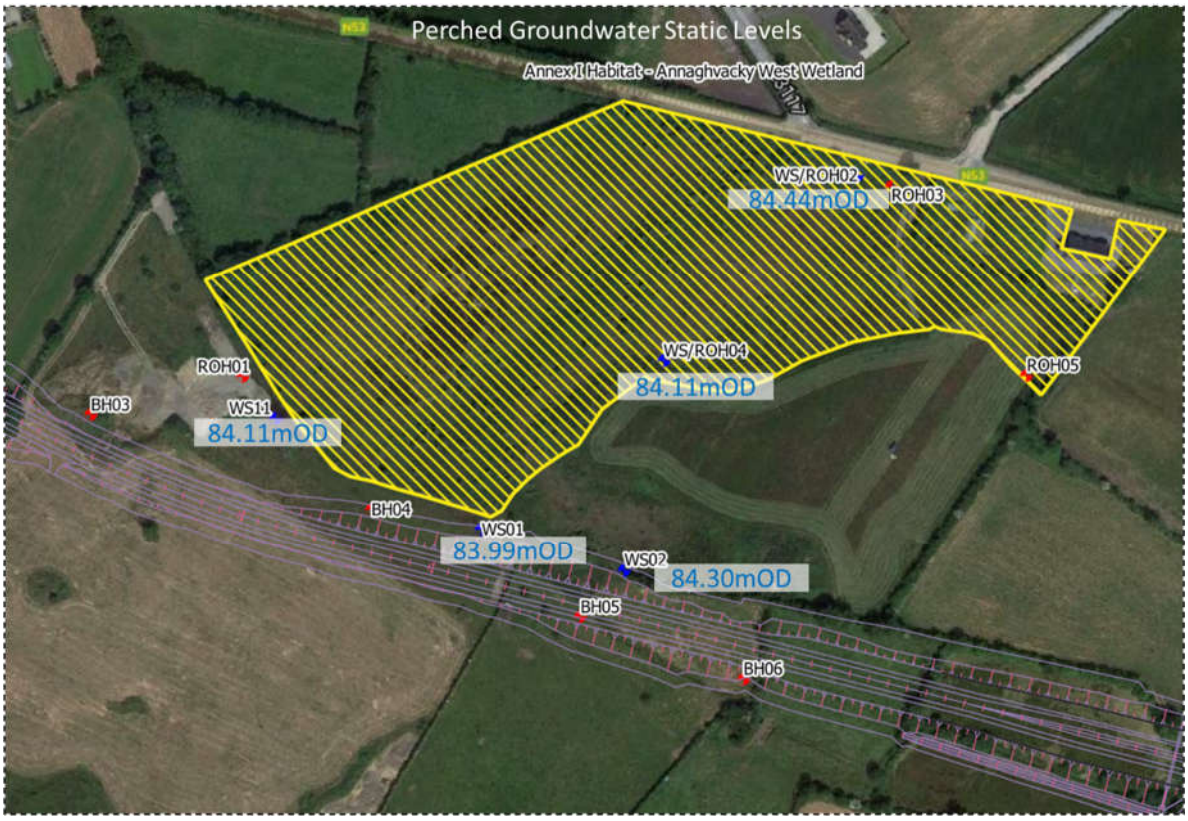


Figure 8-5- Perched Groundwater Levels (mOD) in the vicinity of Annaghvacky West Wetland (Source: IGSL, 2021)

Static groundwater levels (mOD) for the shallow bedrock groundwater zone are presented in Figure 8-6.

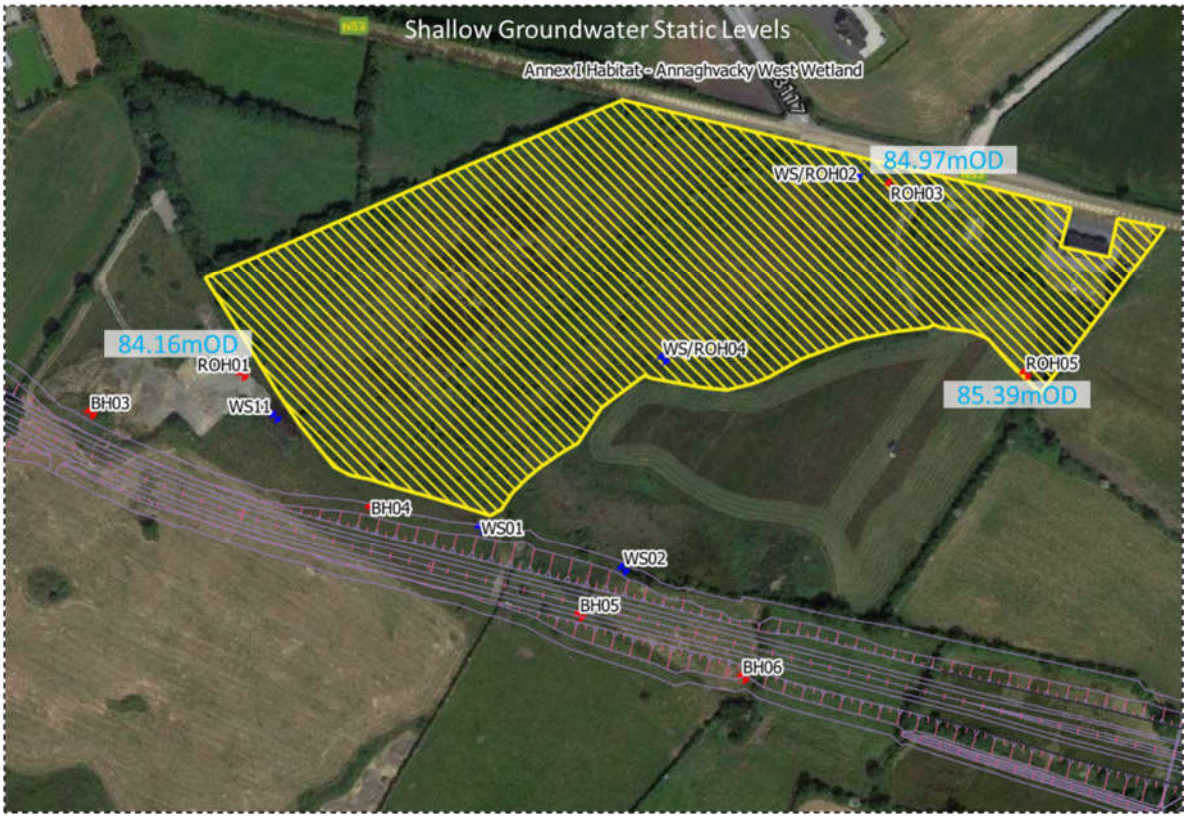


Figure 8-6– Shallow Bedrock Groundwater Levels (mOD) in the vicinity of Annaghvacky West Wetland

Based on measured perched water / shallow groundwater levels it is not possible to conclusively determine perched water /shallow groundwater flow direction in the vicinity of the wetland. However, measured water levels beneath the vicinity of the proposed scheme adjacent to the wetland (WS01, WS02 and WS11), and beneath the wetland itself (WS/ROH04 and WS/ROH02) are generally similar and range from between ground level to 0.23mbgl. Furthermore, encountered soil conditions adjacent to the wetland (WS01, WS02 and WS11) and beneath the wetland itself (WS/ROH04 and WS/ROH02) are similar. This suggests that perched water/ shallow groundwater beneath the vicinity of the proposed scheme adjacent to the wetland and beneath the wetland itself are hydraulically connected via the perched water /shallow groundwater zone.

Based on site specific geological conditions, and the hydrogeological regime encountered beneath the proposed scheme adjacent to the wetland and beneath the wetland itself, it is considered that the proposed scheme (between Ch. 700 and Ch. 1200) is hydraulically connected via. perched water and shallow groundwater, and that the Annex I wetland habitat is primarily perched water / groundwater fed. While it is possible that minor drainage ditches in the vicinity of the proposed scheme adjacent to the wetland are hydraulically linked to the wetland, it is unlikely that the Annex I Annaghvacky West Wetland is surface water fed to any significant extent.

8.1.4.2. Conceptual Site Model

The Annex I Annaghvacky West Wetland is underlain by peat, silt and gravel subsoils. Taking account of all available information, including site-specific data (IGSL Ltd., 2021) the Annex I wetland habitat is likely fed by perched water / shallow groundwater rather than surface water sources, as previously detailed. Based on available groundwater monitoring data, the wetland is fed from perched water in the peat, silt and gravel subsoils. Perched water levels in the area of the wetland vary seasonally with higher levels recorded during the winter season (January 2021) and lower levels recorded during the spring season (April 2021). Perched water levels beneath the proposed scheme (adjacent to the wetland) and beneath the wetland itself have been plotted against available regional rainfall data. Refer to the hydrograph presented in Figure 8-7. Perched water levels beneath the wetland are

immediately responsive to rainfall events, as presented in Figure 8-7, indicating that the habitat is very sensitive to, and dependent on rainfall recharge.

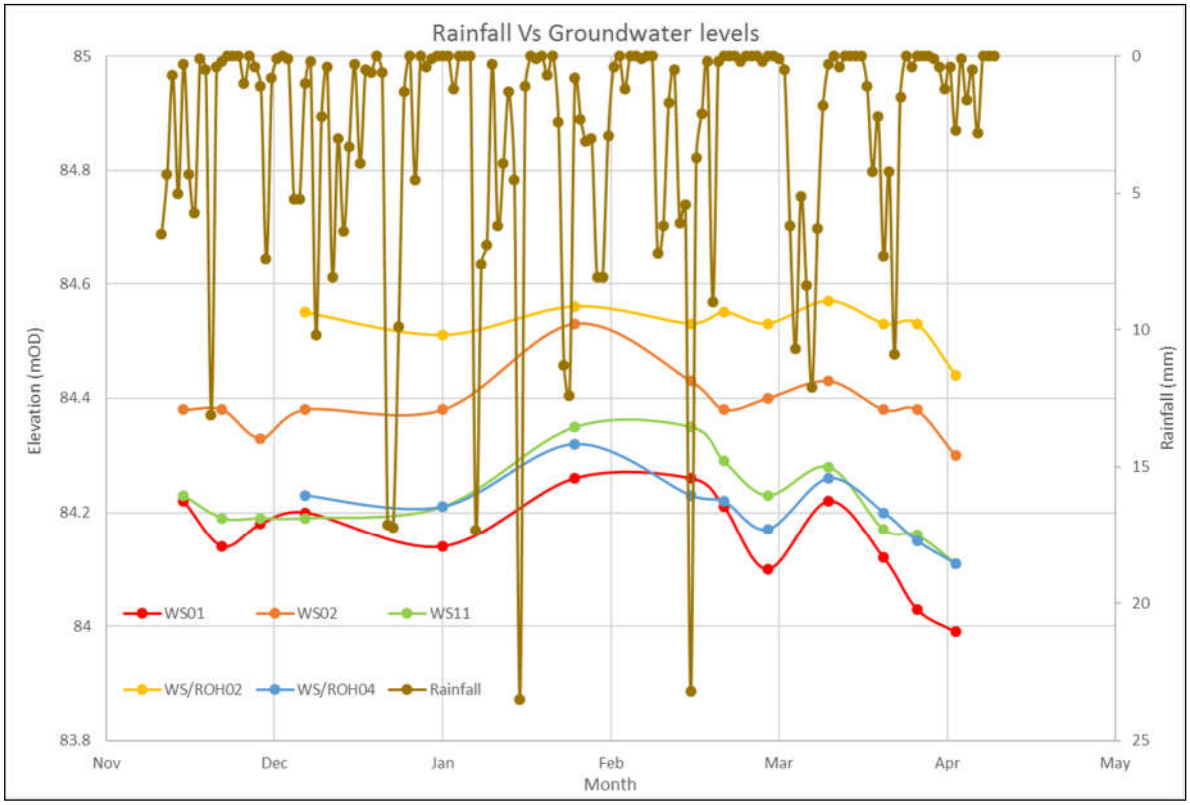


Figure 8-7 - Rainfall vs Perched water Response time series in the vicinity of Annaghvacky West Wetland (November 2020 to April 2021)

A preliminary Hydrogeological Conceptual Site Model (CSM) has been derived for the wetland (based on all available information obtained during the desk-based review including site specific geological and monitoring records). This model, presented in Figure 8-8, represents the current conceptual understanding of surface water / groundwater processes and interactions in the vicinity of the Annex I Annaghvacky West Wetland.

Taking account of the proposed vertical and horizontal alignment along this particular section of the proposed scheme (between Ch. 700 and Ch. 1200) potential impacts to groundwater quality and existing groundwater levels have been identified, as well as potential localised surface water impacts (via. minor drains). Accordingly, potential biodiversity impacts to the Annex 1 habitat have also been identified, via. perched water / groundwater and surface water linkages. Mitigation measures will be required during the construction and operational phases of the proposed scheme in order to ensure any potential impacts (via. perched water / groundwater and surface water linkages) to the Annex I Annaghvacky West Wetland are reduced or eliminated.

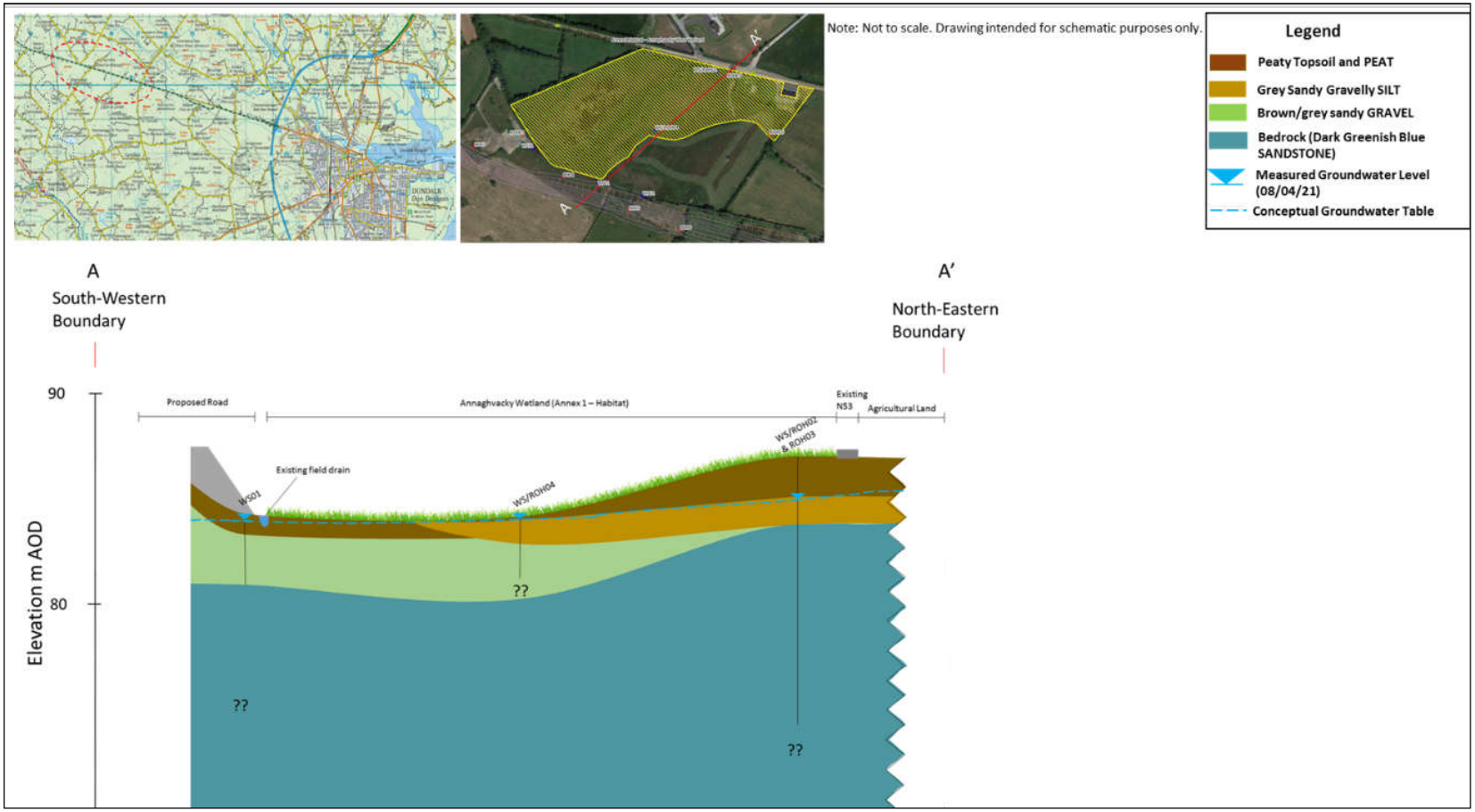


Figure 8-8– Conceptual Site Model (presented for conceptual, schematic purposes only, not to be used for any geotechnical / other interpretation)

8.2. Impact Assessment

8.2.1. Construction Phase

Potential impacts during the construction phase have been considered in terms of surface water / groundwater quality and resources, surface water levels and flows and groundwater supply. In particular potential perched water / groundwater and localised surface water (via. 2no. drainage ditches) impacts, and associated impacts on the Annex I habitat at Annaghvacky West Wetland have been assessed.

The Contractor's compound will include self-contained welfare facilities; therefore, no potential risks to surface water or groundwater quality associated with the temporary compound are identified. Existing subsurface contaminants could pose a potential pollution risk. However, based on the results of the ground investigation, the potential for groundwater impacts via. excavation and mobilisation of any existing subsurface contaminants is negligible. No groundwater or surface water impacts are expected as a result of current or historic land-use within the immediate vicinity of the proposed scheme.

During the construction phase of the proposed scheme, the following potential impacts on surface water or groundwater could occur: -

- Accidental spillages or leaks of fuel, oil, paint or varnish onsite in the vicinity of exposed / shallow perched water / groundwater / surface water pose a potential pollution risk and could result in significant adverse groundwater and/or surface water temporary impacts;

- General site activities during the construction phase associated with cement handling and pouring, pose a potential pollution risk. Such site activities could result in significant adverse temporary impacts (via. groundwater pathways) directly to perched water / groundwater quality beneath the proposed scheme, surface water quality in receiving streams and drainage ditches, and the Annex I Annaghvacky West Wetland;

- Inadequate soil / storm water management during the construction phase poses a risk of excess loadings of suspended solids to receiving streams and drainage ditches, and the Annex I Annaghvacky West Wetland, and could result in significant adverse temporary impacts to surface water quality, and the Annex I habitat;

- Perched water and shallow groundwater quality beneath the Annex I Annaghvacky West Wetland could be impacted due to construction activities. Perched water / groundwater levels are extremely shallow in this area and would therefore be highly vulnerable to potential water quality changes. During construction of the proposed scheme adjacent to the wetland (between Ch. 700 and Ch. 1200) existing ground levels will be raised by ca. 4.4m via. the emplacement of fill. Given that perched / shallow groundwater levels range from between ground level to 0.23mbgl in this area, the fill material used to raise levels could affect baseline groundwater chemistry in this localised area (via. fines from calcareous fill material leaching to ground). This could result in a significant adverse short-term impact to the Annex I Habitat (via perched / shallow groundwater quality impacts).

- Perched water and shallow groundwater levels beneath sections of the scheme where areas of cut are proposed could be impacted due to construction activities and associated dewatering. Given the ground conditions encountered along the proposed scheme, temporary dewatering will likely be required during excavation in areas of significant cut (i.e. cutting of ca. 5m between Ch. 1920 and Ch. 2370) and could result in moderate adverse temporary impacts.

- Temporary onsite perched water / groundwater monitoring wells (WS01, WS02, WS11, WS/ROH02, WS/ROH04, ROH01, ROH03 and ROH05) and any additional monitoring wells installed for geotechnical purposes could provide a conduit for potential contamination of soils and bedrock through site construction activity; in particular the risk of spillages and leakage of any fuel oils and paint. This could result in moderate adverse impacts on groundwater quality in the vicinity of the scheme, and potentially beneath the wetland.

- There will be no impact to regional groundwater resources in the vicinity of the proposed scheme. However 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 likely on private well supply. Such impacts would be moderate adverse, and temporary.

- Based on the proposed design there will be no change to the current flow rates of the Castletown River and its tributary, Carrickastuck Stream, as a result of the proposed construction works. However, the flow rate of Annaghvacky Stream may be impacted due to the encroachment of the proposed alignment on the wet woodland, albeit the impact would be moderate adverse, and temporary.

8.2.2. Operational Phase

Storm water discharge to the Castletown River will be attenuated to greenfield run-off rates; therefore, the proposed scheme will not impact baseline surface water flows in the vicinity, and has been designed to take account of the current hydrological regime.

During the operational phase of the proposed scheme, the following potential impacts on surface water or groundwater could occur: -

- The Annex I Annaghvacky West Wetland could be at risk potentially via. impacts to perched water / shallow groundwater levels in this area (between Ch. 700 and Ch. 1200) given the proximity of the Annex I habitat to the proposed scheme, and based on the existing groundwater regime in this area. Currently rainfall percolates through soils and peat within the wetland site and adjacent areas, and recharges the perched /shallow groundwater system immediately below ground (ranging from between ground level to 0.23mbgl). The Annex 1 habitat would be very sensitive to any subsurface water level changes as a result of the proposed scheme. If stormwater from the proposed scheme between Ch. 700 and Ch. 1200 is attenuated elsewhere along the scheme, this would represent a loss (on a local scale) of potential rainfall recharge to the edge of the wetland habitat. This could in turn impact local perched / shallow groundwater levels. Given the sensitivity of this ecological habitat, potential impacts could be significant adverse and permanent.

- The Annex I Annaghvacky West Wetland Habitat could be at risk potentially via. impacts to perched water / shallow groundwater quality in the vicinity of the proposed scheme (between Ch. 700 and Ch. 1200). Perched water / groundwater levels are extremely shallow in this area and would therefore be highly vulnerable to potential water quality changes. Existing ground levels will be raised by ca. 4.4m via. the emplacement of fill material adjacent to the wetland (between Ch. 700 and Ch. 1200). The fill material used to raise levels could affect baseline groundwater chemistry in this localised area (via. fines from calcareous fill material leaching to ground) during the operational phase. This could result in a significant adverse long-term impact to the Annex I Habitat (via perched / shallow groundwater quality impacts).

- Groundwater and surface water receptors could be at risk from occasional fuel / oil leaks along the proposed road alignment. However the volumes arising from any such spills / leaks are likely to be very minor and such events are likely to be localised and infrequent. Therefore any groundwater / surface water quality impacts are likely to be moderate adverse and temporary. Drainage design measures will be included within the detailed design stage of the project to further mitigate these potential impacts.

- Groundwater and surface water receptors are at risk of becoming contaminated through routine maintenance activity during the operational phase. Road maintenance may result in small quantities of lubricant oils, fuel and chemicals being brought to site. In the highly unlikely event of a spill this could result in slight adverse impacts directly to groundwater / surface water quality.

- Localised potential impacts to groundwater quality and groundwater levels at private supply wells which may be present in the immediate vicinity of the proposed scheme could potentially occur. Such impacts would be moderate adverse and permanent.

8.3. Recommendations (including Mitigation Measures)

- During the detailed design stage, specific stormwater drainage design measures for the proposed scheme in the vicinity of the Annex I Annaghvacky West Wetland habitat (between Ch. 700 and Ch.

1200) will need to be developed. Such measures include ensuring that rainfall/storm water run-off in this localised area is collected, treated (via appropriate pollution control measures) and discharged to ground via diffuse locations immediately adjacent to the wetland habitat. This will ensure that no perched /shallow groundwater impacts via. potential changes in local rainfall recharge rates will occur. Accordingly, potential impacts to the wetland habitat will be designed out.

- Drainage design measures will also be developed during the detailed design stage of the project to ensure that all stormwater drainage is sufficiently treated (via appropriate pollution control measures) prior to discharge.
- Any fill material proposed to be used when raising existing levels by ca. 4.4m adjacent to the Annex I Annaghvacky West Wetland habitat (between Ch. 700 and Ch. 1200) should be carefully selected to ensure this material is of similar geological composition to native subsoils in this area (which are non-calcareous material). Alternatively, should calcareous material be proposed as fill material in this area, an appropriate geotextile membrane must be placed between the existing ground surface and any calcareous material placed on top. This will prevent the potential for any leaching of calcareous fines to ground, which could impact baseline groundwater chemistry, and the Annex I wetland habitat.
- A monitoring programme will be implemented to determine groundwater quality, surface water quality, and groundwater levels at key locations before, during and after the construction phase of the proposed scheme. The monitoring programme will be developed during the detailed design stage of the project but should include as a minimum the following key monitoring location in the vicinity of the Annex I Annaghvacky West Wetland: WS/ROH02, WS/ROH04, ROH01, ROH03 and ROH05, and any adjacent drains.
- In advance of the commencement of construction, contact via a door to door survey or otherwise shall be made with all landowners to develop a register of all identified wells (for potable, agricultural or commercial use) and septic tanks within 150m of the proposed scheme. The register shall be reviewed by the design team in order to identify any well protection works required. Any wells which may potentially be at risk (via. resource / quality impacts) during the construction or operational phases will be identified and appropriate measures implemented in order to protect any vulnerable groundwater supplies within the vicinity.
- In advance of commencement of the Construction Stage, all monitoring wells directly within the alignment of the proposed scheme (as identified in the Ground Investigation Report (IGSL, 2021) should be fully decommissioned by an experienced borehole specialist in accordance with relevant guidelines, '*Good practice for decommissioning redundant boreholes and wells'* (UK Environment Agency, 2012). Offsite monitoring wells (WS/ROH02, WS/ROH04, ROH01, ROH03 and ROH05) should be retained for monitoring purposes with suitable protection measures in place;
- All of the mitigation measures (for the protection of soils and geology) listed in Chapter 6 will be implemented onsite.
- Any groundwater temporarily dewatered during the excavation works for the proposed scheme should be treated via. the installation of a temporary in-situ water treatment system;
    - This system should be designed and sized to ensure that all pumped groundwater water is treated via. a temporary attenuation pond, prior to discharge to a selected onsite location (via. a temporary soakaway).
    - The Contractor will be required to provide a site-specific dewatering plan, clearly setting out proposed excavation methodology, estimated dewatering rates, details of proposed treatment system, and discharge location.
- The construction management of the site should 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.;
- 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.
- In order to prevent any potential surface water / groundwater impacts via. release of hydrocarbon / chemical contaminants the following standard measures will be implemented:
    - 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 proposed development for disposal or re-cycling;
- A response procedure will be put in place to deal with any accidental pollution events. 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 in accordance with all relevant waste management legislation;
- All site vehicles used will be refuelled in bunded and adequately sealed and covered areas in the construction compound area.
- 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 groundwater becoming contaminated through site activity.
- All oil stored on site for construction vehicles will be kept in a locked and bunded area;
- Generators, pumps and similar plant will be placed on drip-trays to prevent contamination;
- 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. Relevant Material Safety Data Sheets along with oil absorbent materials will be kept on site in close proximity to any fuel storage tanks or bowsers during proposed site development works; and,
- All fuel / oil deliveries to on-site oil storage tanks will be supervised, and records will be kept of delivery dates and volumes.

- In order to prevent any potential surface water / groundwater impacts via. release of cementitious materials the following measures will be implemented where poured concrete is being used on site;
  - The production, transport and placement of all cementitious materials will be strictly planned and supervised. Site batching/production of concrete will not be carried out on site;
  - Shutters will be designed to prevent failure. Grout loss will be prevented from shuttered pours by ensuring that all joints between panels achieve a close fit or that they are sealed;
  - Any spillages will be cleaned up and disposed of correctly;
  - Where concrete is to be placed by means of a skip, the opening gate of the delivery chute will be securely fastened to prevent accidental opening;
  - Where possible, concrete skips, pumps and machine buckets will be prevented from slewing over water when placing concrete;
  - Mixer washings and excess concrete will not be discharged directly into any drainage ditches, surface water bodies or exposed groundwater; and,
  - Surplus concrete will be returned to batch plant after completion of a pour.

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, and no significant environmental impacts to the Annex I Annaghvacky West Wetland habitat via. groundwater or surface water sources are likely to occur. Based on the results of the Stage 1 Flood Risk Screening, no flood risk has been identified arising from or to the scheme.

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 (2021);
- National Monuments Service - Archaeological Survey of Ireland Public Viewer (2021);
- 'N53 Hackballscross to Rassan Archaeological, Architectural and Cultural Heritage Options Appraisal Report (Rubicon Heritage, 2019); and;
- N53 Hackballscross to Rassan Archaeological Geophysical Survey (Earthsound Geophysics, 2020).

9.1. Receiving Environment

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 (NMS, 2019). Refer to Figure 9-1. An archaeological, architectural and cultural heritage assessment was carried out for the options selection phase on the preferred route. In addition to this a geophysical survey was carried out for the proposed scheme in October 2020. The geophysical survey is presented in Appendix 9.

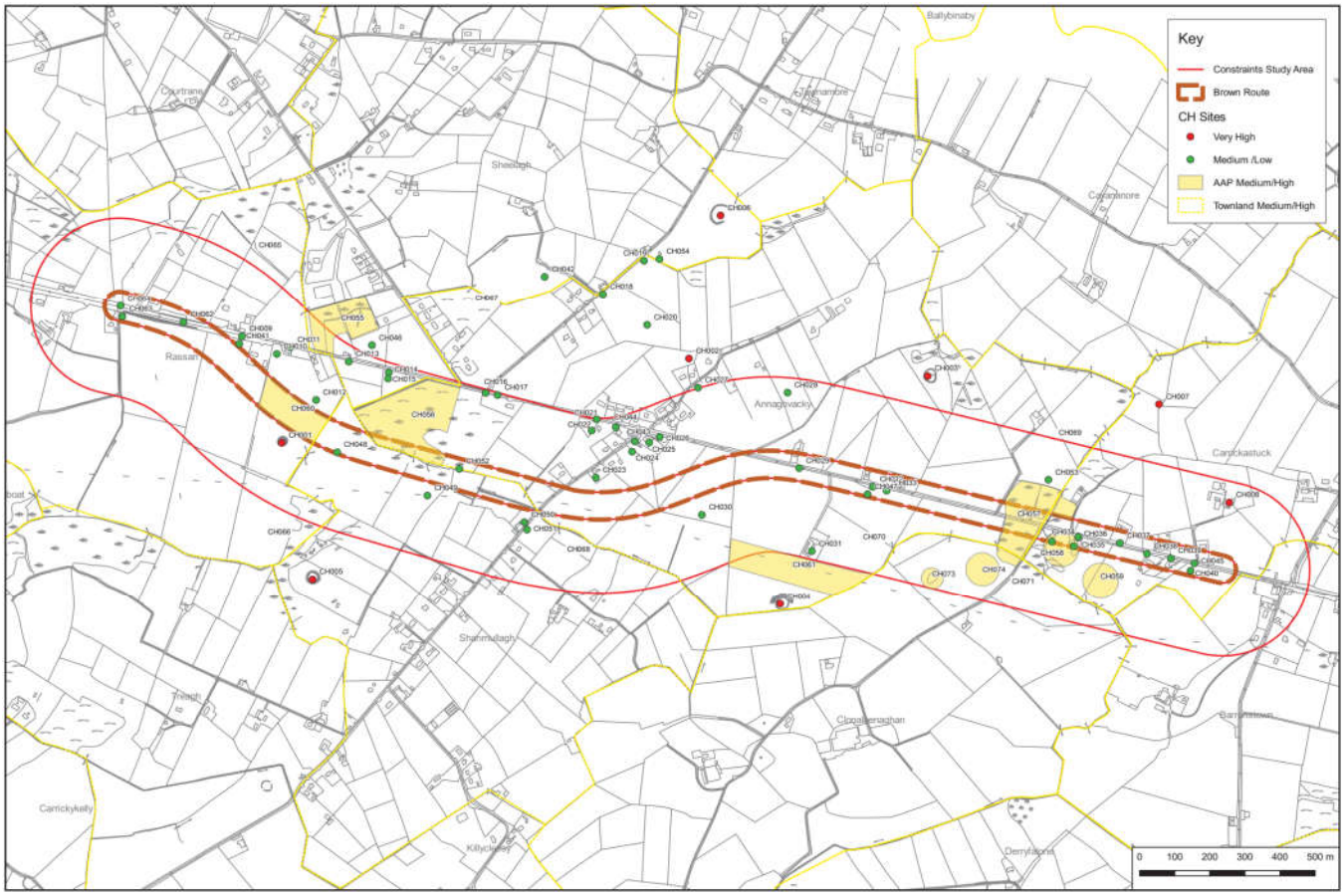


Figure 9-1 – Cultural Heritage Sites Within the General Area of the Scheme (Rubicon Heritage, 2019)

The following information was obtained from the N53 Hackballscross to Rassan Archaeological, Architectural and Cultural Heritage Options Appraisal Report (Rubicon Heritage, 2019). Rubicon Heritage (2019) defined the study area of the proposed scheme as 250m either side of the centre line of the proposed route. Rubicon Heritage (2019) conducted a field inspection and windshield survey to *'verify the extent and condition of recorded sites and to assess local topography in order to identify any potential low-visibility archaeological and/or historical sites that are not currently recorded and which may be impacted upon negatively by the proposed development'.*

There are no Protected Structures, Architectural Conservation Areas (ACAs) or sites listed in the National Inventory of Architectural Heritage (NIAH) database for the proposed scheme. Architectural heritage which will likely be impacted by the proposed scheme are presented in Table 9.1. All sites, within Table 9.1 which will likely be impacted by the proposed scheme are '*unregistered sites with a baseline value of Medium/Low; with one exception (CH045) all are vernacular buildings. In all cases impacts are likely to occur as a result of widening sections of the existing road carriageway*' (Rubicon Heritage, 2019). Rubicon Heritage (2019) states that '*in the case of CH009 road widening is likely to require demolition of one of the extant buildings within the cluster with runs east-west along the existing road frontage. There would also be a loss of a section of the garden of from property. In the case of CH034 and CH038, demolition of structures is less likely to be required but the new road is likely to encroach into the existing garden/curtilage of each property. The entranceway (CH045) will need to be reconfigured as part of the realignment of the on-line section of this route option.'*

Table 9-1 - Evaluation of likely impacts on Architectural Heritage

CH No.	Category	Townland	Summary	Baseline Value	Dist. (m)	Impact Type	Magnitude Impact	Significance Impact Level
CH009	UCH	Rassan	Building Cluster - Extant	Medium /Low	0	Direct	Major	Slight
CH034	UCH	Carrickastuck	Single Building – Extant	Medium /Low	0	Direct	Minor	Negligible
CH038	UCH	Carrickastuck	Building Cluster - Extant	Medium /Low	0	Direct	Moderate	Slight
CH045	UCH	Carrickastuck	Entrance – Extant	Medium /Low	0	Direct	Major	Slight

There are no National Monuments, or sites subject to a preservation order within the proposed scheme. Archaeology and cultural heritage features which will likely be impacted by the proposed scheme are presented in Table 9.2. There are 2no. Record of Monuments and Places (RMP) sites within the study area of the proposed scheme, with a likely impact identified to 1no. of these sites; CH001. Rubicon Heritage (2019) has noted that *'CH001 is an upstanding ring barrow with an associated cist located ca. 50 m to the south of the proposed scheme. There is no screening from either vegetation or topography between the site and closest section of the proposed scheme. Therefore, there is a potential for visual impact on the setting of this monument….The significance level is considered to be moderate'.*

The Archaeological, Architectural and Cultural Heritage Report also states that the proposed scheme '*will intersect with the locations of four areas of archaeological potential (AAPs) (CH056–058 and CH060). These areas have a higher than normal potential to contain subsurface archaeological features or deposits. Construction of this route option would require construction groundworks that could impact upon such material. The significance level of this impact is consider red to be moderate in relation to CH058 and CH060 and slight in relation to CH056–057.'*

The proposed scheme *'will transect and impact upon three townland boundaries (CH066 and CH068–069). The significance level of the impact to the townland boundary between Shanmullagh and Annaghvacky (CH068) is considered to be moderate as the proposed scheme would require the removal of a c. 290 m long section of this townland boundary rather than just a single crossing point. The affected section appears to be currently defined by field fencing and low embankment to the west and largely by hedgerow type field boundaries towards the east. It is unchanged from the 1st edition Ordnance Survey (1837) but there is some deviation from the—more generalised—Down Survey of 1656'* (Rubicon Heritage, 2019).

The proposed scheme *'encompasses the sites of 15 vernacular buildings or building clusters shown on the 1st edition Ordnance Survey 6-inch series map. These largely represent the sites of pre-Famine dwellings and farmsteads. There are no indications of surface remains for these sites, however sub-surface remains may*

still be present. Construction of this route option would require construction groundworks that could impact upon such material. The significance level of this impact is considered to be slight' (Rubicon Heritage, 2019).

Table 9-2 - Evaluation of likely impacts on Archaeology and Cultural Heritage

CH No.	Category	Townland	Summary	Baseline Value	Dist. (m)	Impact Type	Magnitude Impact	Significance Impact Level
CH001	RMP	Rassan	Barrow - ring barrow & cist	Very High	50	Indirect	Moderate	Moderate
CH008	RMP	Carrickastuck	Souterrain	Very High	150	None	N/A	N/A
CH029	UCH	Annaghvacky	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH032	UCH	Annaghvacky	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH033	UCH	Annaghvacky	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH035	UCH	Carrickastuck	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH036	UCH	Carrickastuck	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH037	UCH	Carrickastuck	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH039	UCH	Carrickastuck	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH040	UCH	Carrickastuck	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH041	UCH	Rassan	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH047	UCH	Annaghvacky	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight

CH No.	Category	Townland	Summary	Baseline Value	Dist. (m)	Impact Type	Magnitude Impact	Significance Impact Level
CH048	UCH	Shanmullagh	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH052	UCH	Annaghvacky	Building Cluster – Non-extant	Medium /Low	0	Direct	Major	Slight
CH056	AAP	Annaghvacky	Wetland	Medium /Low	0	Direct	Major	Slight
CH057	AAP	Annaghvacky	Wetland	Medium /Low	0	Direct	Major	Slight
CH058	AAP	Carrickastuck	Raised Ground	Medium /High	0	Direct	Major	Moderate
CH060	AAP	Rassan	Nearby RMP	Medium /High	0	Direct	Major	Moderate
CH062	UCH	Rassan	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH063	UCH	Rassan	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH064	UCH	Rassan	Single Building – Non-extant	Medium /Low	0	Direct	Major	Slight
CH066	TB	Rassan/Shanmullagh	Boundary Townland Boundary	Medium /Low	0	Direct	Moderate	Slight
CH068	TB	Shanmullagh/ Annaghvacky	Boundary Townland Boundary	Medium /Low	0	Direct	Major	Moderate
CH069	TB	Annaghvacky /Carrickastuck	Boundary Townland Boundary	Medium /Low	0	Direct	Minor	Slight

Earthsound Geophysics (2020) completed an Archaeological Geophysical Survey for the proposed scheme. Figure 9.2 shows the detailed location of the geophysics survey. The survey concluded that '*the geophysical surveys undertaken for this report have revealed a series of possible archaeological features. The majority of these are likely to represent boundary features or relict agricultural divisions. One oval possible archaeological enclosure was detected to the east of the ring-barrow (LH003-019001). Two anomalies were also identified which match features shown on the historic Ordnance Survey mapping. Other possible archaeological remains include one possible pit and numerous zones of magnetic enhancement. Evidence of geological activity can be seen throughout the survey areas with the detection of multiple geological dykes. These have created both linear anomalies and zones of high magnetic responses, these responses are so strong that they may have*

masked any archaeological remains within the area. Evidence for cultivation was also detected as well as areas of high magnetic modern disturbance' (Earthsound Geophysics, 2020). Refinements in the proposed design, undertaken during Phase 3, have reduced the impacts that may be listed in the Phase 2 "Archaeology Architectural and Cultural Heritage" assessment. 1no property and 2no. associated outbuildings are directly impacted, following the completion of the Preliminary Design; as shown in the Preliminary Design Drawings and discussed elsewhere in this report.

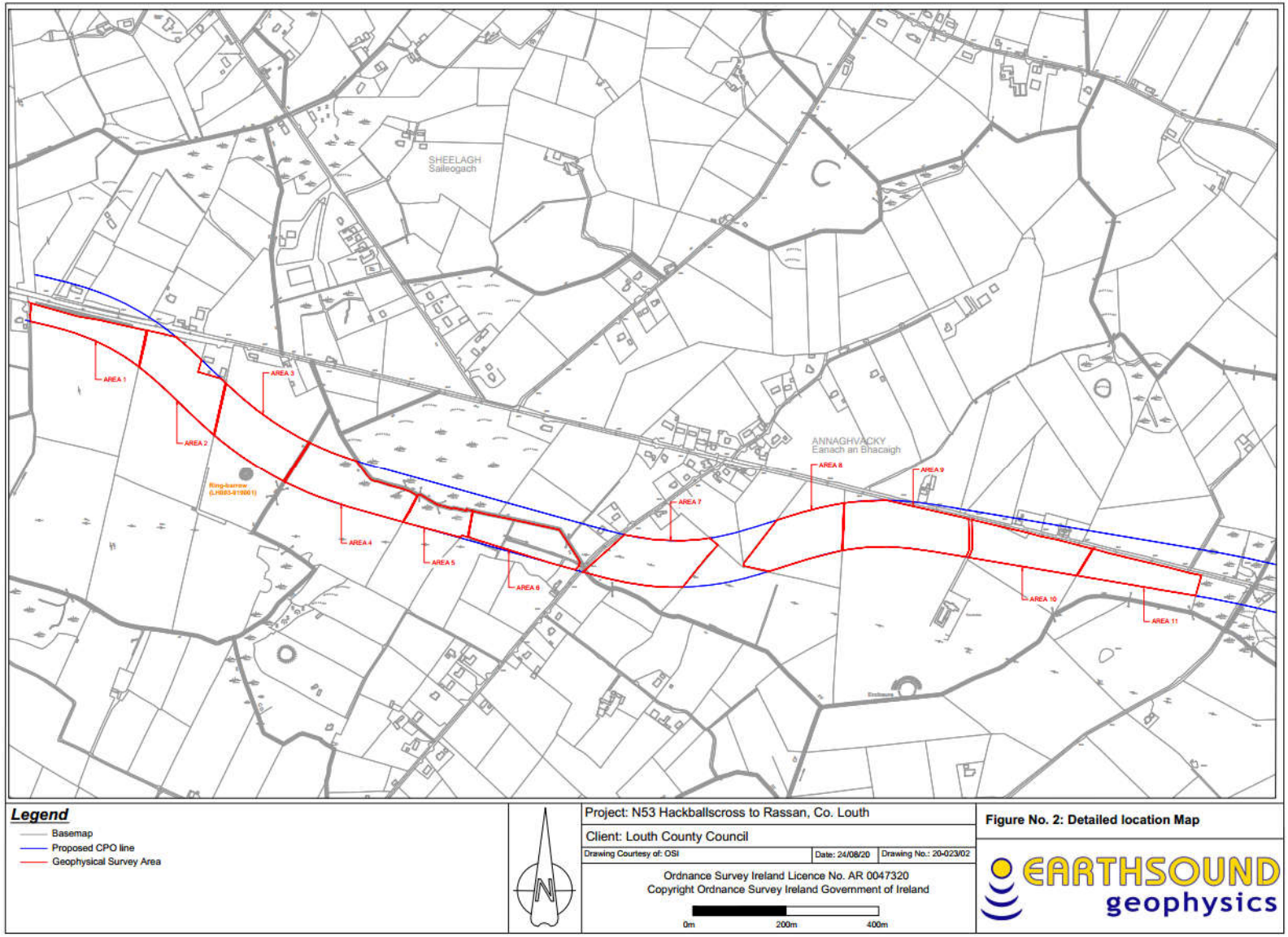


Figure 9-2 - Detailed Geophysical Survey Location Map (Earthsound Geophysics, 2020)

9.2. Impact Assessment

9.2.1. Construction Phase

There are no Protected Structures, Architectural Conservation Areas (ACAs) or sites listed in the National Inventory of Architectural Heritage (NIAH) within the study area of the proposed scheme. The proposed scheme is not predicted to have any very significant, or significant impacts with respect to architectural features. Potential identified impacts will be negligible, slight or moderate.

There are no National Monuments, or sites subject to a preservation order within the study area of the proposed scheme. The proposed scheme is not predicted to have any very significant, or significant impacts with respect to archaeological features. No likely direct impacts have been identified in relation to any of the 8no. RMP sites within the vicinity of the proposed scheme. Potential identified impacts will be either slight or moderate.

Rubicon Heritage (2019) identified 3no. likely direct impacts (which have an impact level of moderate) for the proposed scheme. One of the likely direct impacts is of the potential removal of a ca. 290m long section of the townland boundary between Shanmullagh and Annaghvacky (CH068). '*This would reduce the readability of the townland boundary within the landscape, but it is possible that it could be mitigated by design'* (Rubicon Heritage, 2019). The other two are the result of the route crossing through identified areas of archaeological potential with baseline values rated medium/high—CH058 and CH060. '*There is one indirect impact, with an impact level of moderate identified the proposed scheme. An upstanding ring barrow with a cist (CH001) is located ca. 50 m south of the route corridor. Currently there is no screening of views between the route corridor and this site. There is a potential for a moderate impact on the setting of this monument. However, it is possible that this impact could be mitigated by design'* (Rubicon Heritage, 2019). The upstanding ring barrow with a cist (CH001) is located south of proposed scheme, approx. Chainage 620, as per the Preliminary Design Drawings.

Rubicon Heritage (2019) has stated that for the proposed development *'there are 21no. likely direct impacts which have an impact level of slight'. 15no. of these are as a result of the presence of sites of vernacular buildings within the proposed scheme (CH029; CH032–033; CH035–037; CH039–041; CH047–048; CH052; CH062–064). It is possible that some of these impacts could be mitigated by design. 4no. are the result of transecting townland boundaries at a single location (CH066, CH069, CH070 and CH071). 2no. are the result of the route crossing through identified areas of archaeological potential with baseline values rated medium/low—CH056–057'.*

Rubicon Heritage (2019) concludes that construction of the proposed scheme *'would require construction groundworks that could impact upon such material. The significance level of this impact is considered to be slight'.*

A geophysical survey (Refer to Appendix 9) was completed for the proposed scheme and the mitigation measures proposed within the Geophysical survey and the mitigation measures mentioned below will be implemented during the detailed design stage. Mitigation measures will be undertaken at the detailed design phase, which will be considered in-tandem with the schemes landscape design.

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, provided the recommended measures outlined below are implemented in full.

9.3. Recommendations (including Mitigation Measures)

The following recommendations will be implemented during the construction phase of the proposed development. They will also form part of the site specific Detailed Construction and Environmental Management Plan;

- Advance works testing shall be carried out on the "anomalies" found in the geophysical survey (presented in Appendix 9) at pre-construction stage.

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

9.4. Summary

The Archaeological, Architectural and Cultural Heritage Report (Rubicon Heritage, 2019) has stated that *'there are no Protected Structures, Architectural Conservation Areas (ACAs) or sites listed in the*

*National Inventory of Architectural Heritage (NIAH)' …*within the study area…*'There are no National Monuments, or sites subject to a preservation order within the study area.'* Rubicon Heritage (2019) concludes that the construction of the proposed scheme *'would require construction groundworks that could impact upon such material. The significance level of this impact is considered to be slight.'*

The Archaeological Geophysical Survey (Earthsound Geophysics, 2020) recommended that a number of test excavations be conducted prior to construction works. Such excavations will be undertaken at an appropriate time in the project programme.

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 proposed development is located in a rural environment in Co. Louth, extending from the townlands of Hackballscross to Rassan as shown in Figure 10.1.

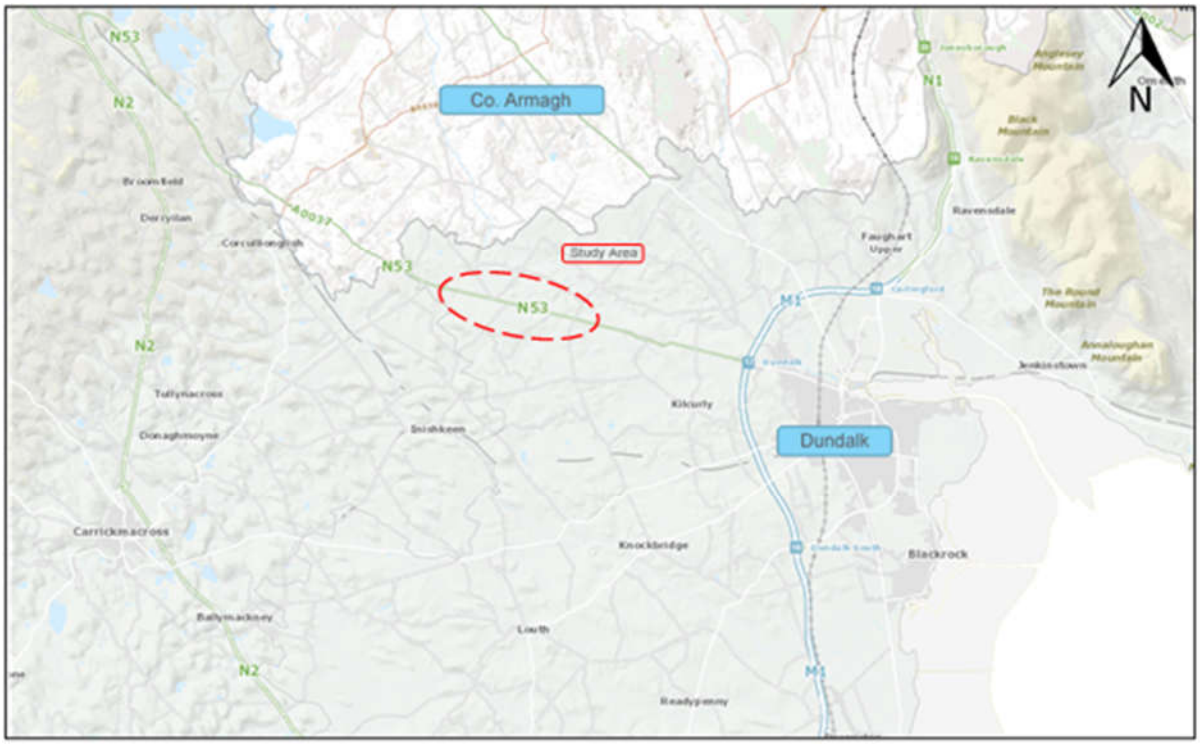


Figure 10-1 - Scheme Location

10.1.2. Pedestrian and Cyclist Facilities

There is no provision for cyclists or pedestrians on this existing section of N53, and it is considered that this section of the road would be particularly hazardous for these vulnerable road users, due to the nature of the geometry of the road and the existing narrow cross section.

Pedestrians and cyclists will be catered for by the scheme. Facilities will be provided to link such users between Annaghvacky and Hackballscross, via a section of the stopped-up N53 combined with a segregated path parallel to the proposed N53. Similarly, a pedestrian subway will be provided beneath the proposed mainline to facilitate a link between Annaghvacky and Shanmullagh (along the L7120 local road).

10.1.3. Existing Public Transport

The study area in question is poorly serviced by public transport and this is due mainly to its rural location. There is only one daily bus service (Route 162) available to the public on weekdays, while there are no buses during the weekend or public holidays. An offline bus stop is proposed as part of the scheme, on the east side of Annaghvacky, as shown in the Preliminary Design Drawings (Refer to Appendix 1).

10.1.4. Existing Road Network

The section of the N53 between Hackballscross to Rassan is a national secondary route corridor which had essentially evolved over the ages and thus fits within the existing landscape. Hence, the current road layout bears little resemblance to modern day safety requirements and transportation

demands. Hence, the alignment is well below current standards as it traverses the hilly terrain. The existing N53 is narrow and undulating in character thereby providing limited overtaking opportunities along its length. This in turn tends to lead to driver frustration and potentially hazardous driving manoeuvres.

The existing carriageway is a single carriageway, generally 6.0m wide with grass verge widths varying between 0.5m and 2.5m. The posted speed limit is generally 100km/h however reduces to 80km/h and 60km/h on approach to and through Annaghvacky. There are no hard shoulders present, nor footways/cycleways, which creates an inherently hazardous environment for vulnerable road users such as pedestrians and cyclists. There is no formal surface water drainage system present and run off from the road surface simply runs along the edge of the carriageway and discharges into the nearest ditch. The uneven surface results in surface water ponding in certain areas during periods of heavy rainfall which creates inherent safety issues in wet weather.

The route passes through a small crossroads at Annaghvacky which has a local shop and several domestic houses. The N53 also caters for significant HGV's and the National Secondary Route is a strategic traffic route from the northeast to the northwest and partly through Northern Ireland. However, the high number of local accesses and the rural environment within which it lies means there is a significant proportion of local traffic and slow-moving agricultural vehicles.

These factors, combined with those already mentioned, lead to unreliable journey times. In addition, road safety is a particular concern along the route given the poor alignment, mix of regional and local traffic, observed traffic speeds and the general lack of facilities / space for vulnerable road users.

10.1.5. Junction Turning Counts

The data collection required as part of the traffic surveys identified for this scheme included Manual Classified Counts (MCC's), Automatic Traffic Counts (ATC's) and journey time assessments, at the locations as shown in Figure 10.2



Figure 10-2 - Traffic Counter Locations

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 route 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: 3.3 km;
- Percentage online / offline: approximately 900m online / 2,500m offline;
- Mainline cross-section: Type 1 Single Carriageway (as per TII's CC-SCD-00001);
- Number of mainline junctions: 3 No. Junctions;

- Side roads realigned (from west to east): L7120;
- Structures: 1 No. Subway; and,
- Townlands through which it travels (from west to east): Rassan, Shanmullagh, Annaghvacky, Carrickastuck and Barronstown.

The drawings showing the alignment of the Proposed Development are contained within Appendix 1.

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 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 approximately 900m length of online works will contribute the most to traffic disruption and will require periods of lane closures and road closures with diversion routes in place during that time. It is estimated that road closures on the N53 could total approximately three months, not necessarily concurrently. However, the details of the closure periods would be dependent on the Contractor's working methods.

During periods of road closure of the N53 for these works, strategic traffic may be directed as follows, subject to the Contractor's working methods and agreement with Louth County Council and TII, shown in Table 10.1.

Table 10-1 - Strategic and Regional Traffic: Diversion Routes

Origin	Destination	Existing Route [1]	Possible Diversion Route [1 & 2]
Castleblayney	Dundalk	N53 to Dundalk; approx. 28km	N2 to Carrickmacross, then R178 to Dundalk; approx. 40km
Dundalk	Castleblayney	N53 to Dundalk; approx. 28km	R178 to Carrickmacross, then N2 to Castleblayney; approx. 40km
Crossmaglen	Dundalk	B30 (Dundalk Rd) to L3117 to Annaghvacky, then N53 to Dundalk; approx. 17.5km	B30 (Newry Rd) to A29 (New Rd) to R177 to Dundalk; approx. 21km
Dundalk	Crossmaglen	N53 to Annaghvacky, then L3117 to B30 (Dundalk Rd) to Crossmaglen; approx. 17.5km	R177 to A29 (New Rd) to B30 (Newry Rd) to Crossmaglen; approx. 21km

Note 1: distances are estimated using Google Maps, from origin centre to destination centre.

Note 2: for the purposes of this assessment, routes in Northern Ireland are considered to be equivalent to Rep. of Ireland routes as follows: A-class road = National Road; B-class road = Regional Road; C-class road = Local Road.

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, where possible, 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 deliveries 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.

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

10.3.2. Operational Phase

10.3.2.1. Establishment of the Traffic Model

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. *5187353DG0033*). 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 each of the Phase 2 Stage 2 Route options – of which one was ultimately selected as the Emerging Preferred Route i.e. the "Brown Route".

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

- N53 / L3117 Priority Junction; and,
- N53 / L7120 Priority Junction.

10.3.2.2. Traffic Flows

Forecast year traffic flows (in terms of all vehicles) for the opening year 2023 and design year 2038 are shown in Table 10.2.

Table 10-2 - Forecast Traffic Flows

	Base year (2019)	Opening year (2023)	Design Year (2038)
AM Peak (8 to 9am)	973	1024	1163
Interpeak (3 to 4pm)	559	588	667
PM Peak (5 to 6pm)	1043	1098	1247

10.3.2.3. Junction Modelling

Junction options were assessed with priority junctions determined most appropriate throughout. The junction arrangements are as displayed in the Proposed Development drawings (refer to Appendix 1).

10.4. Recommendations (including Mitigation Measures)

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 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, as a result of standard growth rates over the appraisal period of 30 years, are not considered to be significant. All proposed road network and junction strategies are considered to be of sufficient capacity to cater for the predicted traffic. Therefore, it is not anticipated that the proposed scheme will have a significant impact on traffic once completed, notwithstanding the temporary traffic disruption that will occur during the construction period as outlined in Section 10.3.

11. Ecology

1.1. Introduction

The following section contains the findings of desk-based studies and site visits / field surveys (undertaken in June 2019 and July 2020) 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).

11.1.1. Methodology

The ecological assessment of the proposed scheme followed methodologies including, but not limited to the following: -

- National Roads Authority (2009). Guidelines for Assessment of Ecological Impacts of National Roads Schemes;
- Environmental Protection Agency (EPA) (2017). Guidelines on the Information to be contained in Environmental Impact Assessment Reports. (Draft, August 2017);
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine; and,
- National Roads Authority. Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes.

11.1.2. Desk Study

A desk study was carried out to collate available existing information on habitats and species of ecological value within and surrounding the proposed scheme. Ecology reports, sourced from National Parks and Wildlife Service and Louth County Council, were also reviewed as part of the desktop exercise. The ecological information was collated with the aim of providing a comprehensive evaluation of baseline ecological conditions found within the scheme study area and was used to undertake an evaluation of the likely impacts the proposed scheme will have on biodiversity.

Sites designated for nature conservation were examined within 15km of the proposed scheme. Sites reviewed in context with the scheme included both internationally (European sites, Ramsar sites) and nationally designated conservation areas (National Heritage Areas, proposed National Heritage Areas, Nature Reserves).

The Natura 2000 network (European sites) 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 Bird Directive (2009/147/EC), regularly occurring populations of migratory species and areas of international importance for migratory birds. Ramsar sites are wetland sites designated to be of international importance under the Ramsar Convention an intergovernmental environmental treaty established by UNESCO. A Natural Heritage Area (NHA) is the basic designation for wildlife under the Wildlife Amendment Act (2000). NHA sites are selected by having special scientific significance for one or more species, communities, habitats, landforms or geological features, or for a variety of natural attributes. A Nature Reserve is an area of importance to wildlife, which is protected under Ministerial order and sites are established under section 15 of the Wildlife Act 1976.

The inland surface waters (e.g. rivers, streams and lakes) that are intersected by the proposed route, or which receive drainage from the proposed scheme, were reviewed. Where information was available waterbodies were assessed in relation to their fisheries value, biological status, water quality and designation status. Relevant waterbodies within the study area were identified through the EPA

online Map Viewer facility[4]. Available records of protected aquatic species, designation status and water quality for these water features were reviewed.

The desk-based study also reviewed available information on any known or potentially important sites for rare or protected flora or fauna known to occur along or within the zone(s) of influence of the proposed scheme. Available information on any other sites of ecological value, that are not nationally or internationally designated, found within or in close proximity to the proposed route of the roadway scheme were also reviewed.

The locations of conservation sites, protected species occurrences and areas of ecological interest were reviewed using Google maps / Google StreetView[5] and Bing maps[6]. Sources of data used to collate and compile information of ecological features of interest and importance for the study include:-

- Northern Ireland Environment Agency (NIEA)
  - ASSI Reports
- National Parks and Wildlife Service (NPWS)
  - Information on sites designated for nature conservation, including spatial data.
  - Habitats and species data
  - Wildfowl Sanctuaries
- National Biodiversity Data Centre (NBDC)
  - Protected species records
  - Invasive species records
- Environmental Protection Agency
  - Watercourses and lake spatial files
  - Water quality data
  - Corine land cover data
- Geological Survey of Ireland
  - Underlying geology, soils and hydrogeology
- Ordnance Survey Ireland
  - Historic mapping
- Birdwatch Ireland
  - Bird count data from the Irish Wetland Bird Survey (IWeBS)
- Wetland Survey Ireland
  - Information on identified wetland habitats within the study area.
- OPW Wildlife Service Report (1990)
  - Wildlife Sanctuaries
- Louth County Development Plan 2015-2021
  - SEA Environmental Report.
  - Volume 3 Environmental Report
  - Appropriate Assessment Report
  - Tree preservation orders
- Irish Peatland Conservation Trust
- National Heritage Plan
- Ramsar sites information service.
- Teagasc
  - Ireland Peatland Maps.
- Louth County Council
  - Louth Hedgerow Survey.
  - Louth Wetland Survey.
  - Louth heritage Plan

[4] https://gis.epa.ie/EPAMaps/
[5] https://www.google.ie/maps
[6] http://www.bing.com/maps/

- Louth Landscape Character Assessment

11.1.3. Zone of Influence of the Proposed Scheme

The zone of influence is the area over which ecological features may be subject to significant effects as a result of the proposed road scheme and associated activities. This is likely to extend beyond the footprint of the route corridor of the new scheme. The zone of influence can vary for different ecological features depending on their sensitivity to environmental change (CIEEM, 2018). Ecological resources or features of conservation value within the zone of influence of the proposed route may be subject to impacts as a result of their direct or indirect connectivity to the proposed scheme. Direct connectivity refers to ecological features found within or partly within the scheme study area. These features may be directly impacted by the proposed scheme, e.g. though habitat loss. Indirect connectivity refers to sites outside of the scheme study area but connected through features such as linear habitats (i.e. wildlife corridors) or surface water pathways. Indirect impacts may include deterioration of water quality, air quality, increase in noise and severing linear corridors used by wildlife to move between sites.

For the purposes of this assessment, direct impacts such as loss of habitat and direct mortalities of species were confined to ecological resources contained within proposed route boundary. For the consideration of indirect impacts, such as impacts to water quality or disturbance of species, the zone of influence was extended to 15km to incorporate the presence of European and nationally designated sites, as the zone of influence will vary for different ecological features depending on their sensitivity to environmental change (CIEEM, 2018). This 15km distance is derived from UK guidance (Scott Wilson *et al*., 2006).

11.1.4. Site Visits

Following the desk-based review of available information on the habitats and species of conservation value found within the zone of influence of the proposed scheme, a series of site visits were undertaken. The aim of these site visits was to view the ecological features of interest first hand, determine the likely interaction that the proposed roadway may have on these habitats and to undertake a preliminary assessment of the potential impact the proposed scheme may have on the identified habitats.

Field surveys were undertaken during June 2019 and July 2020 at key sites and features that were deemed to be of particular ecological value with the aim of assessing the potential impacts of the proposed scheme upon them. Crossing points and points of interaction were visited for the proposed scheme and, where feasible, 'vantage point' surveys were undertaken in the form of visual inspections from strategic locations.

A catalogue of photographs was compiled of the key ecological features and sites within the study area. A review of the catalogue was undertaken to supplement and validate the desktop study.

Site surveys were undertaken during June 2019 and July 2020 which is within the optimal surveying window for habitats and floral species.

As part of the ecological appraisal of the proposed scheme, an assessment of the potential for the habitats within the footprint of the roadway to support protected or notable species was made. This assessment was based on the quality, extent and interconnectivity of suitable habitats, along with the results of the desktop study. Protected species assessed for, but not limited to, include the following: -

- Badger (*Meles meles*);
- Bats;
- Breeding birds; and,
- Plants of conservation concern.

Habitats were assessed for suitability for supporting mammal species and were surveyed for evidence of mammal activity and mammal refugia. Mammal surveys were undertaken in line with published guidance on ecological surveying techniques (NRA 2008).

A floral invasive species survey was also undertaken and primarily focused on, but was not limited to, the following high impact invasive species; Japanese Knotweed (*Fallopia japonica*), Himalayan Balsam (*Impatiens glandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*).

The habitats present in the study area were categorized and photographed and particular attention was paid to the primary habitats and land take to be directly affected by the proposed scheme, with regard to *'Best Practise Guidance for Habitat Surveying and Mapping'* (Smith *et al.*, 2011). Habitat mapping has been produced which was aided by aerial photography and habitats were assessed and categorized as per '*A Guide to Habitats in Ireland'* by J.A. Fossitt (2000) and equivalence to EU Annex habitats has been considered.

Walkover mammal surveys were conducted in July 2020. The walkover mammal surveys were conducted to assess the potential for mammal activity in the study area, including observing trails, tracks and other mammal signs such as prints, scrapes, snagged hairs and faecal deposits. Weather conditions during July 2020 were dry and warm. The ecological study area subject to site surveys is illustrated in Figure 11-1 below.



Figure 11-1 - Area subject to ecological surveys.

11.1.5. Valuing Ecological Importance

Ecological features can be important for a variety of reasons. Importance may relate, for example, to the quality or extent of the site or habitats found within, or the rarity of the habitat and / or species, the extent to which such habitats and / or species are threatened throughout their range, or to their rate of decline.

The importance of an ecological feature was considered within a defined geographical context. The frame of reference used to determine ecological value relied on known and published accounts of the feature's ecological importance, rarity and distribution combined with professional judgement.

The following geographic frame of reference was used for evaluating the importance of ecological features within the study area: -

- International importance
- National importance
- County importance
- Local importance (higher value)
- Local importance (lower value)

The geographical context for determining the value of ecological receptors followed recommendations as outlined in the Guidelines for Assessment of Ecological Impacts of National Roads Scheme, National Roads Authority (2009).

11.2. Existing Environment

The following section outlines the baseline ecological conditions found within and around proposed road scheme. Details of protected sites, habitats, features, flora and fauna that are within the zone of influence of the proposed scheme are listed. Details of the land use and the environmental landscape within the study area are also outlined following a review of aerial photography and Corrine Land Cover datasets[7].

Louth County Development Plan 2015-2021 describes the natural heritage of County Louth as follows: -

'County Louth is rich in biodiversity, thanks to an extensive coastline (stretching from Carlingford Lough to the Boyne Estuary), marine environments, wetlands, woodlands, rivers and upland habitats. Together, these habitats support a rich variety of plant and animal species. The county of Louth is an internationally important destination for migratory wildlife, with Dundalk Bay being Ireland's top location for wading birds. An area equivalent to more than one seventh of the County is designated under Irish and European legislation for wildlife protection, (including marine and inter-tidal areas). Some of the upland areas in the Cooley Peninsula are recognised as being amongst the most unspoilt in the Country.'

A review of aerial photography and Corrine land cover information identifies the proposed scheme as being within 'lands principally occupied by agriculture'. These lands are primarily made up of improved agricultural grasslands used for pasture and crop production. Built areas with the study area include private residences which are mainly adjacent to roads, farm buildings, a school and occasional small and medium sized enterprises (SMEs).

The agricultural grassland and built lands habitats are considered to be of low ecological value in accordance with the NRA (2009) Guidelines for Assessment of Ecological Impacts of National Road Schemes. The treelines and hedgerows bordering the agricultural grassland field are of more ecological value and for the study area, where possible, these hedgerows were reviewed at vantage points during site surveys with the aim to assess their ecological value. Woodland and wetland areas are also identified within the study area which are discussed in greater detail below. Plates 11-2 and 11-2 below illustrate typical land cover found within the study area.



Plate 11-1 - Improved agricultural grassland, treelines and rolling hills.

[7] http://www.epa.ie/soilandbiodiversity/soils/land/corine/



Plate 11-2 - Areas of drumlins, undulating lands.

11.2.1. Sites Designated for Nature Conservation

There are 4 no. sites of international importance which are designated for protection and there are 30 no. sites which are of national importance within 15km of the study area of the proposed scheme. Of note, sites designated for conservation value within both the Republic of Ireland and Northern Ireland were assessed to ensure transboundary impacts can be adequately considered. These designated sites are outlined in greater detail in the following sections of this report.

11.2.2. International Importance – European Sites

Of international importance: there are a total of 4 no. European sites identified to be within 15km of the proposed scheme; 3 no. Special Areas of Conservation (SACs) and 1 no. Special Protection Area for birds (SPA). Details of the European sites including the qualifying interests for which they are designated are provided below in Table 11.1. The European sites in the environs of the proposed scheme are illustrated below in Figure 11.2.

The ecological features for which these sites have been designated were examined and the distances between the sites and the proposed scheme were measured. Potential connectivity between the European sites listed in Table 11.1 and the proposed scheme was assessed through both potential direct and indirect connectivity.

There are no Special Areas of Conservation within the site of the proposed scheme. 1 no. SAC has been determined to have surface water connectivity to the proposed scheme; Dundalk Bay SAC.

There are no SPAs within the site of the proposed scheme. 1 no. SPA has been determined to share connectivity to the proposed scheme; Dundalk Bay SPA. Some of the bird species for which the SPA has been designated may utilise lands within and around the footprint of the proposed scheme.

Table 11-1 - European sites within 15km of the proposed scheme.

European sites - Special Areas of Conservation (SACs)

Site Name (Site Code)	Distance from Study Area	Features of Interest	Connectivity to proposed scheme
Dundalk Bay SAC (000455)	ca. 8.6km east	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]	Yes. Indirect connectivity through surface water pathways. The Carrickastuck Stream, Drumboat Stream and Inishkeen Stream which receive drainage from the proposed roadway flow into the Castletown River and/or Fane River which outfall into Dundalk Bay.

		Mediterranean salt meadows (Juncetalia maritimi) [1410]	
Site Name (Site Code)	Distance from Study Area	Features of Interest	Connectivity to proposed scheme
Slieve Gullion SAC (UK0030277)	ca. 10km northeast	European dry heaths [4030]	No. Located in Northern Ireland. No surface water or landscape connectivity to proposed scheme.
Carlingford Mountain SAC (000453)	ca. 12.6km east	Northern Atlantic wet heaths with Erica tetralix [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Transition mires and quaking bogs [7140] Alkaline fens [7230] Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110] Calcareous rocky slopes with chasmophytic vegetation [8210] Siliceous rocky slopes with chasmophytic vegetation [8220]	No. Located in Northern Ireland. No surface water or landscape connectivity to proposed scheme.
European sites - Special Protection Areas (SPAs)			
Site Name (Site Code)	Distance from Study Area	Features of Interest	Connectivity to proposed scheme
Dundalk Bay SPA (004064)	7.2km east	Great Crested Grebe (Podiceps cristatus) [A005] Greylag Goose (Anser anser) [A043] Light-bellied Brent Goose (Branta bernicla hrota) [A046] Shelduck (Tadorna tadorna) [A048] Teal (Anas crecca) [A052] Mallard (Anas platyrhynchos) [A053] Pintail (Anas acuta) [A054] Common Scoter (Melanitta nigra) [A065]	Yes. Indirect connectivity through surface water pathways. The Carrickastuck Stream, Drumboat Stream and Inishkeen Stream which receive drainage from the proposed roadway flow into the Castletown River and/or Fane River which outfall into Dundalk Bay. Some of the bird species for which the SPA has been

	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]	designated can feed in the wider landscape outside of those habitats associated with the designated site and may utilise the fields within the study area.

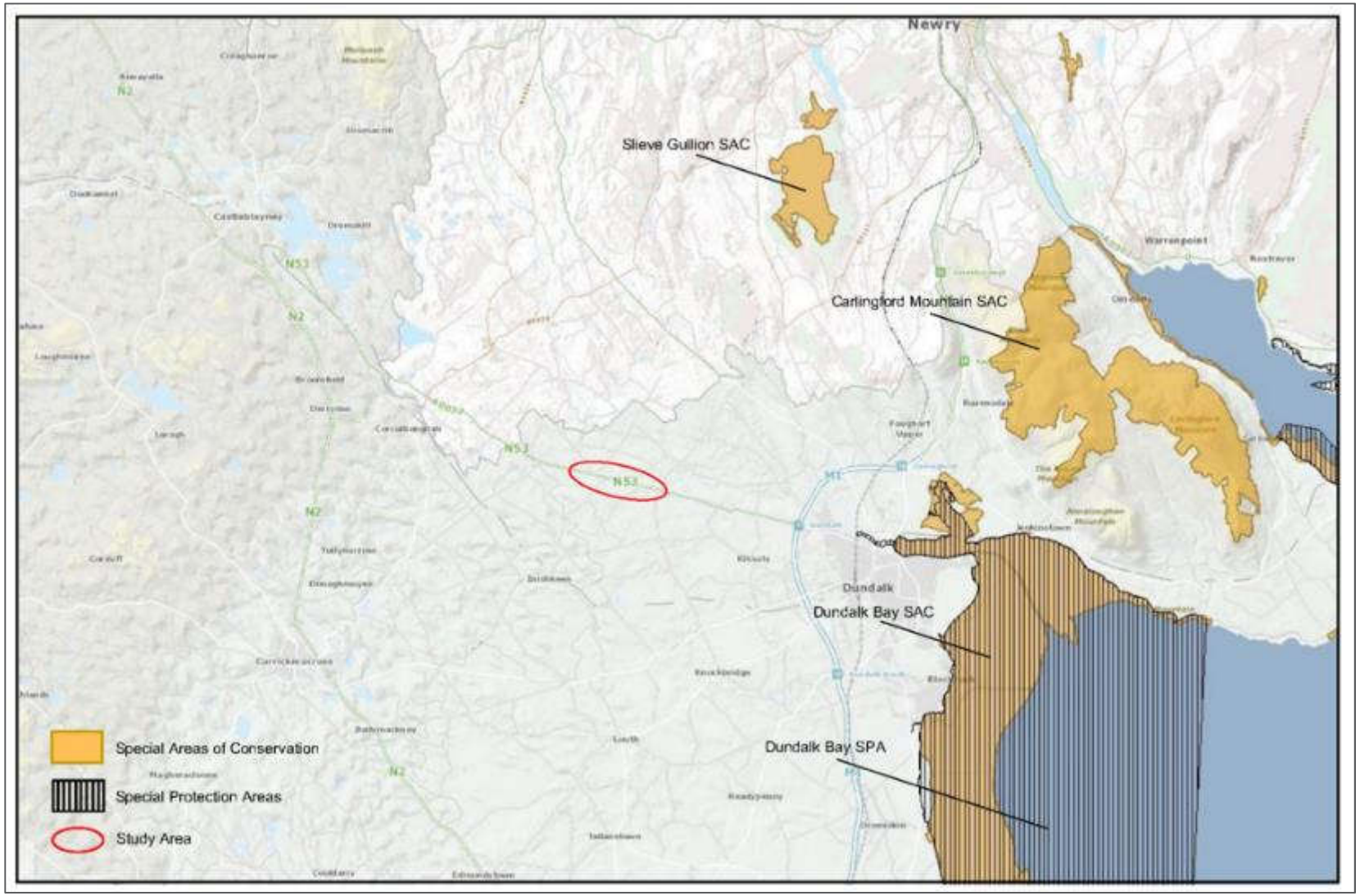


Figure 11-2 - European sites within 15km of the proposed scheme.

11.2.3. International Importance – Ramsar Sites

A Ramsar Site is a wetland site designated to be of international importance under the Ramsar Convention, an intergovernmental environmental treaty established in 1971 by UNESCO. It provides for national action and international cooperation regarding the conservation of wetlands, and wise sustainable use of their resources.

Dundalk Bay is the closest Ramsar site to the study located area ca. 8.6km to the east. The site was identified as a Ramsar Convention Site in 1996 (Ramsar Site no. 834; 4,768 ha). The Site is a wetland of international importance as an open sea bay with extensive saltmarshes, intertidal sand and mudflats encompassing the estuaries of four rivers. The site is internationally important for waterbirds regularly holding over 20,000 birds and supporting over 1% of the Northwest European/East Atlantic Flyway populations of Brent Geese (*Branta bernicla*), Oystercatchers (*Haematopus ostralegus*), Bar-tailed Godwits (*Haematopus ostralegus*) and Knot (*Calidris canutus*).

Carlingford Lough (Site no. 936) is the only other Ramsar Site close to the study area and is located ca. 22km to the east. The site includes mudflats, saltmarsh, small rocks, and shingle islands in both the Republic of Ireland and Northern Ireland. It supports an important assemblage of vulnerable and endangered Irish Red Data Book bird species. It provides habitats for terns, including *Sterna hirundo*, *S. dougallii*, *S. paradisaea*. The site is used for recreation, fishing, marine aquaculture, and hunting.

There is indirect connectively from the proposed scheme to Dundalk Bay Ramsar site through surface water pathways in the form of the Carrickastuck Stream, Drumboat Stream and Inishkeen Stream via the Castletown River and Fane River.

11.2.4. International Importance – Annex I Habitats

The Habitat Directive[8] lists the specific habitat types (and species) which have been designated for conservation by EU member states within the Natura 2000 network (European sites). There are over 200 habitat types listed within Annex I of the Habitats Directive which are legally protected under the directive.

Under Article II of the Habitats Directive EU member states are obliged to monitor the conservation status of annexed habitats (and species). The monitoring requirements obliged to be undertaken by member states is not restricted to European sites / Natura 2000 sites (SACs and SPAs) but encompasses the total national resource of each habitat i.e. Annex I habitats outside of SACs as well as those within SACs. Consequently, data on Annex I habitat must be collected both within and outside the Natura 2000 network and under Article 17 of the Habitats Directive EU member states are obliged to report to the EU commission every six years on the implementation of measures taken towards meeting the objectives of the directive.

In 2019 Ireland submitted to the EU Commission an Article 17 report on the assessment of the status of Annex I habitats (and species) that Ireland is required to protect under the EU Habitats Directive. A review of recently National Parks and Wildlife Service[9] published (2020) Article 17 datasets identifies an area of Annex I habitat in close proximity to the proposed scheme in a wetland site; Annaghvacky West wetlands. The annexed habitat near the proposed scheme does not form part of, nor is it within, any European site.

Annex I Habitat – 7140 Transition mires and quaking bog

An area of wetland habitat; Annaghvacky West wetlands is located directly adjacent to the proposed scheme; ca. 20m north of Chainage 0+950. NPWS datasets identify areas of wetland habitat within Annaghvacky West wetlands as having been recently (NPWS 2020) classified as having correspondence (i.e. similarity) to Annex I habitat: *Transition Mire and quaking bog* [7140] and as such areas of this wetland habitat are included in Ireland's 2020 Article 17 reporting and are therefore considered to be of international conservation value.

Annaghvacky West wetland site was visited during the Louth Wetland Survey (2012)[10] and the wetland site was given a conservation rating C, indicating high local conservation value. A Marsh Fritillary (*Euphydryas aurinia*) survey was recommended by the Louth Wetland Survey (2012) due to the abundance of host plant; Devil's bit scabious (*Succisa pratensis*) noted within the site. The Marsh

[8] formally known as Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora

[9] https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17/habitats/bogs-mires-and-fens

[10] Louth Wetland Survey II (2012). Foss P., Crushell P., O'Loughlin B., & Wilson F.

Fritillary survey was carried out within Annaghvacky West wetland site during 2013 and survey notes[11] (unpublished survey notes as provided by NPWS) outline the main habitat types within the wetland site as including; '*transition mire, dry meadows and grassy verges and cutover bog'.* Following a review of all available published data on the wetland site and following consultation with NPWS (GIS dept.) regarding annexed habitats it is concluded that the presence within Annaghvacky West wetland site of the Annex I habitat; Transition mire and quaking bog [7140] cannot be ruled out.

The habitats with correspondence to Annex 1 Transition mire [7140] within Annaghvacky West wetlands are located ca. 20m to the north of the proposed roadway alignment (outside of the footprint of the proposed roadway). Figure 11-3 below shows the area of Article 17 Annex I Transition mire habitat which is in proximity to the alignment of the proposed scheme. The extents of the annexed habitat has been extracted directly from NPWS datasets published in 2020[12]. [Note: The Annaghvacky West wetland site boundary, as detailed by Wetland Survey Ireland, extends beyond the area of annexed habitat]. Refer to Figure 11.6 in Section 11.2.9 below for wider extents of the Annaghvacky West wetland site.

In the wider landscape there are 2 no. further wetland sites which have correspondence to Annex I habitat; Transition mire and quaking bog [7140]; Treagh North wetlands and Cunnicar wetlands. The Treagh North wetland site is located ca. 440m southwest of the proposed scheme and the Cunnicar wetland site is located ca. 560m southeast of the proposed scheme. Neither of these two wetland sites have direct or indirect connectivity to the proposed road scheme. Wetland habitats relevant to the proposed scheme are also discussed and illustrated in detail below Section 11.6 of this report. Plates 11-3 to 11.5 depict Annaghvacky West wetland (site photos taken in July 2020).



Figure 11-3 - Annaghvacky West wetlands area with correspondence to Annex I habitat: - 7140[13].

[11] Unpublished Report - Appendix VII, Annavacky West, Site visit and details; Surveys of possible Marsh Fritillary sites and habitat in Cos Louth, Meath & Monaghan BEC Consultants 2014.

[12] https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17/habitats/bogs-mires-and-fens.

[13] Shapefiles obtained from NPWS datasets published in 2020; https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17/2019/habitats/bogs-mires-and-fens.



Plate 11-3 - Annaghvacky West wetland site – view from scheme alignment.



Plate 11-4 - Wet ditch within wetland site.



Plate 11-5 - Wetland habitat within wetland site

11.2.5. National Importance – National Heritage Areas

Of national importance; there are no Natural Heritage Areas (NHAs) while there are 18 no. proposed Natural Heritage Areas (pNHAs) within 15km of the proposed scheme. Details of the sites including a synopsis of each site is provided in Table 11-2 below. Nationally important sites within 15km of the proposed scheme are illustrated below in Figure 11-4.

The site synopsis, where available, for each site was reviewed and summarised. The distances between each site and the proposed scheme were also measured and the potential connectivity between them assessed.

1 no. pNHA within the 15km buffer was determined to share indirect connectivity to the proposed scheme. Dundalk Bay pNHA is located ca. 9.4km from the proposed scheme and there is indirect connectivity through surface water pathways. The Carrickastuck Stream, Drumboat Stream and Inishkeen Stream, which receive drainage from the proposed scheme, flow into the Castletown River and Fane River which outfall into Dundalk Bay.

Table 11-2 - Nationally important conservation sites within 15km of the proposed scheme.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
Dundalk Bay 000455	9.2km	No site synopsis available. This pNHA is also a SAC and SPA, see Table 3.1 for details.	Yes. Indirect connectivity through surface water pathways. The Carrickastuck Stream, Drumboat Stream and Inishkeen Stream which receive drainage from the proposed roadway flow into the Castletown River and/or Fane River which outfall into Dundalk Bay.
Drumcah, Toprass and Cortial Loughs 001462	2.2km	This site comprises three lakes which are situated approximately 6km west of Dundalk. The area surrounding these three lakes is drumlin country. The hills enclose basins which in three places form shallow lakes. Semi-aquatic vegetation is now extensive occupying, in places, half the lake surface. The three lakes represent the largest areas of open water in Co. Louth. The extent of the marsh transition from open water to grassland also makes these lakes of great interest.	No surface water or landscape connectivity to the proposed scheme.
Lough Ross 001495	7.4km	Lough Ross is a large, slightly alkaline lake, 90ha in size situated on the border between Co. Monaghan and Co. Armagh. Most of the lake circumference is colonised by species-poor reed swamp vegetation in which Common Reed (Phragmites australis), Common Club-rush (Schoenoplectus lacustris), Reed Canary-grass (Phalaris arundinacea) and Common Spike-rush (Eleocharis palustris) occur. Although it is very similar to nearby lakes, in terms of species and habitat diversity, Lough Ross is one of the larger and least disturbed lakes in the area.	No surface water or landscape connectivity to the proposed scheme.

[14] Distance measured in a straight line from closest point.

[15] Site synopsis summarised from information received from National Parks and Wildlife Service.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
Stephenstown Pond 001803	8.4km	This is a large, artificially excavated, shallow pond with fringing emergent vegetation of Bulrush (Typha latifolia) and Reed Canary-grass (Phalaris arundinacea) with associated species such as Bogbean (Menyanthes trifoliata). There is no feature of the natural history of this artificial lake which makes it of outstanding importance. It has been designated an NHA because it is representative of open water bodies in the area, supports a thriving, typical pond wildlife. Although overall it is rather a small site, the stands of aquatic vegetation are relatively extensive and this may account for the rich invertebrate life.	No surface water or landscape connectivity to the proposed scheme.
Muckno Lake 000563	9.28km	Muckno Lake is situated in the inter-drumlin hollow immediately adjacent to the southeast of Castleblaney. It is the largest lake in Co. Monaghan. There are frequent patches of wet woodland on embankments. These are characterised by Downy Birch (Betula pubescens) and willow (Salix spp.) with an understorey of Common Reed (Phragmites australis) and wet pools. Fish species present in the lake are Brown Trout, Pike Rudd, Perch, Bream and Eel.	No surface water or landscape connectivity to the proposed scheme.
Spring and Corcrin Loughs 001671	9.6km	This site consists of two calcareous loughs, situated 2km east of Carrickmacross. Spring Lough is the larger of the two. Both loughs have similar botanical structures with a ring of White Water-lily (Nymphaea alba) inside a fringe of Common Reed (Phragmites australis). There is a narrow shelf of calcareous mud around the lake edge upon which grows a species of stonewort (Chara spp). This sites value lies in its botanical interest with a stonewort present in the loughs, as well as providing a	No surface water or landscape connectivity to the proposed scheme.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
		typical example of the many small, calcareous lakes in the region.	
Monalty Lough 001608	10.6km	Monalty Lough lies 2.5km to the west of Carrickmacross and is set in typical cattle pasture in the glacial drift of the drumlin belt, underlain by Upper limestone. There is a lot of cover for nesting waterfowl in the reed-beds around the lake and a wide variety of species are regularly recorded here. Monalty has been selected as a Natural Heritage Area because of the richness of the birdlife. The water quality is poor due to nutrient runoff from adjacent farmland, and although this is a cause for grave concern, it does not yet appear to be a serious threat to the wildfowl population.	No surface water or landscape connectivity to the proposed scheme.
Lough Naglack 000561	11.4km	This calcareous lough is situated 2km south-east of Carrickmacross in Co. Monaghan. Together with adjoining limestone grassland, calcareous marsh and mixed woodland this area supports a very rich flora. Several bones of the Irish Giant Deer (Cervus giganteus) have been found in the mud of the lough.	No surface water or landscape connectivity to the proposed scheme.
Creevy Lough 001599	11.4km	The lake is popular with anglers and picnic-makers. The shoreline is very open and is not fringed with reed as are many of the other lakes in this area. Common Spike-rush (Eleocharis palustris), Bladder-sedge (Carex vesicaria) and Bottle Sedge (Carex rostrata) grow in clumps around the perimeter. The floor of the lough is colonised by Shoreweed (Littorella uniflora) and two rare aquatic plant species were found in shallow water, namely Six-stamened Waterwort (Elatine hexandra) and Rigid Hornwort (Certophyllum demersum). This lough is interesting as it exhibits different plant	No surface water or landscape connectivity to the proposed scheme.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
		communities to the other lakes in the region.	
Darver Castle Woods 001461	11.75km	Darver Castle Woods is located just south of Readypenny Cross, Co. Louth, in the grounds of Darver Castle. It is described in a 1972 report as mixed wet deciduous woodland of Beech (Fagus sylvatica), Alder (Alnus glutinosa), Hawthorn (Crataegus monogyna) and Ash (Fraxinus excelsior) with a diverse understorey of orchids. Rhododendron (Rhododendron ponticum) is present in the site. Wet deciduous woodland is an uncommon habitat in the region and this is a site worthy of conservation and possible regeneration into Ash woodland.	No surface water or landscape connectivity to the proposed scheme.
Trumpet Hill 001468	11.9km	The site contains several habitats. The central hill has rocky outcrops, and where it slopes abruptly to the north, various ferns are growing. This slope is covered in mosses and liverworts with Wood Sage (Teucrium scorodonia), Bilberry (Vaccinium myrtillus), Cross-leaved Heath (Erica tetralix) and Great Wood-rush (Luzula sylvatica) also present. The aspect, steep slope and varied plant cover of Trumpet Hill form several habitat types and permit a wide range of microflora to grow there. The association of mixed Beech wood with the basalt outcrop adds diversity of habitat to a small area.	No surface water or landscape connectivity to the proposed scheme.
Nafarty Fen 002077	12km	The hollow is totally filled by vegetation consisting of a mixture of sedges, rushes and reeds with a fringe of willows and some planted trees. A reed-bed of Common Reed (Phragmites australis) covers much of the centre of the site. The site is used by moderate number of Snipe in winter as well as by Water Rail. Both probably nest along with Sedge Warbler, Reed Bunting and Mallard.	No surface water or landscape connectivity to the proposed scheme.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
Ravensdale Plantation 001805	12.1km	Ravensdale Plantation is situated approximately 4km north of Ravensdale in Co. Louth, close to the county border with Armagh. The site is a forest in part of which a nature trail has been established. The trees on site are largely coniferous but Sycamore (Acer pseudoplatanus), Beech (Fagus sylvatica) and Ash (Fraxinus excelsior) also occur. The shrub understorey is composed of Rhododendron (Rhododendron ponticum), Elder (Sambucus nigra), Ash and Bramble (Rubus fruticosus agg.). The insect fauna of the wood is typical and Badger, squirrel, Jay and a varied passerine bird fauna occur.	No surface water or landscape connectivity to the proposed scheme.
Carlingford Mountain 000453	12.7km	No site synopsis available. This pNHA is also a SAC see Table 3.1 for details.	No surface water or landscape connectivity to the proposed scheme.
Louth Hall And Ardee Woods 001616	12.8km	Louth Hall and Ardee Woods proposed Natural Heritage Area (pNHA) encompasses three areas of mixed, planted and semi-natural deciduous woodland to the north of Ardee in Co. Louth. Although parts of these woodlands are comprised of exotic species, they are some of the last remaining well established broadleaved woodlands in the area. They are quite close to the town of Ardee and are of value for educational purposes as well as providing habitats for local woodland flora and fauna.	No surface water or landscape connectivity to the proposed scheme.
Lough Fea Demesne 000560	12.9km	About 1km south of Carrickmacross to the west of a road junction are two small fields of limestone grassland which are extremely rich in varieties and numbers of orchids. Bordering the grassland is a large mixed woodland yielding several interesting species. To the west of the grassland are Lough Fea Woods. This substantial area of mixed woodland consists mainly of magnificent Beech (Fagus	No surface water or landscape connectivity to the proposed scheme.

Proposed National Heritage Areas (pNHAs)

Site Name / Code	Distance from Scheme [14]	Site Synopsis[15]	Connectivity
		sylvatica), about 35m in height. Also present are Ash (Fraxinus excelsior), Scots Pine (Pinus sylvestris), European Larch (Larix decidua), Sycamore (Acer pseudoplatanus) and oak (Quercus spp.). Further into the demesne birch trees (Betula spp.) and conifers replace the Beech.	
Lough Egish	13.7km	The lake is primarily an area of ornithological scientific interest and it is a good overwintering site for Whooper and Bewick's Swans and Goldeneye. Breeding birds recorded here include Black-headed Gull, Common Sandpiper, Lapwing, Coot, Great Crested Grebe, Little Grebe, Tufted Duck and Pochard.	No surface water or landscape connectivity to the proposed scheme.
Stabannan-Braganstown 000456	14.9km	No site synopsis available. A smaller area of this site is an SPA (Site Code: 004091).	No surface water or landscape connectivity to the proposed scheme.

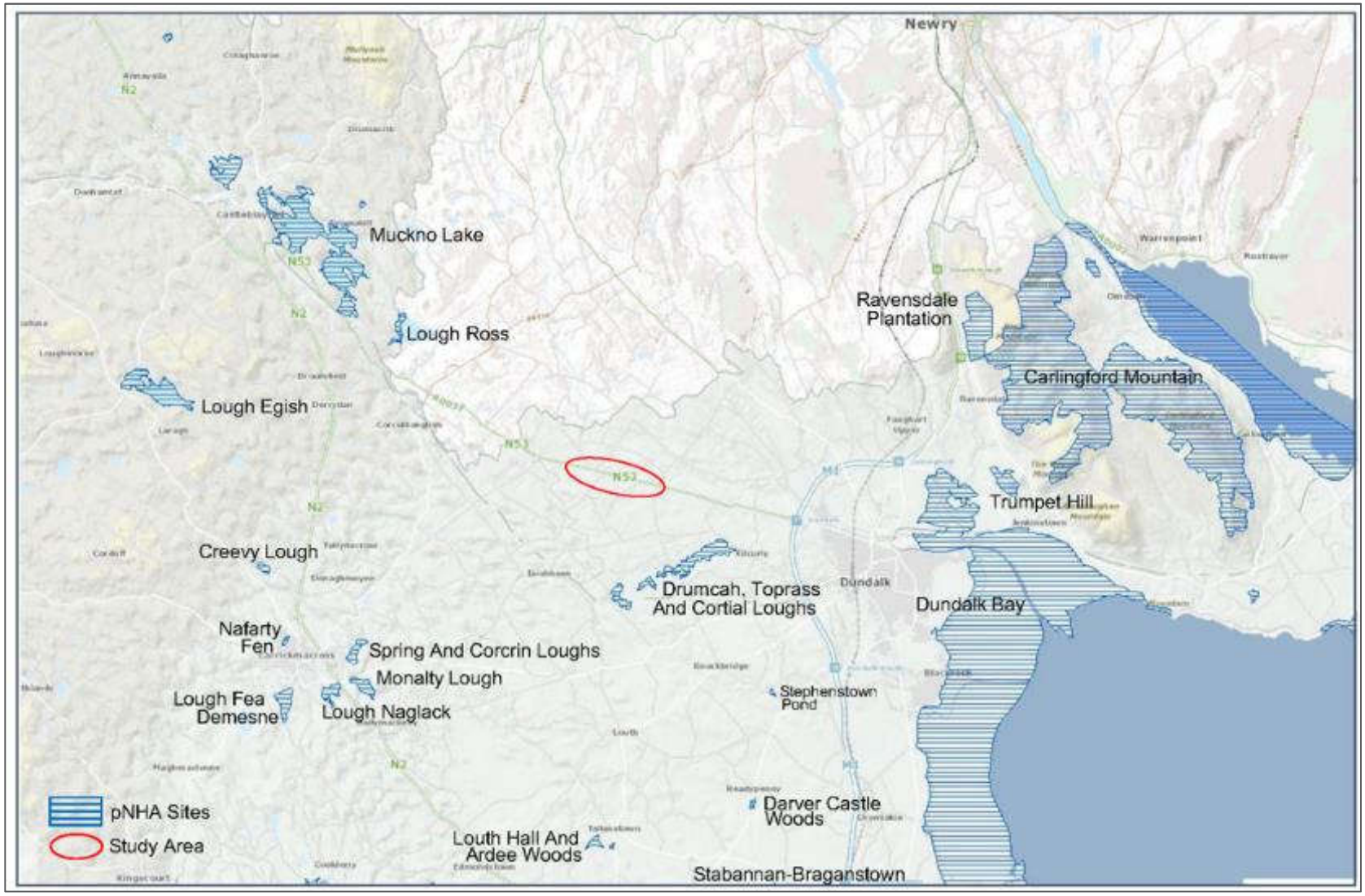


Figure 11-4 - pNHAs within 15km of the proposed scheme.

11.2.6. National Importance – Areas of Special Scientific Interest

Areas of Special Scientific Interest (ASSIs) are protected wildlife and geological sites in Northern Ireland. The protected sites in Northern Ireland were assessed to ensure transboundary impacts can be adequately considered. ASSIs provide statutory protection for the best examples of Northern Ireland's flora, fauna, geological or physiographical features. ASSIs were first designated under the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. New ASSIs are designated under the Environment (Northern Ireland) Order 2002. The Order makes it an offence for anyone to intentionally or recklessly damage any natural feature of an ASSI.

There are no ASSIs directly within the proposed scheme. There are 14 no. ASSIs within 15km of the proposed scheme. Four of these 14 no. sites are of scientific interest purely for geological reasons. These four ASSI sites are Glendesha, Mullaghbane, Cloghinny and Lislea ASSIs which are notable for their geological features associated with the Ring of Gullion. The Slieve Gullion complex is historically important as it has featured in a number of major geological debates on the nature of igneous rocks and the processes by which they can be formed.

The remaining 10 no. ASSIs are of national importance to Northern Ireland for their biodiversity and are assessed in context of the proposed scheme in this ecological appraisal. The site synopsis, where available, for each site was reviewed and summarised[16]. The distances between each site and the proposed scheme were also measured and the potential connectivity between them assessed.

Details of ASSI sites with ecological interest, including a site synopsis of each, are provided below in Table 11.3. The nationally important sites in context of the proposed scheme are illustrated below in Figure 11.5.

No direct connectivity in the form of woodlands or treelines was found between the proposed scheme and any of the 10no. ASSIs. No indirect connectivity in the form of surface water pathways was found between the proposed scheme and any ASSIs.

Table 11-3 - Nationally important ASSIs within 15km of the proposed scheme.

Site Name	Distance from scheme	Site Synopsis	Connectivity
Loughaveely	3.2km	The area is of special scientific interest because of its wetland flora and fauna. Although relatively small, Loughaveely is a diverse site with several wetland plant communities ranging from poor fen vegetation to swamp and open water. As a result, the area supports a large number of wetland plants, some of which are scarce. In addition, the invertebrate community is important for its overall diversity and includes several rare species.	No surface water or landscape connectivity to the proposed scheme.
Lurgan Lough	4.35km	The area is of special scientific interest for its wetland flora and fauna. Lurgan Lough ASSI is a diverse area of good quality fen and freshwater vegetation, interspersed with wet heath and bog. On more elevated ground, dry heath, scrub and acid grassland occur. This mosaic of semi-natural habitats, combined with the relatively large extent, makes it a valuable area for wildlife. A wide range of wetland plants occur, some of which are scarce. In addition, the invertebrate community is important for its overall diversity and includes several rare species.	No surface water or landscape connectivity to the proposed scheme.
Carrickastickan	6.9km	This area is of special scientific interest because of its species-rich dry grassland community.	No surface water or

[16] https://www.daera-ni.gov.uk/protected-areas

Site Name	Distance from scheme	Site Synopsis	Connectivity
		Carrickastickan is an area of semi-natural grassland managed in a traditional way. As such, it provides valuable feeding and roosting sites for a range of animals, including birds and invertebrates. A variety of butterflies have been recorded in the area including Meadow Brown (Maniola jurtina) and Common Blue (Polyommatus Icarus).	landscape connectivity to the proposed scheme.
Tullyard	7.6km	Tullyard is special because of its species-rich hay meadows. There are two hay meadows making up the site. Such species-rich grasslands tend to occur where land management is not intensive, usually where traditional farming practices have been maintained. Species-rich dry grassland is a rare habitat in Northern Ireland, with hay meadows being particularly scarce	No surface water or landscape connectivity to the proposed scheme.
Drumlougher lough	8.5km	The area is of special scientific interest because of its wetland flora and fauna. Drumlougher Lough is a large and diverse area, with particularly rich and varied fen communities. Additional diversity is provided by other semi-natural habitats, such as the open waters of the lough, heath, bog, grassland, scrub and woodland. The area supports a large number of wetland plants, some of which are scarce. In addition, the invertebrate community is important for its overall diversity and includes several rare species.	No surface water or landscape connectivity to the proposed scheme.
Cashel Loughs	8.6km	The area is of special scientific interest because of its wetland flora and fauna. Cashel Loughs is an extensive area of semi-natural vegetation in an ice-sourced rock basin. It takes in a wide range of habitats, including rocky outcrops of dry heath, acid grassland, scrub and woodland. The wetlands are of particular importance, with a wide range of communities including the open waters of the three loughs in addition to adjoining fen, areas of cut-over bog, wet heath and rush pasture. A large number of wetland species occur, including several rare and local plant species and a rich community of aquatic invertebrates.	No surface water or landscape connectivity to the proposed scheme.
Slieve Gullion	10.7km	Whilst Slieve Gullion is most notable for its geological interests the site also has a range of important habitats associated with the rare ground conditions. Biological interest within the ASSI relates to the size, quality and diversity of the habitats within Slieve Gullion, in addition to the presence of particular species of note. Heathland is a scattered resource and Slieve Gullion represents one of the largest areas of dry heath in Northern Ireland outside the Mourne Mountains. Blanket bog, grasslands and	No surface water or landscape connectivity to the proposed scheme.

Site Name	Distance from scheme	Site Synopsis	Connectivity
		wetlands are also represented, producing a varied and diverse mosaic of habitats.	
Levalleymore	13km	This area is of special scientific interest because of its species-rich dry grassland communities. Levallymore represents a large area of semi-natural grassland and associated habitat managed in a traditional way. As such, it provides valuable feeding and roosting sites for a range of animals, including birds and invertebrates. A variety of butterflies have been recorded in the area including Meadow Brown (Maniola jurtina) and Common Blue (Polyommatus Icarus).	No surface water or landscape connectivity to the proposed scheme.
Clermont and Anglesey Mountain	13.9km	The area is of special scientific interest because of its heathland vegetation, in addition to its associated plant and animal species. Complex patterns of dry and wet heath with associated habitats form a mosaic of vegetation within a varied topography.	No surface water or landscape connectivity to the proposed scheme.
Cam Lough	14.9km	The area is of special scientific interest for its aquatic flora and fauna. Cam Lough is a midaltitude lake lying in a steep-sided valley between Slieve Gullion and Sturgan Mountain to the west and Camlough Mountain to the east. The diverse aquatic plant community is characteristic of unpolluted water bodies with low levels of plant nutrients and is among the best examples of its type in Northern Ireland.	No surface water or landscape connectivity to the proposed scheme.

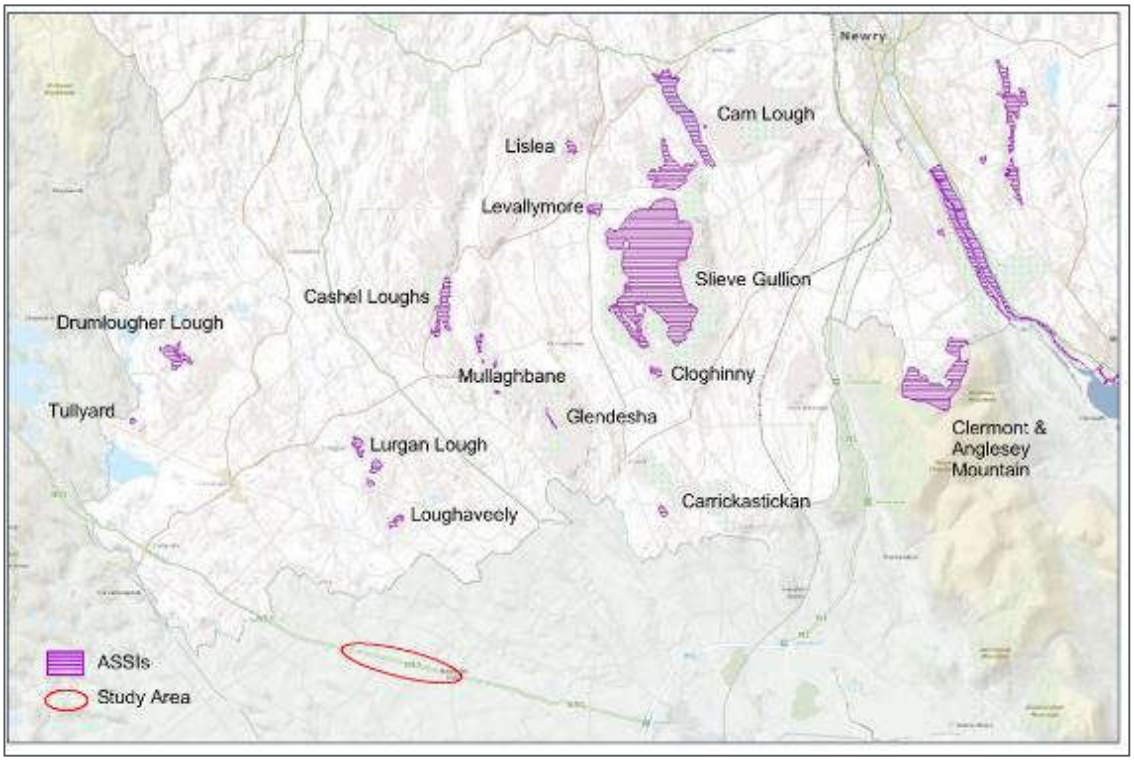


Figure 11-5 - ASSIs within 15km of the proposed scheme.

11.2.7. National Importance – National Parks, Nature Reserves & Wildlife Sanctuaries

There are no National Parks or Nature Reserves within the proposed scheme or within 15km of the proposed scheme nor within County Louth. There are 2 no. of wildfowl sanctuaries within 15km of the proposed scheme: – Ballymascanlan Estuary (Code: WFS-35) and Lurgan Green (WFS-36) both of which are located in Dundalk Bay ca. >10km from the proposed scheme.

11.2.8. Other Known Sites of Ecological Value

There are sites and habitats outside of those designated above which are protected and / or of ecological value which may be impacted by the proposed road scheme. Wetland and woodland habitats within the proposed scheme are discussed in greater detail below. Similarly, surface water features within the proposed scheme, such as rivers and streams, are also detailed in this section of the report.

The details below on sites and habitats of ecological value intersected by, or within the vicinity of the proposed scheme are identified through desk based review of available information and also ecological site walkover surveys (2019, 2020).

11.2.9. Habitats

The predominant habitat types present within the footprint of the scheme, as well as within the lands directly adjacent (ca. 50m) to the proposed scheme, are presented below. Details on the habitats present and adjacent to the proposed scheme are informed through desk based research as well as by site surveys undertaken during June 2019 and July 2020. Habitats were categorized and photographed and particular attention was paid to the primary habitats and land take to be directly affected by the proposed scheme. The walkover survey also included a search for evidence of the presence of, and the potential of each habitat to support, priority and protected species as recommended by CIEEM[17].

A habitat map illustrating the primary habitat types is presented in Appendix 11 of this report. Habitat mapping is in line with the Heritage Council Classification scheme (Fossitt, 2000).

11.2.9.1. Habitat Mapping

Habitat Mapping presented in Appendix 11 illustrates the locations of primary habitat types within and adjacent to the proposed scheme. Habitat mapping is in line with the Heritage Council Classification scheme (Fossitt, 2000). Also presented within these figures are habitats suitable for accommodating bat roosts and amphibians.

11.2.9.2. Wetland Habitat

Wetlands habitat information, along with site evaluation in a geographical context, was sourced from NPWS, Wetlands Surveys Ireland and wetland studies carried out in County Louth[18].

Wetland Surveys Ireland (WSI) identifies 3 no. wetland habitats that are intersected by the proposed scheme; Annaghvacky West wetlands at Chainage 0+950 north, Clonaleenaghan wetlands at Chainage 2700 south and Annaghvacky (Hackballscross) wet woodlands at Chainage 2+700 north. Refer to Figures 11-6 and 11-7 below for the locations of these wetland habitats, these figures also illustrate the alignment of the proposed scheme.

There are a further 5 no. wetland sites within 1km of the proposed scheme. Refer to Figure 11.8 below for locations of all 8 no. wetland sites and their proximity to the proposed scheme. Wetland site boundaries are extracted via WSI web viewer[19]. WSI information on the wetland sites is sourced from wetland surveys commissioned by County Louth.

[17] Chartered Institute of Ecology and Environmental Management (2017) Guidelines for Preliminary Ecological Appraisal, Second Edition.

[18] E.g. Louth wetland Survey III. Foss, Crushell, Kirwan, O'Loughlin & Wilson (2014)

[19] Accessed through http://www.wetlandsurveysireland.com/wetlands/map-of-irish-wetlands--/wetland-data-sets-incorpora.html

Annaghvacky West wetland site (Site Code: WHI_LH237) is the most noteworthy of the wetlands and a southern portion of this wetland site is intersected by the proposed scheme. This wetland habitat has been detailed to be of county conservation value by wetland surveys carried out by County Louth and is detailed as transition mire, cutover bog and scrub habitat. Site surveys identified a wet ditch with standing water along the southern extents of the wetland site. Floral species observed during site surveys 2021 include soft rush (*Juncus effusus*), bulrush (*Typha latifolia*), yellow iris (*Iris pseudacorus*), Devil's bit scabious and meadowsweet (*Filipendula ulmaria*).

Within the larger wetland site, northern areas of the Annaghvacky West site have been detailed within NPWS reporting and datasets (Article 17 Reports published 2020) as having correspondence to Annex I habitat *Transition mire and quaking bogs* [1730] which would deem sections of this wetland site to be of international conservation value. For the purposes of this ecological appraisal the northern area of Annaghvacky West wetland site will be considered to be on international conservation value in line with NPWS Article 17 reporting to the EU commission. Refer to Figure 11-3 above for the boundary of the habitat with correspondence to transition mire which is located within the larger wetland site. Whilst the footprint of the proposed scheme intersects with the southern area Annaghvacky West wetland site, ecological surveys undertaken in 2020 for the proposed scheme identify the intersected areas of the WSI identified wetland site as predominantly agricultural grassland areas (currently farmed). The footprint of the proposed scheme does not intersect with the transition mire [1730] habitat located to the north of the proposed scheme.

Two further wetland habitats are within the footprint of the proposed scheme and both of these sites have been assessed by WSI / Louth Wetland Surveys to be of local conservation value (low value). Annaghvacky (Hackballscross) Wet Woodland site (Site Code: WMI_LH171) is noted to be an area of wet woodland (Oak, Ash or Willow, Alder) and scrub habitat. Site walkover surveys indicate that Annaghvacky (Hackballscross) Wet Woodland site could prove to be of higher conservation value if surveyed in greater detail. The proposed scheme directly intersects the southern section of this wet woodland. The wet woodland does not have correspondence to annexed alluvial woodland habitat.

Clonaleenaghan Wetland site (Site Code: WMI_LH200) is detailed by WSI / Louth Wetland Surveys as now reduced to a small area of quaking reed swamp surrounded by willow scrub. Whilst WSI outline a large boundary for this wetland site, this identified boundary is considered to be indicative as the majority of the lands within the identified boundary are noted from scheme surveys to be well drained agricultural grassland areas (currently farmed). The footprint of the proposed scheme intersects with the northwest section of this wetland site ecological surveys undertaken in 2020 for the proposed scheme identify the intersected areas as entirely agricultural grassland areas only and the proposed scheme does not cross any areas of reed swamp or scrub habitat.

Outside of the footprint of the proposed scheme (within 1km) there are a further 5 no. wetland sites (as detailed by WSI datasets); Annaghvacky wetlands, Rassan wetlands, Treagh North wetlands, Treagh wetlands and Cunnicar wetlands. The wetland type and ecological value as assigned by WSI and NPWS is provided for in Table 11-4 below. None of these 5 no. wetland sites which are outside of the footprint of the proposed scheme have direct or indirect connectivity to the proposed scheme.

One further site which may include wetland habitat has been identified through a review of aerial imagery and on site walk over surveys. The potential wetland habitat is located in the townland of Treagh and is an area of depression in the undulating landscape with ponded water and gorse scrub on the steeply sloping small hillside. This site will be discussed in greater detail as scrub habitat in Section 11.2.9.6 below.

Details of the wetland habitats are summarised in Table 11.4 below and are illustrated in context with the proposed scheme in Figure 11-6 to 11-8 below.

Plates 11-6 to 11-8 depict the 3 no. wetland sites within or directly adjacent to the proposed scheme (photographs from site surveys July 2020).

Table 11-4 - Wetland habitats within the Zone of Influence (ZoI) of the proposed scheme.

Name - Code	Distance to proposed scheme	Main wetland type (WSI)	Description (WSI)	WSI Evaluation	Annex I Habitat20
Annaghvacky West - WMI_LH237	Ca. 20m	Transition Mire, Wet Heath, Cutover Bog, Scrub	Area of transition mire on former cutover with a shallow layer of underlying peat. Groundwater influence evident. Cutover haggs with acid heath vegetation remain at western end of site.	C+ Rating: County Conservation value	1740 Transition mire and quaking bog
Annaghvacky (Hackballscross) - WMI_LH171	within	Wet Woodland (Oak, Ash or Willow, Alder), scrub	Small Alder ash woodland adjacent to N53. Site dry under foot with Bramble layer. Infilling and silage storage at north west end.	E Rating: Local conservation value (low value)	No
Clonaleenaghan - WMI_LH200	within	Scrub, Reed Swamp	This wetland is now reduced to a small area of quaking reed swamp surrounded by willow scrub.	E Rating: Local conservation value (low value)	No
Annaghvacky - WMI_LH235	Ca. 250m	Wet Woodland (Oak, Ash or Willow, Alder), Wet Grassland, Scrub	Wet woodland site with adjacent wet grassland, and open water areas under trees. Sparse stands of Carex rostrata under trees. Rich epiphytic moss and lichen growth on willow tree trunks.	C Rating: Local conservation value (high value)	No
Treagh North - WMI_LH5	Ca. 440m	Transition Mire, Scrub, Cutover Bog	Transition mire and willow scrub have developed across this cutover bog site. The transition mire has a wet and quaking surface. Some drier intervening ridges with heather occur along with Willow and Gorse scrub.	B Rating: Nationally Important	1740 Transition mire and quaking bog
Rassan - WMI_LH326	Ca. 430m	Transition Mire, Scrub	Small transition mire surrounded by improved agricultural land adjacent to the N53. Scrub woodland with Willow occurs at	C+ Rating: County Conservation value	No

[20] Correspondence to Annex I habitat as detailed in NPWS Article 17 datasets published 2020.

			the western end of the site.		
Cunnicar - WMI_LH10	Ca. 560m	Transition Mire, Mesotrophic Lake, Scrub	This site comprises a small mesotrophic lake at the southern end surrounded by floating transition mire which extends to the North. The northern part of the site is degraded due to drainage and infilling.	C Rating: Local conservation value (high value)	1740 Transition mire and quaking bog
Treagh - WMI_LH6	900m	Cutover Bog, Wet Grassland, Scrub	Cutover bog with heather and purple-moor-grass on ridges and intervening wet hollows. Gorse scrub is common on dry banks. Western part of site has been severely degraded due to drainage and infill.	D Rating: Local conservation value (moderate value)	1740 Transition mire and quaking bog

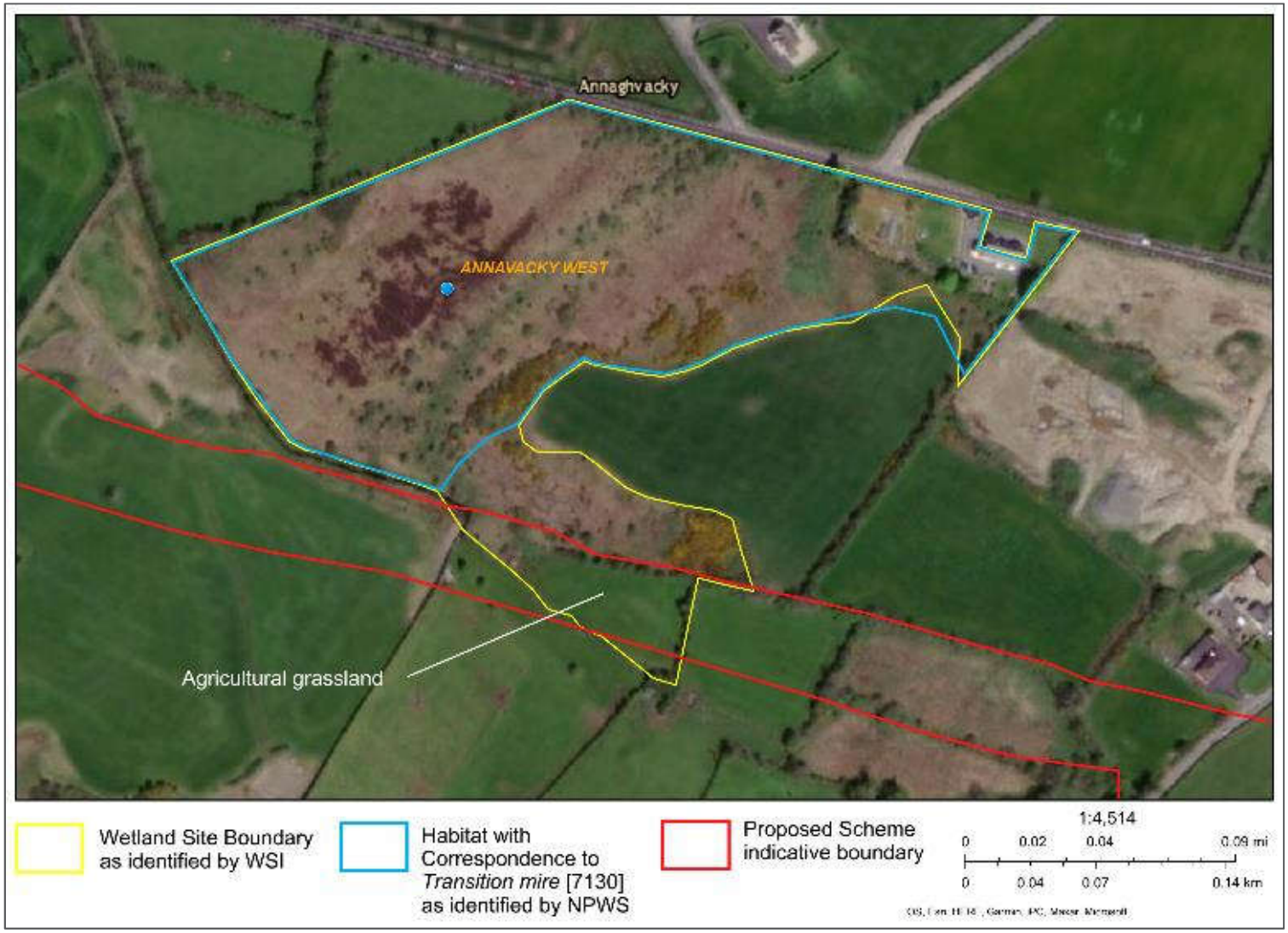


Figure 11-6 - Annaghvacky West wetland site.

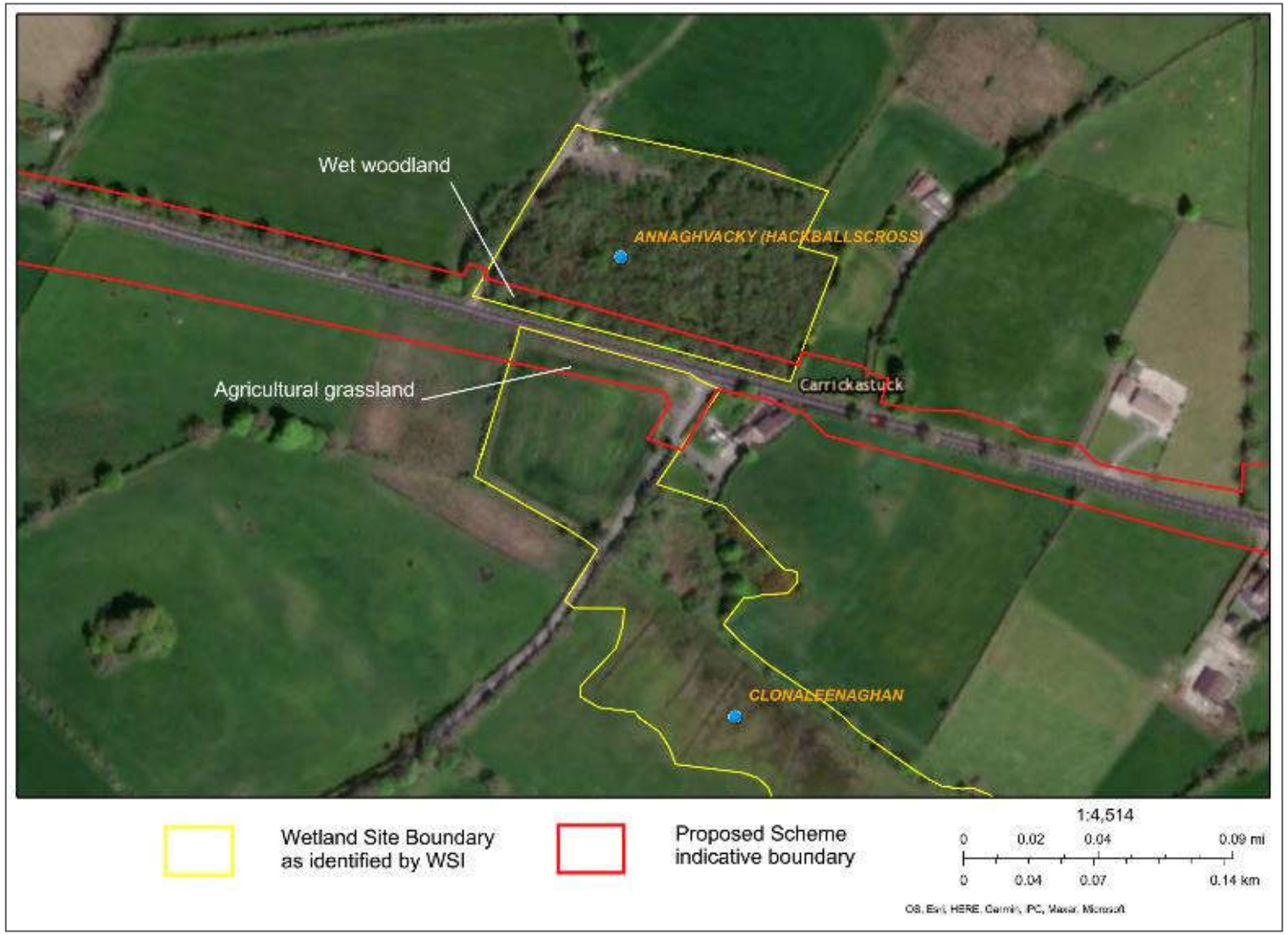


Figure 11-7 - Annaghvacky (Hackballscross) and Clonaleenaghan wetland sites.

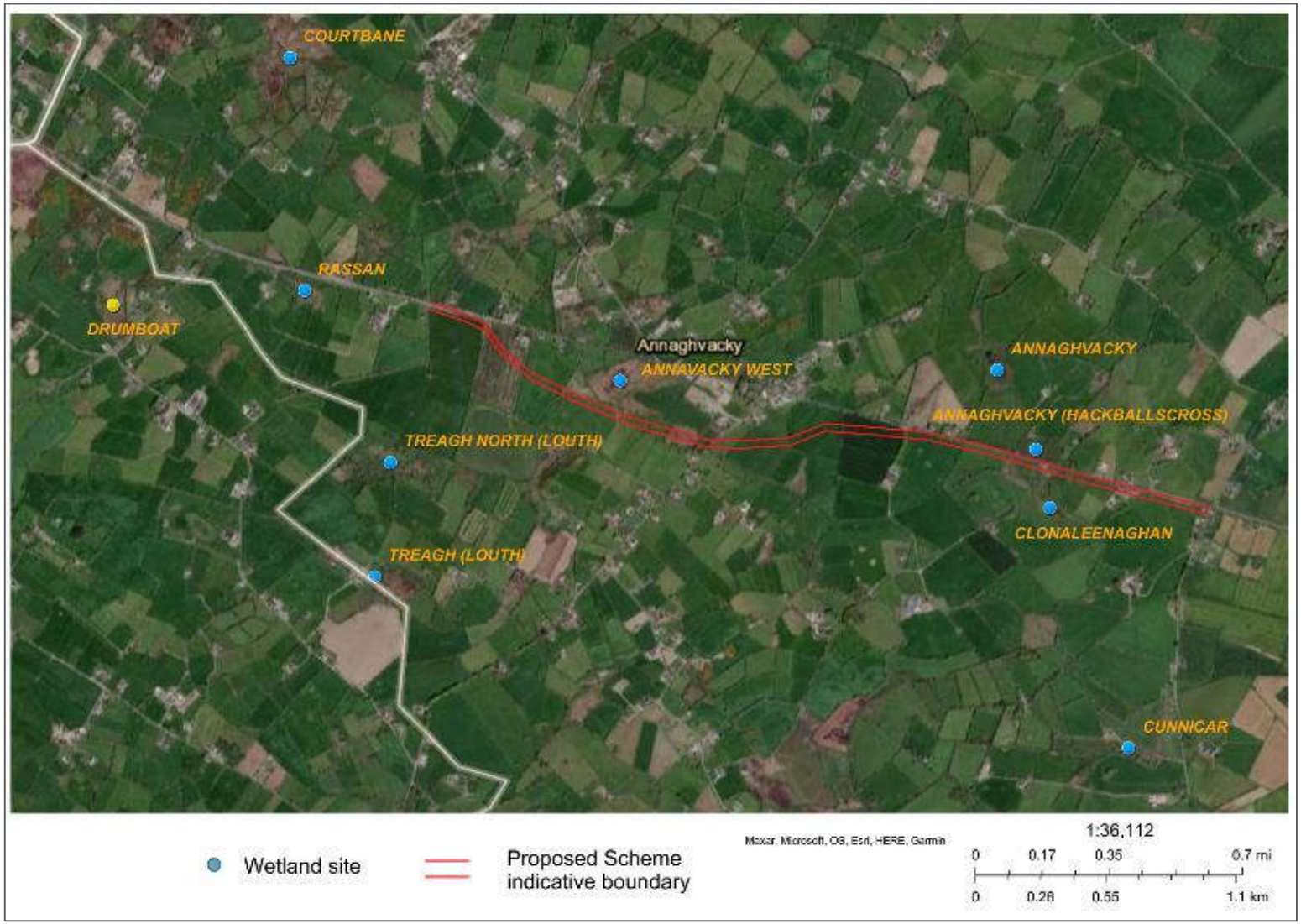


Figure 11-8 - Wetland Survey Ireland - wetland sites near proposed scheme.



Plate 11-6 - Annaghvacky West wetland with wet ditch along southern extents.



Plate 11-7 - Clonaleenaghan wetland, largely drained with lands now agricultural grassland.



Plate 11-8 - Annaghvacky (Hackballscross) wet woodlands dominated by alder and willow.

11.2.9.3. Woodland Habitat

The most notable of the woodland habitats within the proposed scheme are the *wet* woodlands at Annaghvacky (Hackballscross) at Chainage 2+700 north as detailed above. Figure 11-9 below illustrates the scheme alignment through the southern section of Annaghvacky (Hackballscross) Wet Woodland. Site surveys undertaken during July 2021 noted semi mature alder (*Alnus glutinosa*) and willow (*Salix* spp.) as the dominate tree species within this dense woodland with young and semi mature ash (*Fraxinus excelsior*) also noted throughout. The ground storey is dominated by common nettle (*Urtica dioica*) and bramble (*Rubus* spp.) All other woodland habitats found within the vicinity proposed scheme are detailed in this section of the report.

Datasets from the National Survey of Native Woodlands (NSNW) 2003-2008 were reviewed to identify any native woodland habitat (other than wet woodlands) intersected by, or in close proximity to the proposed scheme. The NSNW does not identify any native woodlands within the footprint or within 5km of the proposed scheme. The Ancient and Long-Established Woodland Inventory of Ireland 2010 was also reviewed with no woodland habitat being identified within 5 km of the proposed scheme from this inventory.

A review of the National Biodiversity Data Centre's (NBDC) forestry datasets identified 2 no. areas of woodlands (other than wet woodlands) within close proximity to the proposed scheme both of which are located on the northern side of the exiting N53.

One of these areas of forestry near the townland of Sheelagh (hereafter referred to as Sheelagh woods) is detailed as being mature spruce plantations, site walkover surveys however have identified this wooded area as being predominantly willow and alder with no spruce noted. Sheelagh woods is located ca. 500m north of the proposed scheme and is separated from the scheme by the existing N53 road. There is no direct or indirect connectivity to Sheelagh woods.

A smaller woodland area, adjacent to Scoil Bhride on the L3117 local road, is identified as being more species diverse with scots pine and oak predominant in this small forested area (hereafter referred to as Scoil Bhride woods). Scoil Bhride woods is located ca. 300m north of the proposed scheme and is separated from the scheme by the existing N53 road. There is no direct or indirect connectivity to Scoil Bhride woods.

A review of the Louth County Development Plan (LCDP) 2015-2021 was undertaken to determine if there were any woodlands of special amenity value within the proposed scheme. The LCDP details 23 no. of amenity value woodlands within the county, none of which are within the extents of or close to the proposed scheme.



Figure 11-9 - Annaghvacky (Hackballscross) wet woodland intersected by the proposed scheme at Chainage 2+700 north.

11.2.9.4. Freshwater Habitats

Water features within the study were examined through a review of the Environmental Protection Agency (EPA) spatial data and water quality records[21], a review of aerial imagery and following site walkovers. EPA datasets do not identify any loughs or lakes within the proposed scheme.

There are no watercourse directly intersected by the footprint of the proposed roadway. There are 3 no. streams with connectivity to the proposed scheme via the proposed road's surface water drainage, these streams are: Carrickastuck Stream, Drumboat Stream and Inishkeen Stream. The Carrickastuck Stream is located to the north of the proposed scheme and flows in northerly direction to join the larger Castletown River which outfalls ca. >12km downstream into Dundalk Bay. To the south of the proposed roadway alignment surface water drainage is proposed to outfall via field boundary ditches to the Drumboat and Inishskeen streams which conjoin with the Fane River which outfalls to sea in the area of Blackrock town ca. >18km downstream of the proposed scheme.

Whilst not receiving surface water drainage from the proposed scheme, the Annaghvacky stream is mapped (within EPA datasets) as directly adjacent to the proposed roadway.

Details of the Carrickastuck Stream, Drumboat Stream, Inishkeen Stream and the larger Castletown and Fane Rivers as outlined by the EPA[22] are summarised in Table 11-5 below. Details of the Annaghvacky stream which is in close proximity to the proposed scheme is also included within Table 11-5.

[21] https://gis.epa.ie/EPAMaps/

[22] EPA records last accessed 21/07/2020

Table 11-5 - WFD details of watercourses within, connected or adjacent to proposed scheme.

Watercourse	Code	River Waterbody WFD Status (2013-2018)	River Waterbody Risk
Carrickastuck Stream	IE_NB_06C010200	Good	Under review
Drumboat Stream	UKGBNI1NB060608249	Moderate	At Risk
Inishkeen Stream	IE_NB_06F010900	Good	Under review
Annaghvacky Stream	IE_NB_06C010200	Good	Under review
Castletown River	IE_NB_06C010200	Good	Under review
Fane River	IE_NB_06F010900	Good	Under review

Carrickastuck Stream

The Carrickastuck Stream is directly adjacent to the proposed scheme (at approximate Chainage 3400 north) and will receive surface water drainage from the proposed roadway during the operational phase. This watercourse is a tributary of the Castletown River. Site walkovers noted that the Carrickastuck Stream is currently accepting road drainage from a significant stretch of the existing N53 east of Hackballscross. The EPA have mapped this stream as originating from directly adjacent to the N53 and subsequently running under the local road L3125 to the north of the existing N53. The L3125 local road forms the cross roads with the N53 at Hackballscross. Site visits identify this watercourse to have very low flow at the time of the site visit and the stream is considered to be more akin to a drainage ditch with flow. The watercourse runs for 90m in a northerly direction and following this the stream may be culverted as site visits found there is no open watercourse crossing the L3126 or within the fields on either side of this local road as is indicated on EPA watercourse mapping datasets.

Drumboat Stream and Inishkeen Stream

Both of these watercourses are ca. 1km from the proposed scheme (south, direct line distance), refer to Figure 11-10 below for stream locations. These 2 no. watercourses will receive surface water drainage from the proposed scheme via local field boundary drainage ditches. The proposed drainage outfall locations into these streams were not accessible during the site walkover surveys. Both of these small watercourses are tributaries of the Fane River.

Annaghvacky Stream

The EPA outline the Annaghvacky Stream as originating from Annaghvacky (Hackballscross) Wet Woodland site (Code: WMI_LH171) and as flowing in a northerly direction along field boundaries, before crossing a local road to the north of the existing N53 and outfalling into the Castletown River. The northern section of this small watercourse was inspected at the crossing point of a local road during site walkovers and it is considered that EPA location mapping of the Annaghvacky Stream may be somewhat erroneous, or the stream may be culverted for significant stretches. It is noted that historical mapping of the Annaghvacky stream is the same as the EPA mapped alignment.

During site visits a stream was noted to be in the same vicinity, ca. 800m west of the EPA mapped alignment, and it was noted that this stream has been channelled and culverted along the local road and has a fast steady flow. This watercourse as noted during the site visits is assumed to be the Annaghvacky Stream originating from the general area of Annaghvacky Wet Woodlands. Refer to Figure 11-10 below for the EPA identified location of the Annaghvacky stream and the watercourse nearby identified during site surveys 2020. Whilst this watercourse is in relatively close proximity the proposed scheme, it is outside the footprint of the proposed scheme it will not receive surface water drainage during the operational phase of the proposed roadway.

Castletown River

The Castletown River flows in a general easterly direction and outfalls into the Irish Sea at Dundalk Bay. Dundalk Bay is noted to be an internationally important conservation site most notable for its bird species and habitats as detailed in Section 11.2.2 above.

The EPA have undertaken biological monitoring at a sampling station north of the N53 at Ballybinaby bridge, ca. 500m from the proposed scheme, the watercourse was assigned a Q Value of 4 (2020) indicating good water quality within this regionally important salmonid river. There is a second river sampling station; Castletown bridge, directly north of Hackballscross where the last assessment was undertaken in 1990 with a Q Value of 4-5 determining high water quality.

The Castletown River is known for its populations of Atlantic Salmon (*Salmo salar) and Brown Trout (Salmo trutta*). Inland fisheries Ireland (IFI) undertook surveys in seven areas along the river (Matson *et al* 2018). Seven fish species were recorded at seven sites on the Castletown River Catchment in 2017. Brown trout was the most abundant species captured. Salmon were recorded at six out of seven sites fished. Lamprey (*Lampetra* spp.) a species required to be monitored under the Habitats Directive and Red Data Book, were captured at one site. European eel (*Anguilla anguilla*) was noted at four sites. Other species include Three-spined stickleback (*Gasterosteus aculeatus*) and Stone loach (*Barbatula barbatula*). Two sites on the Castletown catchment achieved good fish ecological status, one site was classed as moderate and one as poor and two were not assessed. It is considered that species associated with the Castletown River may also be found within adjoining tributaries such as the Annaghvacky and Carrickastuck streams. The Castletown River will receive road surface water drainage during via the Carrickastuck Stream.

Fane River

As with the Castletown River, the Fane River outfalls in Dundalk Bay. Inland fisheries Ireland (IFI) undertook surveys in seven areas along the river (Matson *et al* 2019). Ten fish species were recorded at six sites on the Fane River Catchment in 2018. Brown trout was the most abundant species captured. Salmon were recorded at five out of six sites fished. Lamprey were captured at two sites. European eel was noted at five sites. Other species include Gudgeon (*Gobio gobio*), Pike (*Esox lucius*), Perch (*Perca fluvialtili),* Roach (*Rutilus rutilus*) Three-spined stickleback and Stone loach. No survey sites assigned fish ecological status met the minimum requirement of ‘Good’ as part of the Water Framework Directive surveillance monitoring assessment programme in 2018. Fish ecological status was Moderate at four sites within the Fane Catchment during 2018.

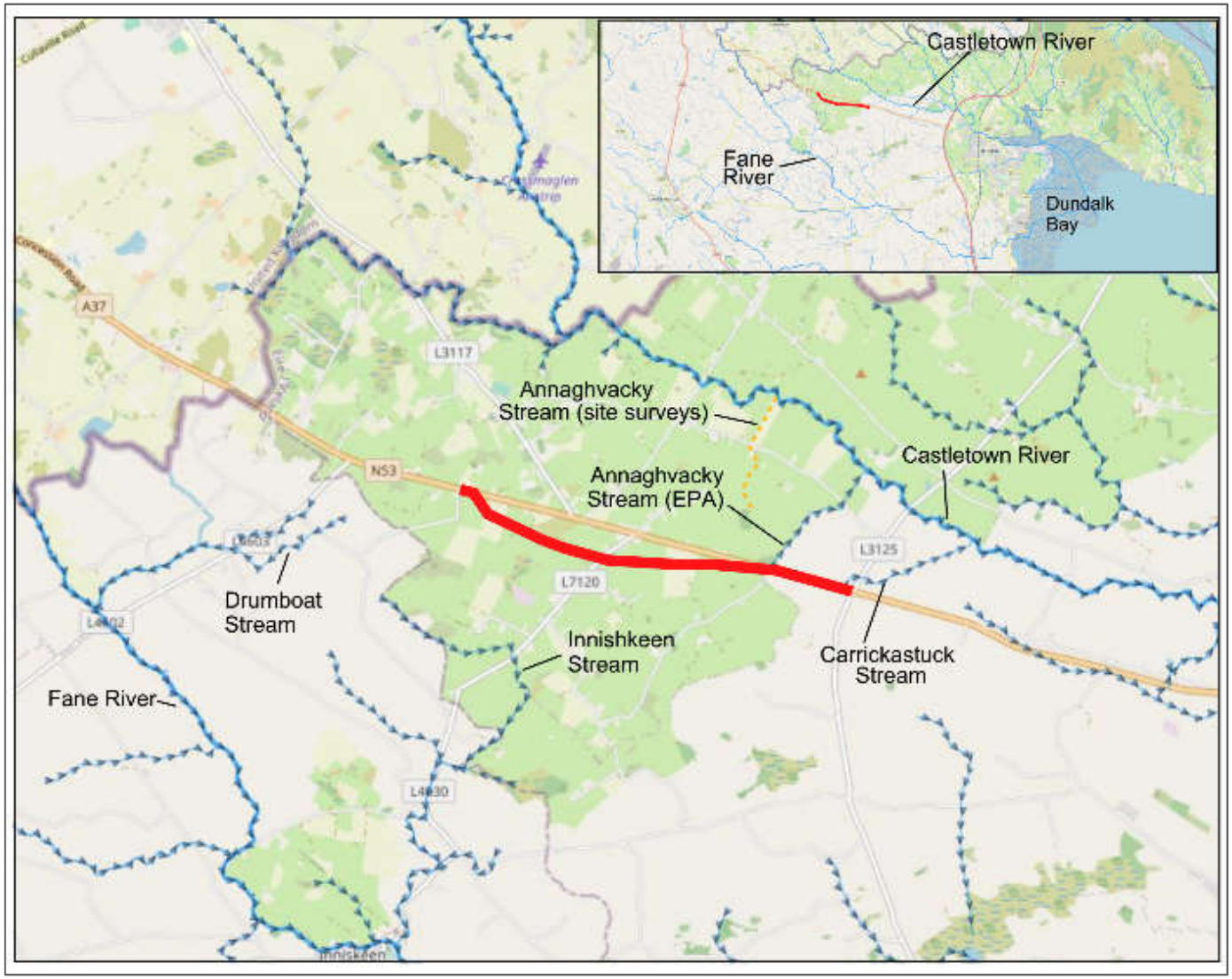


Figure 11-10 - Watercourses receiving drainage from the proposed scheme.

11.2.9.5. Wet Ditches

There are 2 no. wet ditches intersected by the proposed scheme. A wet ditch with standing water is located at the south side of Annaghvacky West wetland site at Chainage 0+950 (north side of scheme alignment). A second wet ditch with standing water is located at Chainage 1+200 (south side of the alignment). Floral species noted within and adjacent to the wet ditch habitat during site surveys 2020 include bulrush (*Typha latifolia*), yellow iris (*Iris pseudacorus*), soft rush (*Juncus effusus*) and meadowsweet (*Filipendula ulmaria*). The ditches were observed during the site surveys for amphibian activity with none noted. The walkover surveys were outside the seasonal window (Feb-Mar) for assessing the ditches for accommodating frog spawn. The 2 no. ditches are greater than 1m in depth and water levels during July 2020 were observed to be high indicating these ditches could be permanently wet with standing water. It is considered that these 2 no. wet ditches provide for excellent amphibian habitat. (refer to Habitat Mapping figures in Appendix 11 for locations of wet ditches).

11.2.9.6. Treelines and Hedgerows

The dominant habitat found within the proposed scheme is improved agricultural grassland. The hedgerows and treelines which act as field boundaries around the field systems serve as wildlife habitats and corridors connecting many of the sites of ecological interest within the wider area. Plates 11-9 & 11-10 show an example of hedgerows and treelines within the footprint of the proposed scheme. Site surveys during July 2020 noted trees with suitability for accommodating bat roots, details of potential bat roosts trees are detailed in Section 11.2.10 below.

Site surveys identified hedgerows within the proposed scheme are largely managed and cut, particularly in the southern side of the proposed scheme, and are predominantly made up of hawthorn, ash, blackthorn and elder, species with sycamore also widespread throughout these important linear ecological features. Larger, more unmanaged hedgerow can be found in the western side of the proposed scheme. Mature and semi mature sycamores trees are common along the verges of the existing N53 roadway with occasional mature Beech, ash and Scots Pine also present.

A County Louth Hedgerow Survey identifies hawthorn as the most frequently occurring woody species in Louth's hedgerows with a percentage frequency occurrence of 87.5, ash was the next most frequently occurring (54.2%). Like hawthorn, bramble occurs widely throughout Irish hedgerows and in County Louth it is recorded in 97% of surveyed hedgerows. Ash is the most commonly occurring tree in Irish hedgerows and it is recorded in 48% of the surveyed County Louth hedgerows. The survey further identified that only 16.7% of county Louth's hedgerows are considered to be species rich, i.e. four or more shrub or small tree species per hedgerow.

According to Louth County Development Plan there are no Tree Preservation Orders within the proposed scheme.



Plate 11-9 Mature beech trees along avenue ca. 15m from existing



Plate 11-10 - Typical managed and cut hedgerow with hawthorn predominant.

11.2.9.7. Scrub Habitat

A review of aerial imagery has identified an area of scrub within the southern section of the proposed scheme. The scrub habitat is located in the townland of Treagh between the Treagh North wetland site and the Annaghvacky West wetland site and is predominantly along a steeply sloping small hillside beside an area of depression in the undulating landscape. Gorse and willow are predominant within this scrubland habitat Access within this area was not possible during site visits. The scrub habitat in context of the route options is illustrated in Figure 11-11 below.

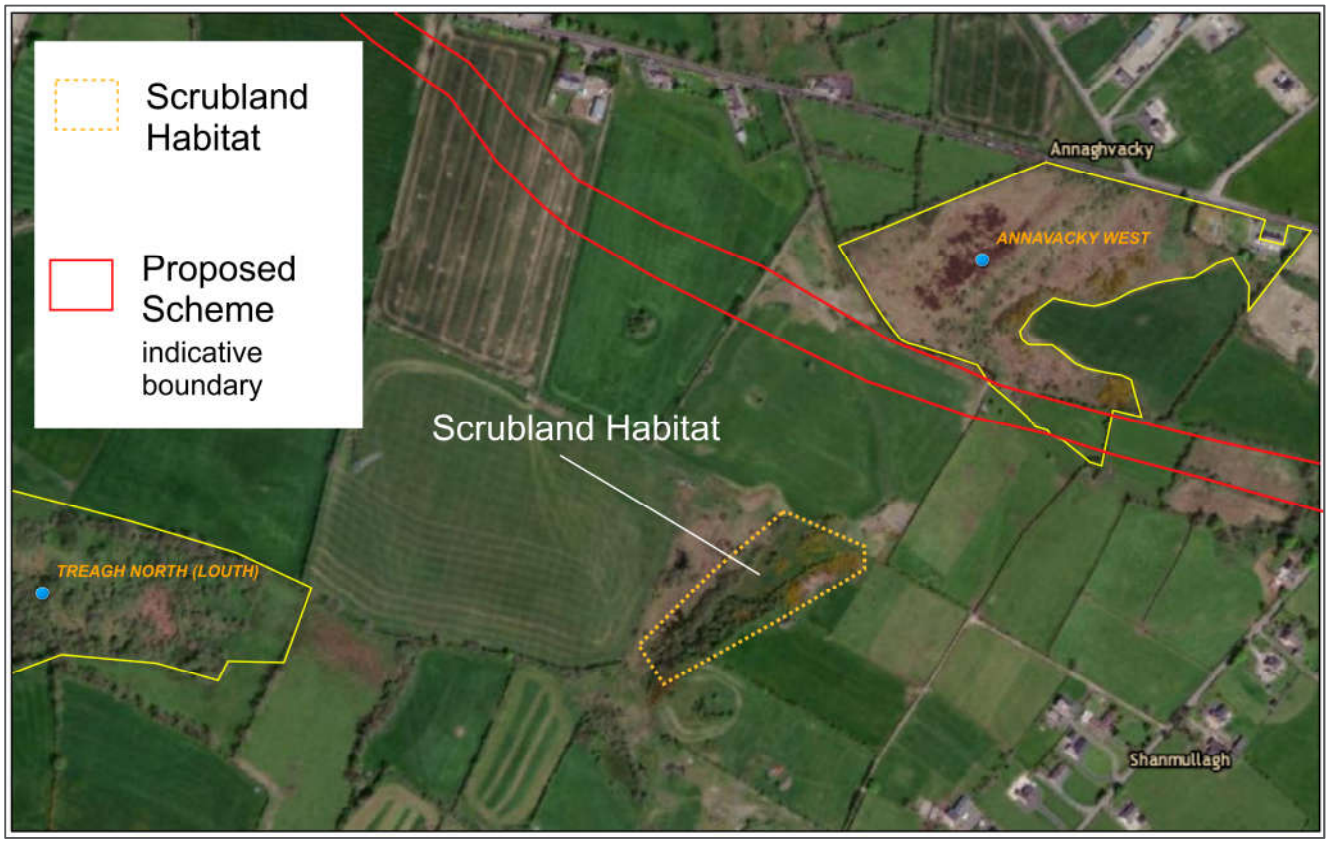


Figure 11-11 - Location of scrub habitat.

11.2.9.8. Wet Grassland

One area of wet grassland habitat was noted within the footprint of the proposed scheme during site surveys 2020. The area of wet grassland is within a fallow / uncut grassland field located at Chainage 1+250. The wet grasslands were noted to have *Juncus effusus* throughout with sporadic areas of meadowsweet also noted. The area of wet grassland is bordered to the south by a wet ditch with standing water. The location of the wet grassland area is present below in Habitat Mapping in Appendix 11. Plate 11-11 below show the area of wet grassland intersected by the proposed scheme.



Plate 11-11 - Wet grassland area within footprint of the proposed scheme.

11.2.9.9. Agricultural Grassland and Arable crops

The lands within the proposed scheme are dominated largely by intensively managed or highly modified agricultural grasslands. These improved agricultural grasslands are species poor and as such are of poor ecological value. There are a fewer number of areas where the agricultural land is managed for the production of arable crops.

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 wheat crops. In total the proposed scheme passes through 21 no. of improved agricultural grassland fields and/or arable crop fields all of which are noted as of low ecologically value.

Within an agricultural grassland field; Chainage 0+700 – 0+950 south side of proposed scheme, areas of shallow top soil have been excavated to expose the underlying stone materials. In some areas these shallow excavations have been recolonised with grasses (predominantly fescue and meadow grass species) with Oxeye daisy (*Leucanthemum vulgare*), thistle (*Cirsium* spp.) and dock (*Rumex* spp.) noted throughout. Plates 11-12 and 11-13 below show an example of the areas of exposed stone and occasional areas where the ground has been recolonised with floral species.



Plate 11-12 - Exposed (shallow) stone material.



Plate 11-13 - Areas of floral recolonization.

11.2.10. Species

This section of the report outlines species that have been recorded within the proposed scheme and also details the findings of ecological walkover surveys undertaken during June 2019 and July 2020.

NBDC datasets of rare and protected species records for every 1km x 1km grid square within the proposed scheme were examined to provide a detailed account of species previously recorded within the zone of influence of the various routes that may be potentially impacted by a road construction project. Species datasets for the proposed scheme were also requested and procured from NPWS. The absence of recent records of species from the NBDC and NPPWS databases does not necessarily mean that species does not occur within the area rather a species presence has not formally been recorded to date. Only records for the past 12 years are included within this report as older records are unlikely to still be relevant given their age and the changes in land use and management that has occurred in the intervening period.

The available rare and protected species records, dated within the last 12 years, are presented at the end of this section in Table 11.8 below. Certain species recorded within the zone of influence of the proposed scheme that have the potential to be impacted by a road construction project are discussed further within this section of the report, the list of species discussed is non-exhaustive.

11.2.11. Rare and Protected Species

Badger (*Meles meles*)

Badger is a protected species under the Wildlife Acts and has historically been recorded throughout the proposed scheme with the majority of recordings found to the north of the existing N53 roadway. Two of the NBDC records, sourced from the Badger Setts of Ireland Database, are noted to be along hedgerows in the townlands of Annaghvacky and Sheelagh away from rural roads which may indicate historic badger setts in these areas as opposed to only sightings of the species. Of all the species detailed within NPWS datasets and NBDC information, badger is by far the most frequently recorded mammal species within the proposed scheme.

The alignment and ca. 50m either side of the proposed scheme were surveyed for evidence of badger setts and badger activity (prints, trails, faecal deposits etc.). No badger setts were found within the footprint of the proposed scheme. Site surveys observed that the hedgerows and treelines are well managed with no ideal habitat that would provide cover and refuge for badgers (e.g. banks or overgrown areas) along any field boundaries. Within the footprint of the proposed scheme a singular badger print and a mammal faint trail were noted within a field at Chainage 1+000 (south). Plates 11-14 and 11-15 below show the badger print and faint mammal trail. No other evidence of badger activity was noted during walkover surveys. The mammal trail was noted to be in a general direction towards the scrubland habitat noted ca. 300m south of the footprint of the proposed scheme (refer to Figure 11-11 above for scrubland location). Of all habitats observed within and in close proximity to the proposed scheme it is considered that this scrubland habitat provides for the most suitable location for badger refugia.



Plate 11-14 - Badger print



Plate 11-15 - Faint mammal Trail

Red Deer (*Cervus elaphus*)

Red Deer are protected under the Wildlife Acts. A sighting of this species was noted in an agricultural grassland field in 2011 in the area of Annaghvacky within the proposed scheme. Deer warning signage is to be found along the N53 in this area and deer are historically known to frequent the mountainous regions to the north in Ulster. No evidence of deer activity (e.g. prints) were noted during site surveys.

European hedgehog (*Erinaceus europaeus*)

The European hedgehog is protected under Appendix III of The Berne Convention and under the Wildlife Act (1976) and Wildlife (Amendment) Act 2000. Within European countries this species is considered to be in decline with intensification of agriculture considered to be one of the leading causes. The only hedgehog sighting within the area was along the existing N53 and was a road kill sighting.

Bats

Although bat sighting records for the proposed scheme are not extensive 4 no. bat species have been recorded which include; Soprano Pipistrelle (*Pipistrellus pygmaeus*), Pipistrelle (*Pipistrellus sensu lato*), Lesser Noctule (*Nyctalus leisleri*) and Brown Long-eared Bat (*Plecotus auritus*). Specific sightings of Soprano pipistrelle and Lesser Noctule have been recorded along the Castletown River directly north of the proposed scheme.

During site walkover surveys undertaken July 2020 trees and treelines were inspected for their potential for providing habitat suitable to accommodate bat roosts. Multiple holes, cracks and cervices were noted in several mature sycamore, ash and beech trees (and treelines) within the footprint of the proposed scheme. These trees have been identified as Potential Bat Roosts (PBRs). The locations of these PBR trees are illustrated in Habitat Mapping in Appendix 11 and locations are also provided for in Table 11-6 below.

Note: On the north side of the existing N53 roadway, along the northern boundary of the propose scheme between chainage 2+450 – 2+600, there is a sporadic treeline predominantly consisting of young ash and semi mature and mature sycamore species. 3 no. of mature sycamore are considered to be PBR trees. Trees within this treeline will be retained where possible. This treeline is also included in Table 11-6 below.

Table 11-6 - Trees with potential bat roosts (PBR).

PBR Trees	Location	Observations / Notes
3 no. mature ash trees	Chainage 0+700	Within scheme alignment. 3 no. trees within hedgerow. Holes noted in trunks.
1 no. mature ash	Chainage 1+280	Northern side of scheme alignment. Mature ash with dense ivy.
1 no. mature sycamore	Chainage 1+980	Cracks and crevices noted. Adjacent to existing N53.
7 no. mature beech	Chainage 2+200	Multiple holes noted on main trunks. Tree aligned along private laneway.
3 no. mature sycamore	chainage 2+450 – 2+600	Along northern verge of existing N53 roadway.
1 no. mature sycamore	Chainage 2+900	Several cracks and crevices noted. Tree located on north side of existing N53 at entrance to private residence.

Birds

A review of BirdWatch Ireland information indicates that there are no bird reserves in County Louth. A review of data of waterbirds sightings at Irish wetland sites (I-WeBs count sites[23]) indicate the nearest waterbirds recorded as part of the monitoring surveys are in the area of Dundalk Bay Special Protection Area for birds. Due to the proximity of the proposed scheme to Dundalk Bay it is considered probable that some of the bird species for which the SPA site has been designated can feed within the wider landscape. This could include the fields within the proposed scheme. A review of the Countryside Bird Survey Coverage[24] indicates 58 no. different species of our common and widespread birds are to be found in County Louth. These species include Swift, Kingfisher, Buzzard, Kestrel, Skylark, Grey Wagtail and Reed Bunting to name but a few. A number of birds identified within the survey are included on the Red List (high conservation concern) and Amber List (medium conservation concern) as Birds of Conservation Concern in Ireland[25].

Yellowhammer (*Emberiza citrinella*) has been recorded within the north half of the proposed scheme in the townland of Sheelagh in 2015. Yellowhammer is a *Red List* Annex I species which indicates a species requiring the highest conservation priority. Kingfisher (*Alcedo atthis*) has been recorded at a bridge north of Hackballscross. Coot (*Fulica atra*), Spotted Flycatcher (*Muscicapa striata*) and Long-eared Owl (*Asio otus*) have also been sighted in the area.

The bird species within the Site noted during walkover surveys 2020 are given in Table 11-7 below. Within this table the Birds of Conservation Concern in Ireland[26] (BoCCI) conservation status is listed for each species. The BoCCI study uses a 'traffic light' system to indicate the conservation status of bird species placing them on three lists: Red (high conservation concern), Amber (medium conservation concern) and Green (low conservation concern).

Table 11-7 - Bird species noted during site surveys.

Species	Scientific name	BoCCI status
Blackbird	Turdus merula	Green
Wood pigeon	Columba palumbus	Green
Robin	Erithacus rubecula	Green
Rook	Corvus frugilegus	Green
Starling	Sturnus vulgaris	Amber
Song Thrush	Turdus philomelos	Green
Magpie	Pica	Green
Hooded Crow	Corvus cornix	Green
House sparrow	Passer domesticus	Amber

Amphibians

No amphibians were noted during site walkover surveys. The wet ditches located at Chainage 0+950 and Chainage 1+200 (refer to Section 11.2.9.4 above) are considered to be ideal amphibian habitat given the presence of standing water during dry summer months.

Other Species

No other species were recorded during site visits. Whilst no targeted surveys were undertaken, no Lepidoptera or Hymenoptera species were noted. The Annaghvacky West wetland site provides for suitable habitat to accommodate a wide range of insect species and presence of a wide variety of floral species including Devil's bit scabious would indicate this wetland area is suitable for a wide range of butterfly species, including Marsh fritillary.

[23] https://bwi.maps.arcgis.com/apps/View/index.html?appid=1043ba01fcb74c78bc75e306eda48d3a

[24] https://birdwatchireland.ie/our-work/surveys-research/research-surveys/countryside-bird-survey/

[25] Colhoun and Cummins (2013) *Birds of Conservation Concern in Ireland 2014-2019*.

[26] Gilbert, G., Stanbury, A. and Lewis, L. (2021). Birds of Conservation Concern in Ireland 4: 2020-2026. *Irish Birds* 43: 1-22.

11.2.12. Non-native Invasive Species

The European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477) contains provisions that outline the governance for the control of invasive alien species in Ireland. The Third Schedule of the regulations lists species subject to legal restrictions. Further to this Invasive Species Ireland undertook a risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland with the report being prepared for the National Parks and Wildlife Service and the Northern Ireland Environment Agency. The prioritisation risk assessment was carried out for 377 non-native species recorded in Ireland and 342 non-native species not known to be present in Ireland. These species were assessed, scored and ranked into impact categories of high, medium and low.

Records of invasive species listed on the Third Schedule or listed as High Impact invasive species were reviewed for the proposed scheme. No Third Schedule or High Impact invasive plant or animal species have been recorded within the proposed scheme.

The footprint of the proposed scheme was surveyed for invasive plant species listed on the third schedule of the EC (Birds and Natural Habitats) Regulations 2011 S.I. No. 477/ 2011. Species surveyed for included Japanese knotweed (*Fallopia japonica*) and associated hybrids. Surveys were undertaken during July 2020 which is within the seasonally appropriate window to assess the survey area for the presence of invasive plant species.

No evidence of third schedule invasive plant species were recorded within the extents of the proposed scheme.

Table 11-8 - Rare and protected species recorded within and around the proposed scheme.

Common Name	Scientific name	Grid Square / Spatial Ref	Record Count	Date of last record	Dataset	Protected species designation
Mammals						
Soprano Pipistrelle	*Pipistrellus pygmaeus*	H9511	1	2008	National Bat Database of Ireland	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts
Pipistrelle	*Pipistrellus sensu lato*	H9511	1	2008		
Lesser Noctule	*Nyctalus leisleri*	H9511	1	2008		
Brown Long-eared Bat	*Plecotus auritus*	H91V	1	2008		
West European Hedgehog	*Erinaceus europaeus*	H91F	1	2012	Road kill survey	Protected Species: Wildlife Acts, Berne Convention on the Conservation of European Wildlife and Natural Habitats
Red Deer	*Cervus elaphus*	H956106	3	2011	Atlas of Mammals in Ireland 2010-2015	Protected Species: Wildlife Acts
Eurasian Badger	*Meles meles*	H91Q	5	2016	Mammals of Ireland 2016-2025	Protected Species: Wildlife Acts
		H9511	1	2012	Badger Setts of Ireland Database	
		J01A	8	2014		
		H90U	4	2008		
		H91V	7	2013		
		H9611	1	2012		

Common Name	Scientific name	Grid Square / Spatial Ref	Record Count	Date of last record	Dataset	Protected species designation
Birds						
Yellowhammer	*Emberiza citrinella*	H9411	1	2015	Birds of Ireland	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern – Red List
Long-eared Owl	*Asio otus*	J01A	1	2011	Bird Atlas 2007 – 2011	-
Spotted Flycatcher	*Muscicapa striata*	J01A	1	2011	Bird Atlas 2007 – 2011	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern – Amber List
Kingfisher	*Alcedo atthis*	H91 / H9756110761	1	2011	Otter – National Otter Survey 2010-2011	
Common Coot	*Fulica atra*	H91 / H9756110761	1	2011	Otter – National Otter Survey 2010-2011	
Plants						
Swamp Meadow-grass	*Poa palustris*	H90U	1	2011	Discrete vascular plant surveys	Threatened Species: Vulnerable

11.3. Impact Assessment

11.3.1. Potential Impacts

The potential for impacts on nature conservation interests have been assessed in light of habitats and the species that are likely to be affected by the proposed road improvement scheme. The approach considers the following guidance: -

- *Guidelines on the Information to be Contained in Environmental Impact Assessment Report*, EPA (2017);
- *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018);
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes*, 2nd Edition (NRA, 2009);
- *Guidelines for the treatment of Otters Prior to the Construction of National Roads Schemes* (NRA, 2006);

- *Guidelines for the treatment of Badgers Prior to the Construction of National Road Schemes* (NRA 2006);
- *Requirement for the Protection of Fisheries Habitat During the Construction and Development Works at River Sites* (Eastern Regional Fisheries Board, 2006); and
- *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes* (NRA, 2005).

Potential impacts from the proposed scheme on the protected sites, habitats and species (which are listed in Section 11.2) above are outlined in this section. Potential direct and indirect impacts during both construction and operational phase of the proposed scheme are discussed. Impacts to European sites are also considered in detail within the accompanying Screening for Appropriate Assessment prepared by Atkins (2021) (Document Ref. 5187353DG0115).

11.3.2. Construction phase

Designated Sites

The proposed scheme does not directly intersect with any internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar, ASSIs sites or NHAs.

During the construction phase, the proposed scheme involves the construction of 1 no. drainage outfall directly to the Carrickastuck stream. This stream provides connectivity to the designated conservation sites located within Dundalk Bay namely; Dundalk Bay SAC, Dundalk Bay SPA, Dundalk Bay Ramsar Site and Dundalk Bay pNHA. Whilst indirect connectivity exists through this surface water feature, impacts on the conservation sites within Dundalk Bay are not anticipated during the construction phase of the proposed road scheme due to the distance of the road scheme to Dundalk Bay which is noted to be ca. >10km downstream of the project site / drainage outfall location.

No other watercourses which are receiving road surface water drainage are within the footprint of the proposed scheme. There are a further 2 no. surface water drainage outfalls which connect to field drains which convey flow to Drumboat and Inishkeen streams. There is no potential for negative impact to these 2 no. of streams during the construction phase of the proposed scheme as they are remote (ca. 1km) from the proposed scheme and no works are necessitated near these watercourses. Potential operational phase impacts on watercourses are discussed below.

Annex I Wetland Habitat

The proposed scheme is located adjacent to Annaghvacky West Wetland site between approximately Chainage 0+700 and 1+200. This wetland consists of transition mire, wet heath, cutover bog and scrub habitats and is noted by WSI to be of county conservation value. Areas of this wetland site have recently been classified as having correspondence to Annex I Habitat -Transition Mire and quaking bog [7140] and as such areas of this wetland habitat are now considered to be of international conservation value.

The scheme has been designed to ensure that the habitat with correspondence to Annex I wetland habitat is not intercepted by the proposed route. There will be no direct loss of this annexed habitat. A hydrogeological review, prepared as part of this Environmental Report, was undertaken to evaluate any surface water and/or groundwater linkages with this sensitive wetland site. This review also identified design measures and monitoring works which may need to be implemented during the construction phase. The hydrological impact assessment for Annaghvacky West wetland site is presented in Chapter 8 of this report. The hydrological assessment outlines the Annex I wetland habitat is likely fed by perched water / shallow groundwater rather than surface water sources. Based on groundwater level monitoring, static groundwater levels beneath the Annex I wetland habitat and also beneath the adjacent proposed route (Ch. 700 and Ch. 1200) are within 0.5m of the existing ground level in these areas. Therefore, taking account of the vertical and horizontal alignment along this particular section of the proposed scheme, potential impacts to groundwater quality and existing groundwater levels have been identified. Potential impacts to the Annex I wetland habitat have also been identified, via. perched water / groundwater linkages. Mitigation measures, which are documented fully within the hydrological impact assessment (Chapter 8) of this report will be fully implemented during the detailed design, construction (and operational) phases of the proposed scheme. These mitigation measures will ensure any potential impacts to groundwater and / or surface water are addressed. Therefore, significant ecological impacts to the Annex I wetland habitat via.

groundwater or surface water sources are not likely to occur during the construction and operational phases of the proposed scheme.

Habitats

Approximately 38 acres of improved agricultural grasslands / arable crops are to be lost as a result of the proposed scheme, these agricultural lands are of low ecological value. The construction phase will involve the removal of ca. 0.465 hectares of wet woodlands at Annaghvacky (Hackballscross) wet woodland site. These woodlands have been categorised by WSI to be local conservation (low value). The loss of woodland habitat can be compensated for by the completion of the soft landscape design. The alignment of the scheme also crosses through WSI delineated boundary of Clonaleenaghan wetland site noted to be of be local conservation (low value). This wetland site is largely drained with only one small area of wetland habitat remaining. The proposed scheme does not intersect with the remaining wetland habitat within the Clonaleenaghan wetland site and only a drained agricultural grassland field (within the WSI wetland site boundary) will be intersected.

The construction phase will result in the loss of wet grassland habitat at Chainage 1+250 and may result in the loss of a wet ditch at Chainage 1+200. The wet grassland is not of high ecological value. The loss of wet ditch, which provides for excellent amphibian habitat is be mitigated by the inclusion of 3 no. attenuation ponds. The construction phase will involve the removal of existing hedgerows and treelines which are important habitats of local conservation value and which are connecting corridors for a wide range of native species. The construction phase will have a negative impact on bird nesting and potentially on mammal foraging habitat and will potentially impact bat roosting habitat in a number of locations where trees identified as suitable bat roosting habitat are to be lost. The loss of hedgerow and treeline habitat can be compensated for by the completion of the soft landscape design. The proposed scheme does not intersect any other habitats of ecological importance.

As detailed above the Carrickastuck stream is the only watercourse within the footprint of the scheme. Works near the stream are not significant as the road construction works commence ca. 100m west of the watercourse. The stream is included within the footprint of scheme so as to receive road drainage only. No significant impacts to the Carrickastuck stream, or any other watercourse, are anticipated during the construction phase of the proposed scheme.

Species

There are no badger setts within the footprint of the proposed scheme. The scheme may be within badger foraging territory; however, evidence of badger activity was low at the time of surveying. Given the location of the existing N53 roadway and the alignment (and length) of the proposed scheme, it is considered that the linear feature of the new roadway will not result in the exclusion of terrestrial mammals from extensive areas of foraging habitat. Only relatively small areas of agricultural lands (between the two roadways) with be restricted to mammals by the physical barrier the new roadway will represent. No significant impacts to badgers or any other terrestrial mammals are anticipated from the construction (or operation) of the proposed scheme.

Several mature trees within the footprint of the scheme are considered to have potential to provide habitat suitable for bat roosts (PBR trees). It is unconfirmed if these trees have roosting bats. Recommendations for pre-construction bat surveys of these PBR trees are included below. Given the relatively small number of mature trees to be lost as result of the proposed scheme significant impacts to local bat populations are not anticipated.

The wet ditches noted during site surveys provide for ideal amphibian habitat. The loss of potential amphibian habitat is compensated for by the inclusion of 3 no. of attenuation ponds which will provide for larger areas of ponded water that would be lost during the construction phase for the proposed scheme.

As noted above, there will be a loss of potential bird nesting habitat (hedgerows and trees) as a result of the construction phase. The loss of potential nesting habitat can be compensated for by the completion of the soft landscape design. Recommendations outlined below include for site clearance works to be undertaken outside of the nesting season (1st May – 31st August) and such significant impacts on breeding birds are not anticipated during the nesting season.

Ideal lepidoptera (butterfly) habitat is noted to be within the transition mire located within Annaghvacky West wetland site. This habitat is not intersected by the prosed scheme. No significant impacts are anticipated to lepidoptera, or any other insect species, as a result of the prosed scheme.

11.3.3. 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 species through the physical barrier that the roadway will present. Only a relatively small area of agricultural lands between the footprint of new proposed scheme and the existing N53 roadway will have potentially restricted access for terrestrial mammals. These lands between the two roadways are predominantly farmed and intensively managed and is not considered prime or ideal habitat suitable for badger refugia. The only unmanaged / unfarmed area between the existing N53 roadway and the proposed scheme is Annaghvacky West wetland site. This wetland site has been identified as having very high groundwater levels. Given the water logged nature of this site, it is considered that this wetland site does not provide for ideal habitat suitable of accommodating badger setts. No significant impacts to terrestrial or volant mammal species are anticipated from the operation of the proposed scheme.

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. Surveys should include for bat surveys of trees identified as Potential Bat Roosts (PBRs), amphibian surveys of the 2 no. identified wet ditches and terrestrial mammal surveys (badgers). Pre-construction ecological surveys should outline ecological mitigation measures, to be implemented during the construction phase, for protected species as required.
- The construction phase mitigation and monitoring measures outlined in Chapter 8 of this report should be implemented to ensure the annexed transition mire habitat within Annaghvacky West wetland site is not impacted.
- Trees, treelines and hedgerows on the boundary of the proposed scheme should be retained where possible.
- A landscaping design should be developed following; NRA (2012) *Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland*. The landscaping design should aim for a net gain of semi-natural habitats including compensatory wetland and woodland areas planted with native species which are representative of those to be lost.
- 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.

- Site clearance works should be undertaken during the appropriate season so as not to impact on bird nesting or bat roosting activity. Breeding bird surveys will be required if vegetation clearance is to be undertaken within nesting season 1st March – 31st August.
- In-stream works at Carrickastuck (if required) should be undertaken during the appropriate season so as to minimise impact on any aquatic species that may be accommodated within this small stream.
- Attenuation ponds should be designed so as to hold water to provide for additional wetland habitat and amphibian habitat.

11.5. Summary

A screening for Appropriate Assessment has been prepared by Atkins (2021) (Document Ref. 5187353DG0115) and concludes '*the proposed N53 Hackballscross to Rassan Scheme, either alone or in combination with other plans or projects, does not pose likely significant effects on European sites*'. Similarly, no nationally important conservation sites will be impacted by the scheme.

Transition mire annexed habitat is within close proximity to the proposed scheme. Given the groundwater and surface water mitigation measures which will be implemented during the detailed design, construction and operational phases of the proposed scheme, no significant impacts on ecologically high value wetland habitats are anticipated during the construction or operational phases of the proposed road scheme.

No habitats of high ecological value will be lost or impacted by the road scheme. The construction of the scheme will involve the loss of hedgerows and treelines which can be compensated for by a landscape design.

The proposed scheme has surface water drainage to 3 no. small watercourses and given standard mitigation measures will be implemented no significant impacts on water quality or protected aquatic species are anticipated.

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.

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 recommendations. This assessment is based on the findings of a desk-based review of available information from the following sources:

- Louth County Council Development Plan 2015 – 2021; and,
- *'N53 Hackballscross to Rassan Route Selection Report: Landscape and Visual Impact Assessment'* prepared by Eamonn Byrne Landscape Architects (EBLA, 2019).

12.1. Receiving Environment

The proposed scheme is located within the Lower Faughart, Castletown & Flurry River Basins Landscape Character Areas (LCA) and is characterised as follows (EBLA, 2019): -

- This area borders on Co. Armagh which has an adjacent designated Landscape Area called the Crossmaglen Drumlins and Loughs;
- The soils are acid brown earths with a mix of gleys and brown podzolics. In the west and east of the area the lands are marginal. In the Sheelagh area rock outcrops are noted, displaying the shallowness of the soil cover;
- There is a good mix of tillage and pasture of the area with traditional hedgerows of thorn, ash, sycamore, bramble and elder;
- This area is no exception to the wealth of archaeological items that are evident throughout the county. Items include souterrains, ringforts, holy wells, sweathouses, cairns etc;
- The N53 National Secondary Route links Dundalk with Castleblayney. Its relative straight-line alignment in this terrain is highly unusual - in that it undulates up and down the land formation with little or no deviations; and,
- This area enjoys the scenic quality of the surrounding landscape of the Carlingford Mountains in the east to Slieve Gullion and beyond.

As noted by EBLA (2019), the following statement is included within the Louth Landscape Character Assessment;

> *'this LCA has local value, but does not state its sensitivity to road schemes.'*

EBLA (2019) noted from their field study that the proposed scheme has strongly undulating topography and the general area of the proposed scheme is agricultural in nature with fields of small to large scale which are '*rectangular and irregular shaped and enclosed by hedgerows and tree lines'.* EBLA (2019) has noted that the *'views from within this area towards a line of mature beach trees lining the avenue to Roachdale House and a small hillock with a tree group on top east of Roachdale House.* There are a number of *settlement clusters at Annaghvacky, Sheelagh, Hackballs Cross'* and other settlements comprise of *'numerous one off housing and farm buildings dotted throughout area'* (EBLA, 2019). EBLA (2019) noted from their field study that there are '*irregular grid of minor roads crosses the area and the existing N53 is in a straight alignment'* to the proposed scheme. The presence of rural settlement, isolated dwellings and farms and the existing N53 reduce the tranquillity of the area (EBLA, 2019). EBLA (2019) also noted that the '*attractive appearance partially degraded by views to electricity pylons'.* There are no Tree Preservation Orders (TPO), Trees and Woodlands of Special Amenity or Areas of Outstanding Natural Beauty or Areas of High Scenic Quality / designated Scenic Routes within the general area of the proposed scheme (EBLA, 2019).

EBLA (2019) has noted that there *is 'one View and Prospect of Special Amenity Value, VP16 at Hackballscross refers to views recorded at the crossroad at Hackballscross'* as well as '*views of mountains in the far distance to the north east of the site*.'

12.2. Impact Assessment

The following observations have been made with respect to potential visual and landscape impacts on the receiving environment (EBLA, 2019):-

- Visibility of the route from within the surrounding landscape is limited by intervening topography and vegetation;

- There would be some disruption to local landform from cutting and filling required to fit this route into the landscape, in particular a large fill embankment;
- There would be limited loss of rural tranquillity due to the location of the route either online with the existing N53 Road or in close proximity to the existing N53 Road corridor;
- The route will bypass Annaghvacky leading to an improvement to the setting of Annaghvacky;
- There will be slight to moderate adverse effects on pasture/ arable farmland, hedgerows and trees to accommodate proposed carriageways, embankments and cuttings. There would be some loss of woodland edge at Ch. 2650-2850.
- The proposed scheme is located south of the bog at Ch. 800-1100;
- It is anticipated that there will be a '*Neutral*' impact on 70no. dwellings / community buildings, '*Slight Adverse*' impact on 17no. dwellings / community buildings and '*Moderate Adverse'* impact on 11no. dwellings / community buildings with an overall visual impact of '*Neutral to Slight Adverse'*

Table 12.1 presents EBLAs (2019) assessment, summarising the potential impacts and mitigation measures.

Refinements in the proposed design, undertaken during Phase 3, have reduced the height of the large embankment that was proposed at Phase 2, adjacent to the Annavacky Wet Woodland, and therefore reduced the impact from a visual perspective.

12.2.1. Construction and Operational Phases

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

12.3. Recommendations (including Mitigation Measures)

As recommended by EBLA (2019) the following non exhaustive list of mitigation measures should be implemented during the construction phase of the scheme, to further reduce the potential landscape and visual impacts of the proposed scheme;

- Embankment and cutting slopes graded out;
- New planting to restore severed field pattern;
- Replanting of trees and hedgerows and woodland (including off-site planting);
- Appropriate boundary treatment such as planting/ local stone walls to severed front gardens; and,
- Ensure planting species are appropriate to surroundings.

12.4. Summary

When the mitigation measures as outlined in Section 12.3 are implemented there will be a slight adverse (negative) visual and landscape impact associated with the proposed scheme.

Table 12-1 - Lower Faughart, Castletown & Flurry River Basins Character Area (Source: EBLA, 2019)

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Mitigation
Pattern	Strongly undulating topography. Small, medium to large rectangular and irregular shaped fields enclosed by hedgerows and tree lines. There are long distance views to Carlingford Mountains in the east and to Slieve Gullion from elevated/ open areas and where hedgerows are low, otherwise the landscape is enclosed at lower elevations between hills and where hedgerows are high. Views from within this area towards a line of mature beach trees lining the avenue to Roachdale House and a small hillock with a tree group on top east of Roachdale House. Settlement clusters at Annaghvacky, Sheelagh, Hackballs Cross. Other settlement consists of numerous one off housing and	Local	Locally Common	Medium	Field pattern may be reproduced. Undulating topography could be reproduced.	Circa. 100m online widening at west end of route. Circa. 1090m online widening at east end of route. Circa. 2.14km of carriageway will cross through greenfield land within this character area. Reconfigured link roads/ junctions. Form and arrangement of carriageways would be in keeping with existing route patterns within the wider landscape. Some field pattern severance. Cutting and embankment slopes would disrupt existing landform. Generally, alignments follow landform well except: Moderate cutting between chainage; 1920 and 2370 (Max depth cut 5m).	Embankment and cutting slopes graded out. New planting to restore severed field pattern.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Mitigation
	farm buildings dotted throughout area. Irregular grid of minor roads crosses the area. Existing N53 is in a straight alignment.					Large fill between chainage; 2420 and 3070 (Max depth fill 6.5m) Visibility of the route within the surrounding wider landscape is limited by intervening topography and vegetation. Route does pass close to dwellings south of Annaghvacky and may potentially be visible from some of these dwellings. Large fill embankment (ch.2420 to ch. 3070) may potentially be visible forma wide area.	
Tranquillity	Rural settlement and numerous isolated dwellings in combination with the N53 corridor reduces the tranquilly of this rural area.	Local	Locally Common	Medium	Once lost is difficult to recover.	Route follows within close proximity of existing N53 Route corridor or existing settlement (within 270m) which already impacts on local tranquillity. No significant additional adverse effects on tranquillity	None possible without further disruption to pattern, landform and visual amenity.
Cultural	Elements of historic character include the historic field pattern, country lanes and minor roads. Numerous ringforts.	Local	Locally Common	Medium	Cultural features may not be replaced.	Fields will be bisected. New links to existing road pattern.	Embankment and cutting slopes graded out New planting to restore severed field pattern.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Mitigation
Landcover	Pasture and arable land. Tree lines and hedgerows. Small areas of woodland copse and bog. Numerous one -off dwellings and farm buildings, settlement clusters at Annaghvacky, Sheelagh, Hackballs Cross. Detractors within the landscape include views to overhead electricity wires and pylons and the noise of traffic along the N53 Road.	Local	Locally Common	Medium	Undeveloped agricultural land and woodland difficult to reproduce. Settlements easily reproduced. Cultural features may not be replaced.	Loss of farmland and hedgerows to carriageways, cutting and fill embankments. Loss of woodland edge at ch. 2650-2850. Loss of farmsteads: None Loss of dwellings: Demolition limited to 1No. House with 2No outbuildings Route will bypass Annaghvacky leading to an improvement to the setting of Annaghvacky.	Replanting of trees and hedgerows and woodland. Including off-site planting. Appropriate boundary treatment such as planting/ local stone walls to severed front gardens.
Summary of character	Attractive rural pastoral and arable landscape. Undulating topography with variation in elevation. Views out from open and elevated areas to distant uplands. Attractive appearance partially degraded by views to electricity pylons. Tranquillity already affected by the existing N53 Road and numerous one-off dwellings.	Local	Locally common rural landscape.	Medium	As a whole this character would be difficult to substitute.	Disruption to landform is limited. Limited loss of rural tranquillity due to location of the route close to existing N53 and existing settlement. Improvement to the setting of Annaghvacky. 2.1km through greenfield. Route does pass close to dwellings south of Annaghvacky and may potentially be visible from some of these dwellings. Limited visual impact to properties west of Annaghvacky.	Ensure planting species are appropriate to surroundings.

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 recommendations. Consultation has taken place with various landowners at the public consultations whose lands will be impacted by the proposed scheme. Individual meetings with the design team and Philip Farrelly & Co. occurred with each landowner. This assessment is based on the findings of 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.

- Louth County Council Development Plan (2015 – 2021);
- Google Maps / Bing Maps;
- Philip Farrelly & Co. (2019) '*N53 Hackballscross to Rassan Agronomy and Agricultural Appraisal Report'*; and,
- Agronomy Reports prepared by Philip Farrelly & Co. (2020).

13.1. Receiving Environment

The land quality in the area is considered good with the land undulation ranging in height from 70 meters to 97 meters above sea level. The proposed scheme is within a rural setting. The land is primarily in agricultural use. Land use is almost entirely grass based with some land used for growing crops. The farmland is good quality suited to intensive farming with some intensive dairy and beef farms located throughout the vicinity of the proposed scheme.

It is assumed at this stage 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.

The proposed scheme impacts 20no. land parcels; 15no. of which are Grass lands with 2no. forestry lands and 3no. tillage lands.

13.2. Impact Assessment

13.2.1. Construction Phase

The proposed scheme intercepts (and therefore impacts) 20no. land parcels as mentioned above; 16no. of the land parcels are good land quality, 1no. average land quality and 3no. poor land quality. 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 type of agricultural enterprise will determine the degree of impact on each of the intercepted land parcels. It is anticipated by Philip Farrelly & Co. (2019) that the following overall impact levels will apply to the land parcels;

- Medium Impact to 5no. land parcels, as a result of land take and severance. 4no. of the identified medium impacts relate to mixed livestock enterprises, 1no. relates to a tillage enterprise;
- Low impact to 7no. land parcels; and,
- Very low impact to 8no. land parcels

According to Philip Farrelly & Co. (2019) '*The route does not impact on any farmyards'.*

The following potential impacts may apply during the operational phase, to the various land holdings which will be severed 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;

- 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 (including Mitigation Measures)

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 measures are recommended for all of the 20no. land parcels which will be severed by the proposed scheme: -

- Access to severed lands is essential if they are to continue to be farmed. On some severed farms it will be necessary to reorganise the existing paddocking system on the farms, and to ensure lands remain stock proof;
- Direct access from the new road may be required for certain farms while for other operations the provision of alternative access from the local roads network in the area will provide a satisfactory level of access to severed lands;
- The reinstatement of services such as water, farm roadways and animal handling facilities to severed lands will also be necessary to facilitate the continued farming of lands affected by the proposed scheme; and,
- Small portions of land left as a result of the new road will be extremely difficult and uneconomic to farm. In this situation purchase of the small portions remaining may prove to be the best option from an overall point of view.

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 (2021); and,
- CSO (2021). Census 2016 Small Area Population Maps (Sapmap) Area: County Louth.

14.1. Receiving Environment

Collisions

For the period 2005-2015, the Road Safety Authority data notes 1no. fatal collision, 8no, serious collisions and 27no. minor collisions along the section of the N53 being assessed.

TII Collision Data (2011-2013) shows the section of the N53 under consideration has a collisions rate Twice Above Average, and for the period 2014-2016 varying from Twice Above Average to Twice Below Average. It is noteworthy that in this latter period the section which was Twice Above Average was through the settlement at Annaghvacky (i.e. the most populated section with the highest potential for Non-Motorised Users (NMUs)) and also incorporated the junction to Crossmaglen (which has the largest volume of turning movements). Therefore, any proposed bypass of this area could be seen as beneficial in road safety terms.

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 farm landholdings / properties within vicinity of the scheme; 20no. of which will be impacted by the proposed scheme, as discussed further in Chapter 13 – Agronomy. Demolition works necessitated by the proposed scheme will be limited to 1no. House with 2no. outbuildings, these buildings are owned by 1no. landowner. The owner of these properties have been consulted with and is aware of the proposed demolition works.

Population

The proposed scheme is located predominantly within the Creggan Upper Electoral Division. The population of this area in 2011 was reported as 787. The population size has increased by 7.5% to 846 in 2016 (CSO, 2021).

Air Quality

The baseline air quality within the vicinity of the proposed scheme is generally considered to be good based on current levels recorded at Kilkitt Station, the closest rural Zone D location to the proposed scheme (EPA, 2021).

Noise

According to the TII (2021) the primary source of noise in the general area of the scheme is the N53 and the M1 to the east. Based on available baseline noise mapping from the TII (2021) day-time noise levels of 70-74dB and >75dB are generated within the confines of these schemes respectively. Along the same schemes i.e. N53 and M1, night time noise levels may decrease to 60-64dB and 65-69dB respectively as reported by the TII (2021). Regional and third class roads along with agricultural activities in the vicinity of the proposed scheme will contribute to the baseline noise environment.

Water

The key surface water features in the vicinity of the scheme comprise 2no. tributaries of the Castletown River; namely Annaghvacky Stream and Carrickastruck Stream. Both streams start at the existing N53 route in the eastern portion of the proposed scheme and flow in a general easterly direction before joining the Castletown River and in turn discharging to Dundalk Bay Special Area of Conservation (SAC) and Special Protection Area (SPA). It is assumed that all properties within the vicinity of the proposed scheme are on private well supplies. Based on the results of the Ground Investigation (at specific exploratory hole locations) (IGSL, 2021) no evidence of existing ground contamination has been identified in the vicinity of the proposed scheme.

Land, soils & geology

The proposed scheme is located in lands which are predominantly (historically and currently) agricultural in nature. Based on the results of the Ground Investigation (at specific exploratory hole locations) (IGSL, 2021) no evidence of existing ground contamination has been identified in the vicinity of the proposed scheme.

14.2. Impact Assessment

The proposed scheme will be utilised by all of the local residents / workers within the 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 result in an increase of noise and vibration levels for 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 Detailed 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 Detailed 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 specific Detailed C&D WMP. It will be the responsibility of the Contractor to develop a site-specific Detailed C&D 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 Detailed CEMP which will identify 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 N53 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 Construction Traffic Management Plan which will be prepared by the Contractor; and,
- Demolition works necessitated by the proposed scheme will be limited to 1No. House with 2No outbuildings, these buildings are owned by 1no. landowner. The owner of these properties have been consulted with and is aware of the proposed demolition works.

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: -

- There are 14no. air sensitive building receptors 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;
- 20no. 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; and,
- An increase in noise levels for the residential properties within the 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 (including Mitigation Measures)

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;
- Chapter 7 – Material Assets; and,
- Chapter 8 – Water.

14.4. Summary

It is anticipated that any potential impacts associated with the proposed scheme in relation to population and human health will be mitigated through the implementation of all recommendations outlined in Section 14.3 and the relevant chapters of this report.

15. Conclusions & Recommendations

LCC have appointed Atkins to prepare an Environmental Report as part of a Part 8 Planning application for the proposed scheme. This 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) 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, 2021), 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 Architectural and Cultural 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 Contractor's responsibility to prepare a site specific Detailed 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.

It will be the Contractor's responsibility to prepare a project specific Detailed C&D Waste Management Plan (WMP) in accordance with '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects'* and '*The Management of Waste from National Road Construction Projects*' (TII, 2017), in advance of commencing the works, as the proposed scheme will likely exceed the relevant thresholds for the preparation of such plans.

Table 15-1 – Schedule of Environmental Commitments (Mitigation Measures to be Implemented)

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
1	Chapter 4 - Air Quality	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 if 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	In order to reduce operational noise levels along the length of the proposed scheme mitigation measures through the use of acoustic screening have been included. The mitigation measures detailed here are based on the current scheme design. In the first instance, a low-noise road surface giving a reduction in noise levels of 2.5 dB(A) with respect to stone mastic asphalt is recommended for the full length of the scheme. This measure addresses the need to provide noise mitigation for the houses at the east end of the scheme where barriers are not practicable. To address remaining requirements for mitigation a set of barriers is also proposed. Barriers can take the form of proprietary acoustic screens, solid block walls, earth berms or other solid structures. The barriers chosen should be solid, with no gaps at the base or between vertical joints and should have a minimum surface mass of 10 kg/m2. All barriers shall achieve the performance specified in I.S. EN 1793 – 1:1998, I.S. EN 1793-2:1998, I.S. EN 1973-3:1998, I.S. 1794-1:2003 and I.S. EN 1794-2:2003. Table 5-15 summarises the location and extent of screening requirements for noise mitigation. The extent of noise mitigation measures proposed is illustrated in Figures 5-2 and 5-3.		✓ ✓

Barrier Reference	Location(s) requiring Mitigation	Barrier Details	Side of Road	Barrier Height (m)

Item Reference	Environmental Topic	Mitigation Measures / Recommendations					Construction Phase	Operational Phase
		NB01	H05b	From Chainage 230 to 480	North	2.0 m above road level		✓
		NB02	H22, H23a & H23b	From Chainage 1190 to 1610	North	2.5 m above road level Absorptive side facing road		✓
		NB03	H24b	From Chainage 1190 to 1350, rounding corner on junction	South	2.5 m above road level Absorptive side facing road		✓
		The contract documents will clearly specify the construction noise criteria included in this chapter which the construction works must operate within. The Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228-2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 and 2 and the Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that:					✓	
		• No plant used on site will be permitted to cause an ongoing public nuisance due to noise;					✓	
		• The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;					✓	
		• All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;					✓	
		• Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; and,					✓	
		• Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.						
		During the course of the construction programme, the contractor will be required to manage the works to comply with the limits detailed in Table 5-3 of this report. The following sections provide outline guidance on measures to control construction noise, in accordance with BS 5228 2009+A1 2014 Parts 1 and 2.					✓	
		Selection of Quiet Plant						
		The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already						

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.	✓	
		For static plant such as compressors and generators used at work areas such as construction compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where possible.	✓	
		The contractor will evaluate the choice of excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative lower noise generating equipment that would economically achieve, in the given ground conditions, equivalent structural/ excavation/ breaking results, these will be selected to minimise potential disturbance.		
		General Comments on Noise Control at Source	✓	
		If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise.	✓	
		Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:	✓	
		• For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant will be switched off when not in use and not left idling;	✓	
		• For percussive tools such as pneumatic concrete breakers or tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed and erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction;	✓	
		• For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights;	✓	
		• Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/ areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation;	✓	
		• Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact;	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary, and;	✓	
		• All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.	✓	
		Screening		
		Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver.	✓	
		The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source.	✓	
		BS 5228 -1:2009+A1 2014 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 10 kg/m2 will give adequate sound insulation performance. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver.	✓	
		Working Hours		
		Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:30hrs Saturday. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority. This permission, if granted, can be withdrawn at any time should the working regulations be breached.	✓	
3	Chapter 6 - Land, Soils & Geology	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).	✓	
		Specifically, with regard to soils and geology, the following will be adhered to:		

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• 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 site 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 access, and haulage roads will be clearly defined;	✓	
		• In the unlikely 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 an 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,	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		- 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 Detailed Construction Environmental Management Plan (CEMP) to be prepared by the Contractor in advance of commencing the works.	✓	
4	Chapter 7 - Material Assets	• The Contractor should undertake pre-demolition surveys for all properties and infrastructure scheduled for demolition including asbestos surveys if required.	✓	
		• A Project specific Detailed 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'* and '*The Management of Waste from National Road Construction Projects*' (TII, 2017), in advance of commencing the works, as the proposed scheme will likely exceed the relevant thresholds for the preparation of such plans;	✓	
		• A detailed Demolition Plan shall be prepared by the appointed Contractor and included as an integral part of the Project specific Detailed 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;	✓	
		• All waste soils / material removed from site will need to be classified in accordance with EPA guidelines (2018). Soils testing will be required, the results of which should inform the preparation of a waste classification tool (in order 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 will be segregated and removed from site for disposal or recycling, in accordance with all relevant Waste Management Legislation; and,	✓	
		• All waste-related control measures set out in Chapter 6 – Land, Soils and Geology will apply during the construction phase.	✓	
5	Chapter 8 – Water	• During the detailed design stage, specific stormwater drainage design measures for the proposed scheme in the vicinity of the Annex I Annaghvacky West Wetland habitat (between Ch. 700 and Ch. 1200) will need to be developed. Such measures include ensuring that rainfall/storm water run-off in this localised area is collected, treated (via appropriate pollution control measures) and discharged to ground via diffuse locations immediately adjacent to the wetland habitat. This will ensure that no perched /shallow groundwater impacts via. potential changes in local rainfall recharge rates will occur. Accordingly, potential impacts to the wetland habitat will be designed out.	✓	✓

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• Drainage design measures will also be developed during the detailed design stage of the project to ensure that all stormwater drainage is sufficiently treated (via appropriate pollution control measures) prior to discharge.	✓	✓
		• Any fill material proposed to be used when raising existing levels by ca. 4.4m adjacent to the Annex I Annaghvacky West Wetland habitat (between Ch. 700 and Ch. 1200) should be carefully selected to ensure this material is of similar geological composition to native subsoils in this area (which are non-calcareous material). Alternatively, should calcareous material be proposed as fill material in this area, an appropriate geotextile membrane must be placed between the existing ground surface and any calcareous material placed on top. This will prevent the potential for any leaching of calcareous fines to ground, which could impact baseline groundwater chemistry, and the Annex I wetland habitat.	✓	✓
		• A monitoring programme will be implemented to determine groundwater quality, surface water quality, and groundwater levels at key locations before, during and after the construction phase of the proposed scheme. The monitoring programme will be developed during the detailed design stage of the project but should include as a minimum the following key monitoring location in the vicinity of the Annex I Annaghvacky West Wetland: WS/ROH02, WS/ROH04, ROH01, ROH03 and ROH05, and any adjacent drains.	✓	✓
		• In advance of the commencement of construction, contact via a door to door survey or otherwise shall be made with all landowners to develop a register of all identified wells (for potable, agricultural or commercial use) and septic tanks within 150m of the proposed scheme. The register shall be reviewed by the design team in order to identify any well protection works required. Any wells which may potentially be at risk (via. resource / quality impacts) during the construction or operational phases will be identified and appropriate measures implemented in order to protect any vulnerable groundwater supplies within the vicinity.	✓	
		• In advance of commencement of the Construction Stage, all monitoring wells directly within the alignment of the proposed scheme (as identified in the Ground Investigation Report (IGSL, 2021) should be fully decommissioned by an experienced borehole specialist in accordance with relevant guidelines, '*Good practice for decommissioning redundant boreholes and wells'* (UK Environment Agency, 2012). Offsite monitoring wells (WS/ROH02, WS/ROH04, ROH01, ROH03 and ROH05) should be retained for monitoring purposes with suitable protection measures in place;	✓	
		• All of the mitigation measures (for the protection of soils and geology) listed in Chapter 6 will be implemented onsite.	✓	✓
		• Any groundwater temporarily dewatered during the excavation works for the proposed scheme should be treated via. the installation of a temporary in-situ water treatment system;	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		○ This system should be designed and sized to ensure that all pumped groundwater water is treated via. a temporary attenuation pond, prior to discharge to a selected onsite location (via. a temporary soakaway).	✓	
		○ The Contractor will be required to provide a site-specific dewatering plan, clearly setting out proposed excavation methodology, estimated dewatering rates, details of proposed treatment system, and discharge location.	✓	
		• The construction management of the site should 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.;	✓	
		• 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.	✓	
		• In order to prevent any potential surface water / groundwater impacts via. release of hydrocarbon / chemical contaminants the following standard measures will be implemented:	✓	
		○ 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 proposed development for disposal or re-cycling;	✓	
		○ A response procedure will be put in place to deal with any accidental pollution events. 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 in accordance with all relevant waste management legislation;	✓	
		○ All site vehicles used will be refuelled in bunded and adequately sealed and covered areas in the construction compound area.	✓	
		○ 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 groundwater becoming contaminated through site activity.	✓	
		○ All oil stored on site for construction vehicles will be kept in a locked and bunded area;	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		○ Generators, pumps and similar plant will be placed on drip-trays to prevent contamination;	✓	
		○ 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. Relevant Material Safety Data Sheets along with oil absorbent materials will be kept on site in close proximity to any fuel storage tanks or bowsers during proposed site development works; and,	✓	
		○ All fuel / oil deliveries to on-site oil storage tanks will be supervised, and records will be kept of delivery dates and volumes.	✓	
		• In order to prevent any potential surface water / groundwater impacts via. release of cementitious materials the following measures will be implemented where poured concrete is being used on site;	✓	
		○ The production, transport and placement of all cementitious materials will be strictly planned and supervised. Site batching/production of concrete will not be carried out on site;	✓	
		○ Shutters will be designed to prevent failure. Grout loss will be prevented from shuttered pours by ensuring that all joints between panels achieve a close fit or that they are sealed;	✓	
		○ Any spillages will be cleaned up and disposed of correctly;	✓	
		○ Where concrete is to be placed by means of a skip, the opening gate of the delivery chute will be securely fastened to prevent accidental opening;	✓	
		○ Where possible, concrete skips, pumps and machine buckets will be prevented from slewing over water when placing concrete;	✓	
		○ Mixer washings and excess concrete will not be discharged directly into any drainage ditches, surface water bodies or exposed groundwater; and,	✓	
		○ Surplus concrete will be returned to batch plant after completion of a pour.	✓	
6	Chapter 9 – Archaeology and Architectural Heritage	The following recommendations will be implemented during the construction phase of the proposed development. They will also form part of the site specific Detailed Construction and Environmental Management Plan;		
		• Advance works testing shall be carried out on the “anomalies” found in the geophysical survey (presented in Appendix 9) at pre-construction stage.	✓	
		The above recommendation is to be subject to the approval of the National Monuments Section at the Department of Culture, Heritage and the Gaeltacht.	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
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 4 – Air Quality and Chapter 5 – Noise & Vibration will also apply	✓	✓
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. Surveys should include for bat surveys of trees identified as Potential Bat Roosts (PBRs), amphibian surveys of the 2 no. of identified wet ditches and terrestrial mammal surveys (badgers). Pre-construction ecological surveys should outline ecological mitigation measures, to be implemented during the construction phase, for protected species as required. • The construction phase mitigation and monitoring measures outlined in Chapter 8 of this report should be implemented to ensure the annexed transition mire habitat within Annaghvacky West wetland site is not impacted. • Trees, treelines and hedgerows on the boundary of the proposed scheme should be retained where possible. • A landscaping design should be developed following; NRA (2012) *Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland*. The landscaping design should aim for a net gain of semi-natural habitats including compensatory wetland and woodland areas planted with native species which are representative of those to be lost. • 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).	✓ ✓ ✓ ✓ ✓ ✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		– 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.	✓	
		• Site clearance works should be undertaken during the appropriate season so as not to impact on bird nesting or bat roosting activity. Breeding bird surveys will be required if vegetation clearance is to be undertaken within nesting season 1st March – 31st August.	✓	
		• In-stream works at Carrickastuck (if required) should be undertaken during the appropriate season so as to minimise impact on any aquatic species that may be accommodated within this small stream.	✓	
		• Attenuation ponds should be designed so as to hold water to provide for additional wetland habitat and amphibian habitat.	✓	
9	Chapter 12 - Landscape & Visual	As recommended by EBLA (2019) the following non exhaustive list of mitigation measures should be implemented during the construction phase of the scheme, to further reduce the potential landscape and visual impacts of the proposed scheme;		
		• Embankment and cutting slopes graded out;	✓	
		• New planting to restore severed field pattern;	✓	
		• Replanting of trees and hedgerows and woodland (including off-site planting);	✓	
		• Appropriate boundary treatment such as planting/ local stone walls to severed front gardens; and,	✓	
		• Ensure planting species are appropriate to surroundings.	✓	
10	Chapter 13 – Agronomy	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 measures are recommended for all of the 20no. land parcels which will be severed by the proposed scheme: -		

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• Access to severed lands is essential if they are to continue to be farmed. On some severed farms it will be necessary to reorganise the existing paddocking system on the farms, and to ensure lands remain stock proof; • Direct access from the new road may be required for certain farms while for other operations the provision of alternative access from the local roads network in the area will provide a satisfactory level of access to severed lands; • The reinstatement of services such as water, farm roadways and animal handling facilities to severed lands will also be necessary to facilitate the continued farming of lands affected by the proposed scheme; and, • Small portions of land left as a result of the new road will be extremely difficult and uneconomic to farm. In this situation purchase of the small portions remaining may prove to be the best option from an overall point of view.	✓ ✓ ✓ ✓	
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 operational phases of the scheme;- • Chapter 4 - Air Quality; • Chapter 5 - Noise & Vibration; • Chapter 6 - Land, Soils and Geology; • Chapter 7 – Material Assets; and, • Chapter 8 – Water.	✓	✓

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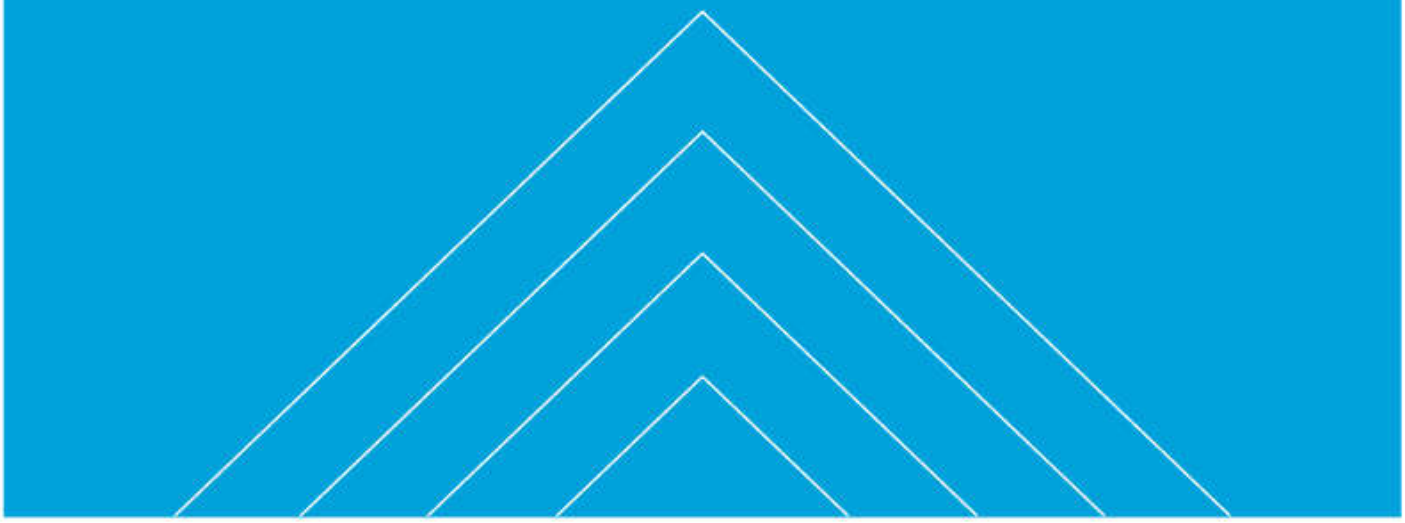
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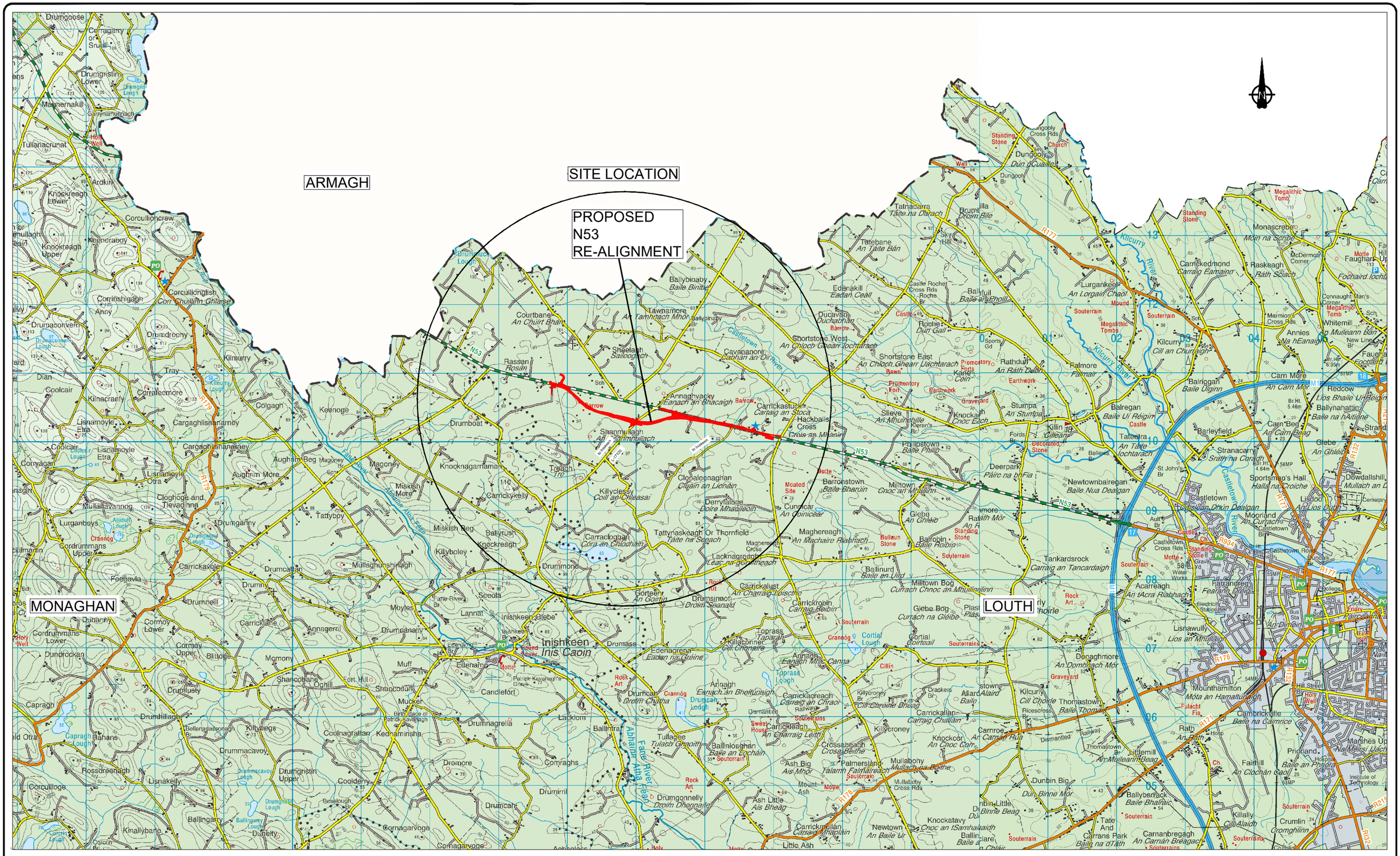
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Appendices



Appendix 1: Proposed Scheme Drawings



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Project: N53 Hackballscross to Rassan

Title: Site Location Plan

(Sheet 01 of 01)

Designed:	KM	Job No:	WH5302
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Checked:	KL	Date:	19th May 2021
Approved:	AC	Printed:	May 20, 2021 - 3:56pm

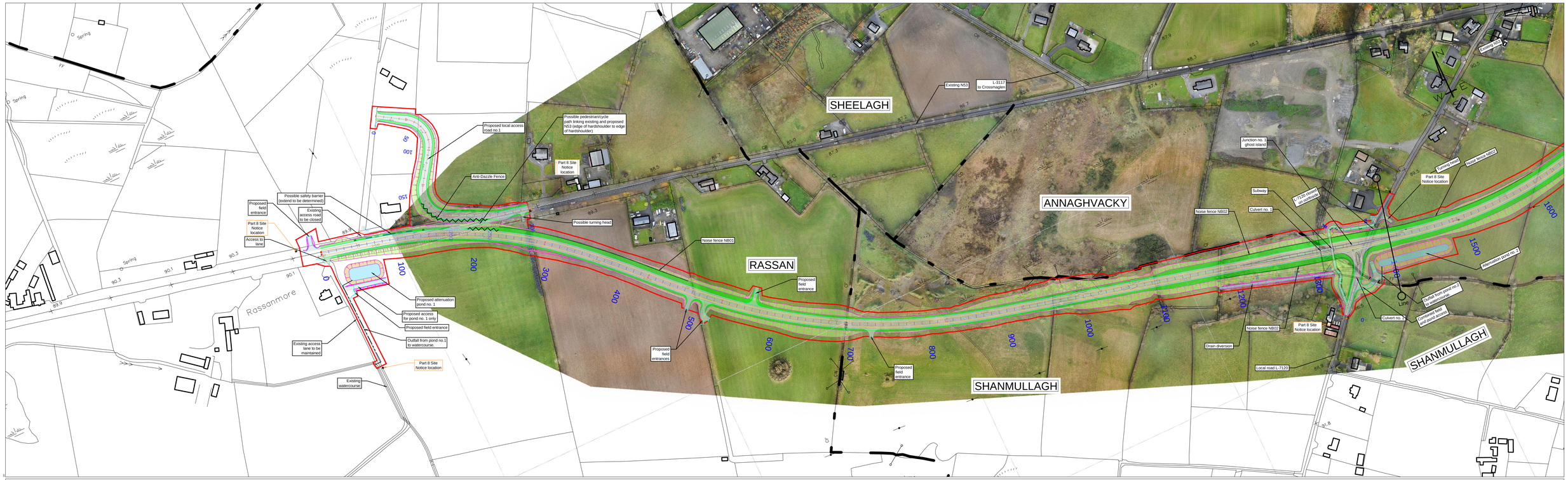
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Drawing No: WH5302-04-005.1

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Project
N53 Hackballscross to Rassan

Title
Mainline location map - horizontal and vertical ch0 to ch1400

(Sheet 01 of 03)

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Checked:	TB	Date:	21th May 2021
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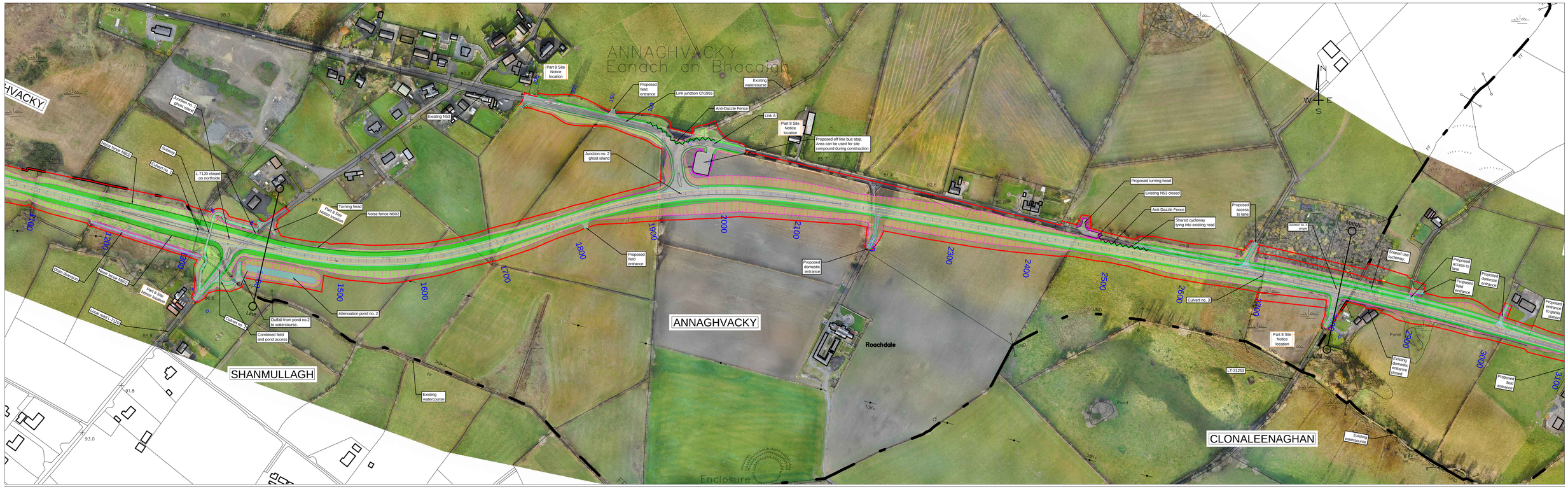
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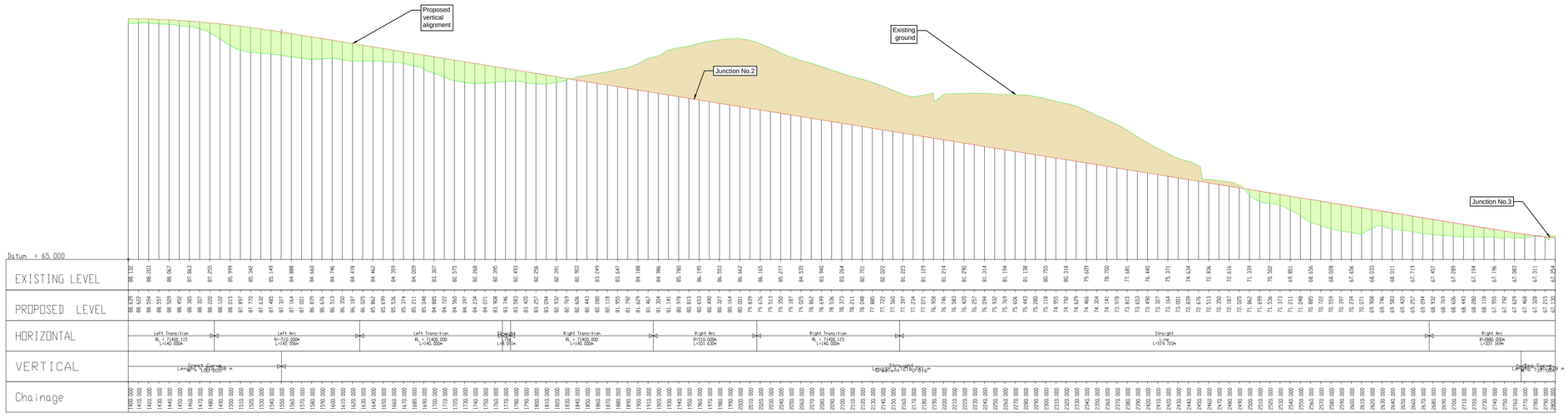
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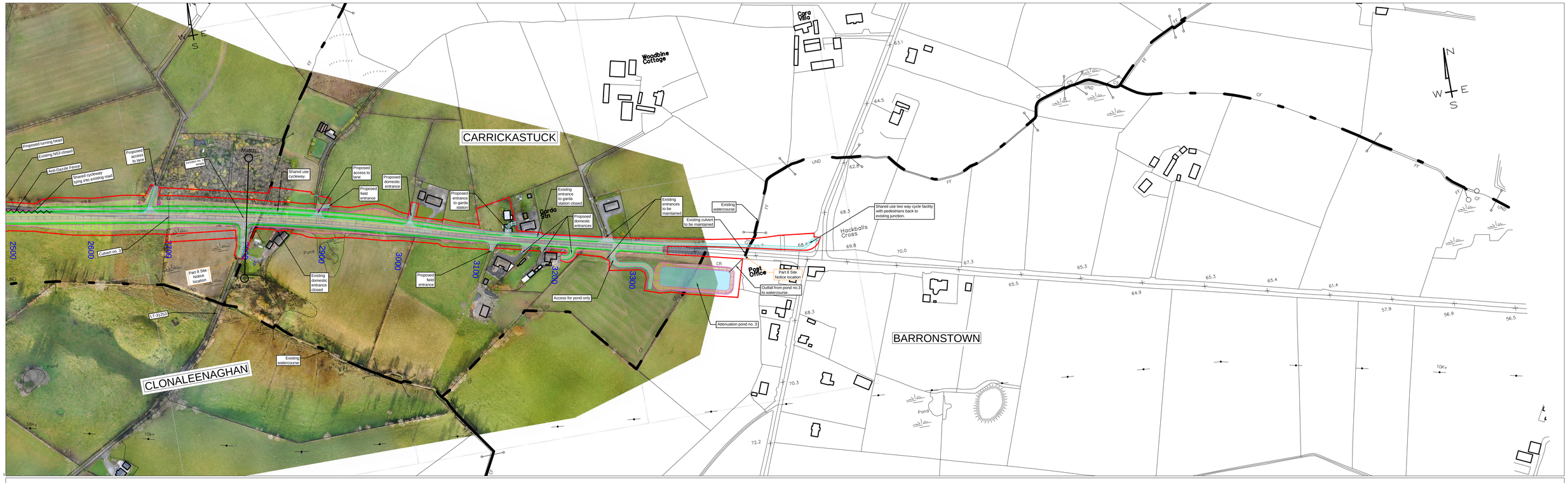
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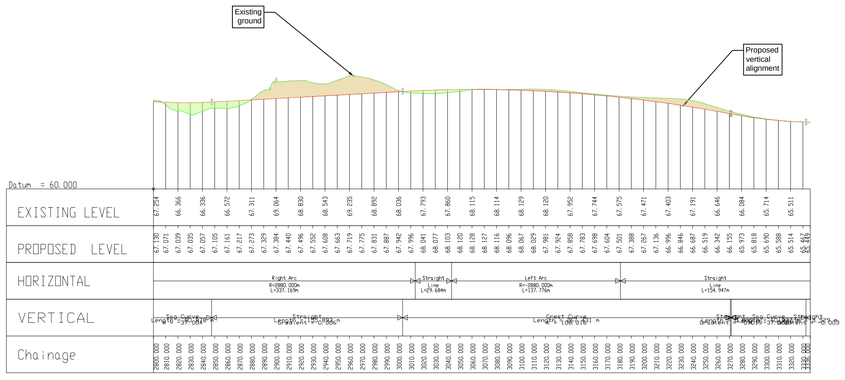
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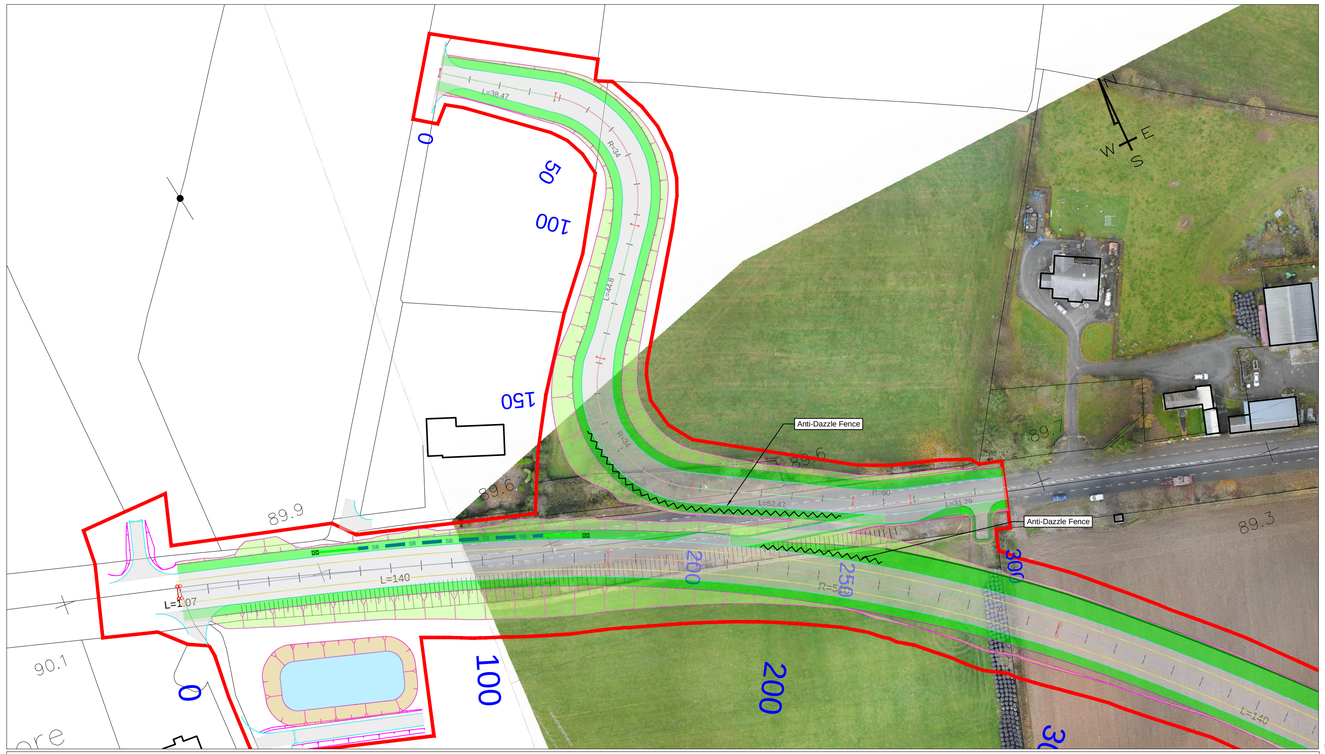
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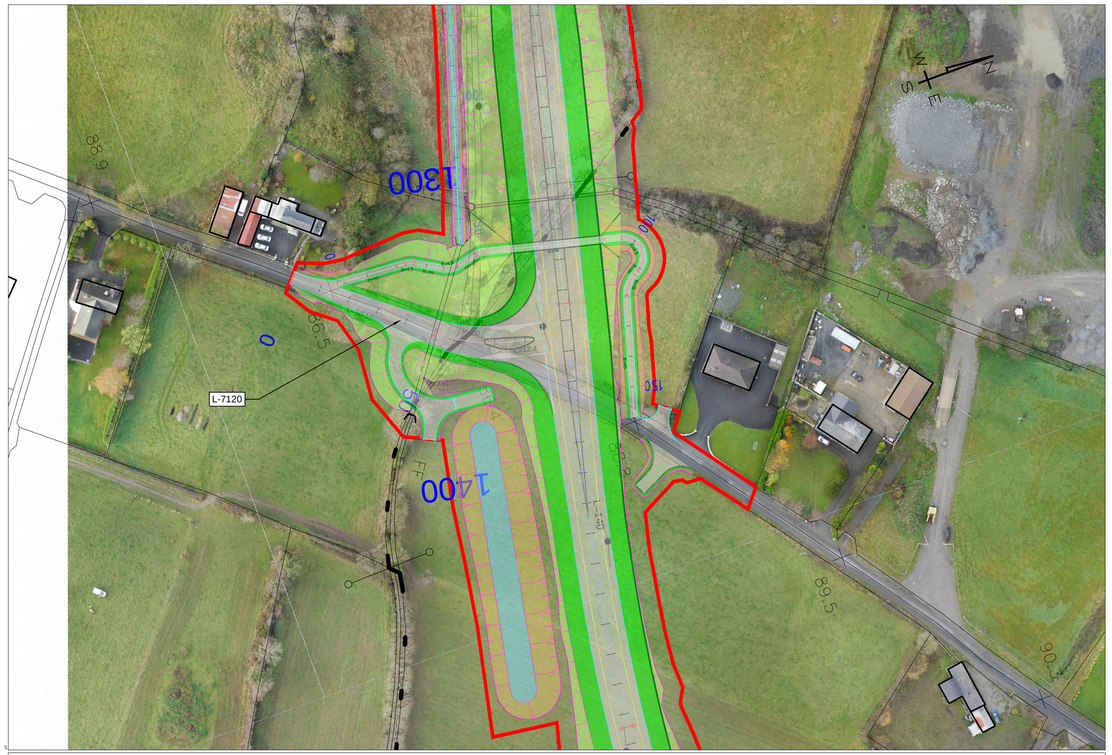
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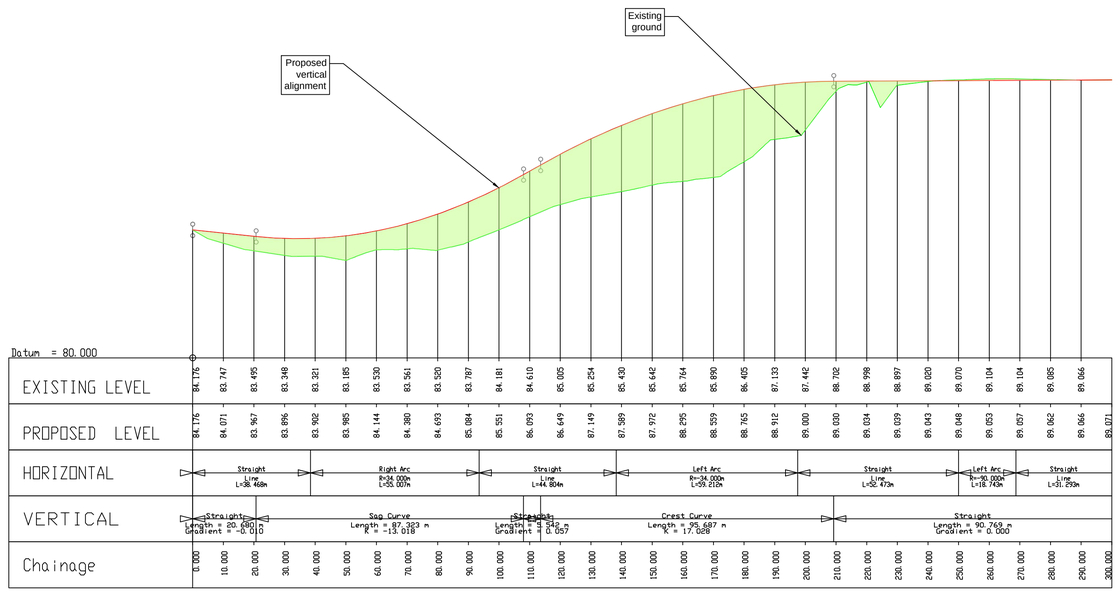
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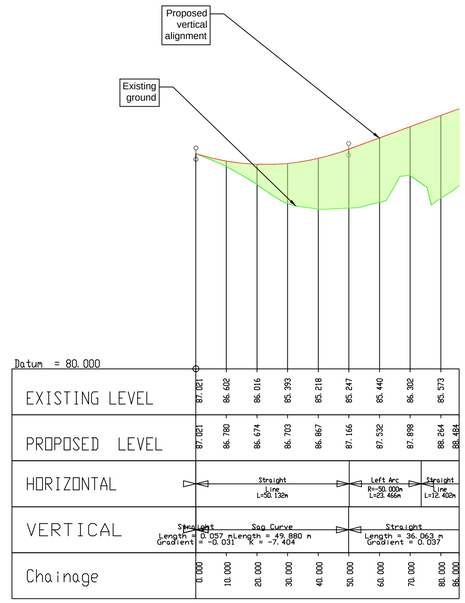
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Local access road no.1



L-7120

Scale 1:1,000 horizontal
1:100 vertical
10x vertical exaggeration

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Title: Sideroad location map - horizontal and vertical Local Road & L-7120

(Sheet 01 of 04)

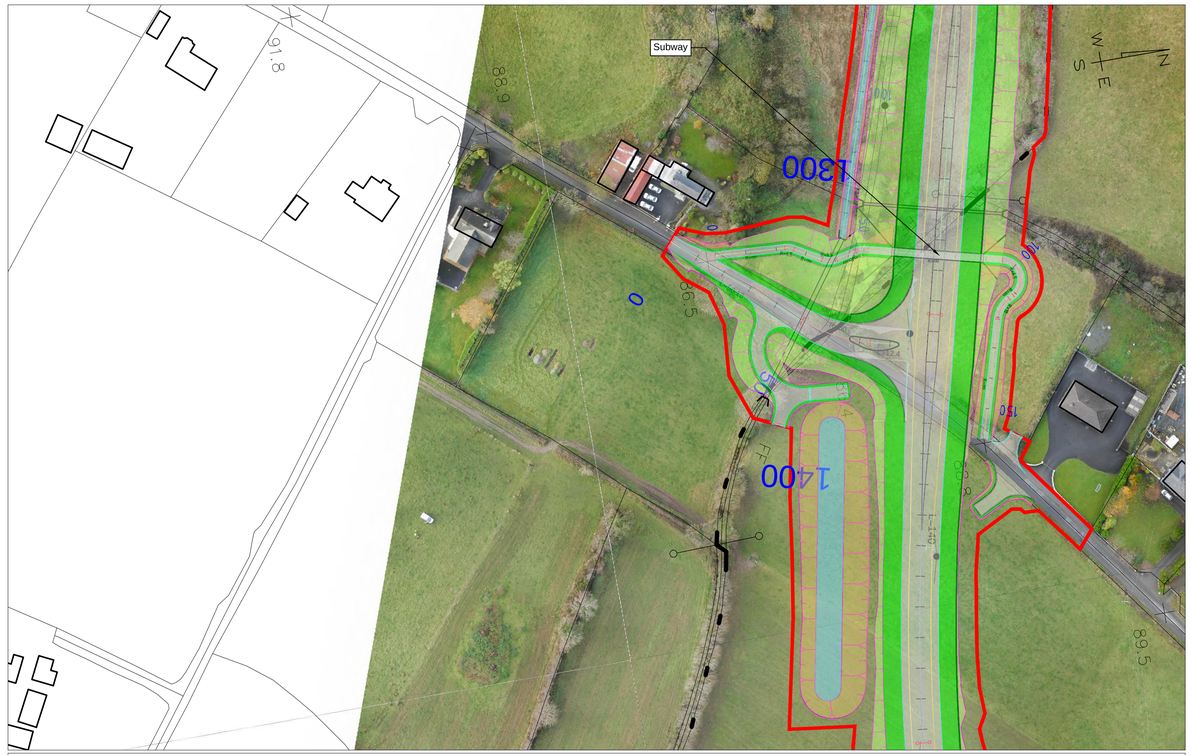
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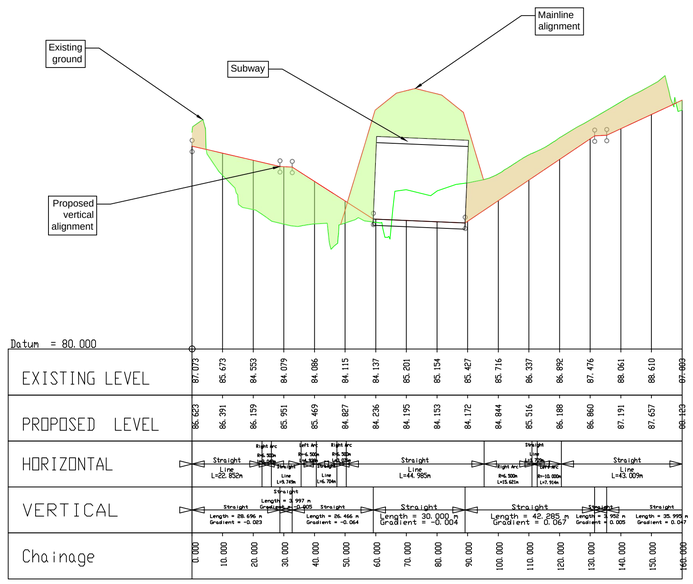
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Typical Subway (Sample Photo)





Subway

Scale 1:1,000 horizontal
1:100 vertical
10x vertical exaggeration

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Title: Sideroad location map - horizontal and vertical Subway

(Sheet 02 of 04)

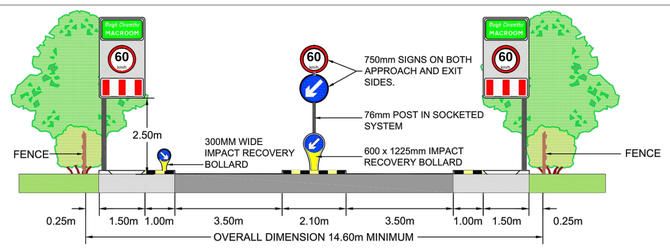
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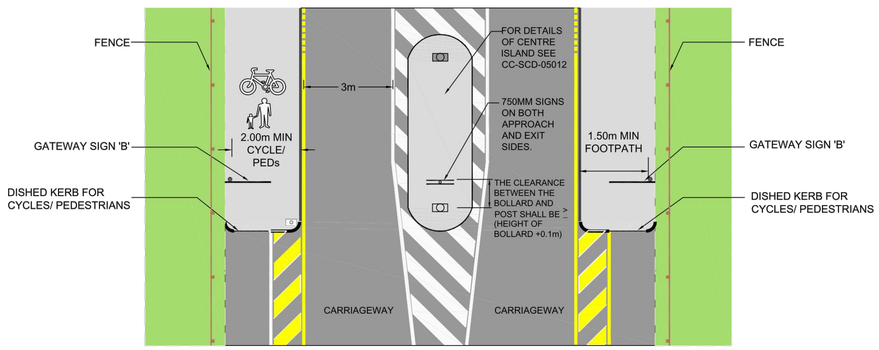
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NOTE:

1. ALL FIXTURES AT GATEWAY SHOULD CONFORM TO EN 12767.
2. ALL LIGHTING SHALL BE IN ACCORDANCE WITH THE TII LIGHTING STANDARD DN-LHT-03038.
3. SEE CC-SCD-05039 AND CC-SCD-05040 FOR DETAILS OF SIGNS FOR GATEWAY TYPE B.
4. SEE CC-SCD-05041 FOR FURTHER DETAILS OF POSITIONING OF RURAL FRINGE SIGNS.



ELEVATION



PLAN

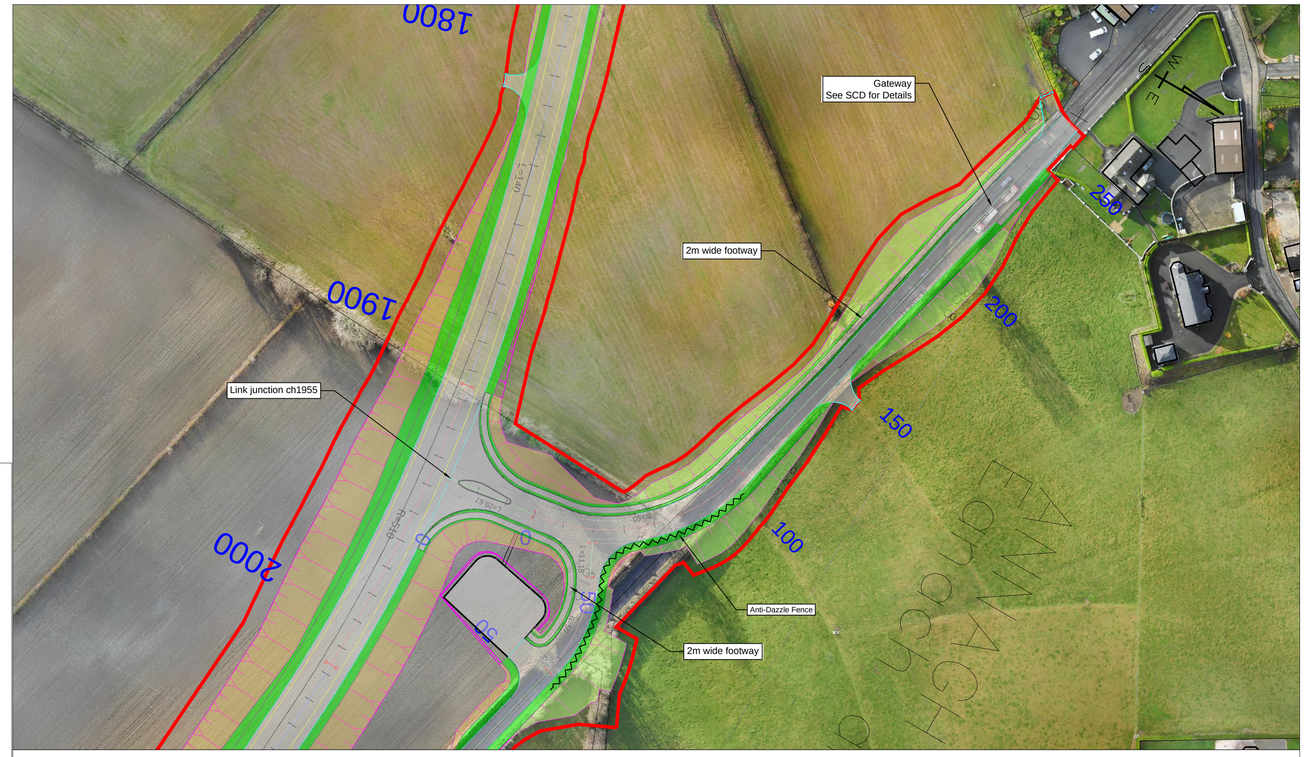
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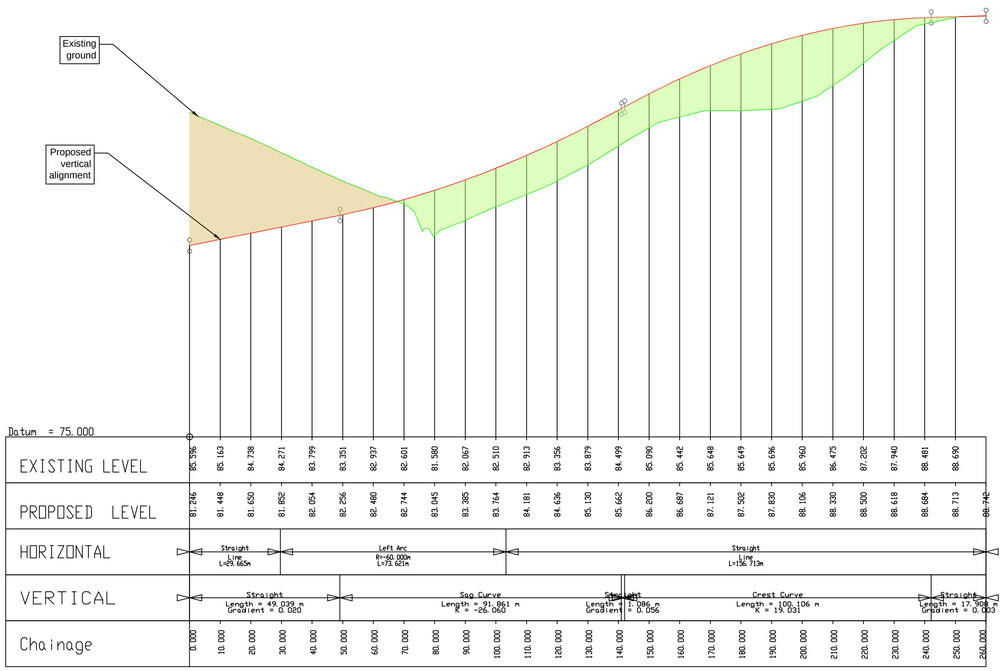
- ROAD
- FOOTPATHS
- GRASS VERGE
- SHARED CYCLE / PEDESTRIAN FACILITY

NOT TO SCALE

Gateway Type B Design (CC-SCD-05005)

Scale 1:1,000 horizontal
1:100 vertical
10x vertical exaggeration





Link Junction ch1955

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Title: Sideroad location map - horizontal and vertical link ch1955 & SCD

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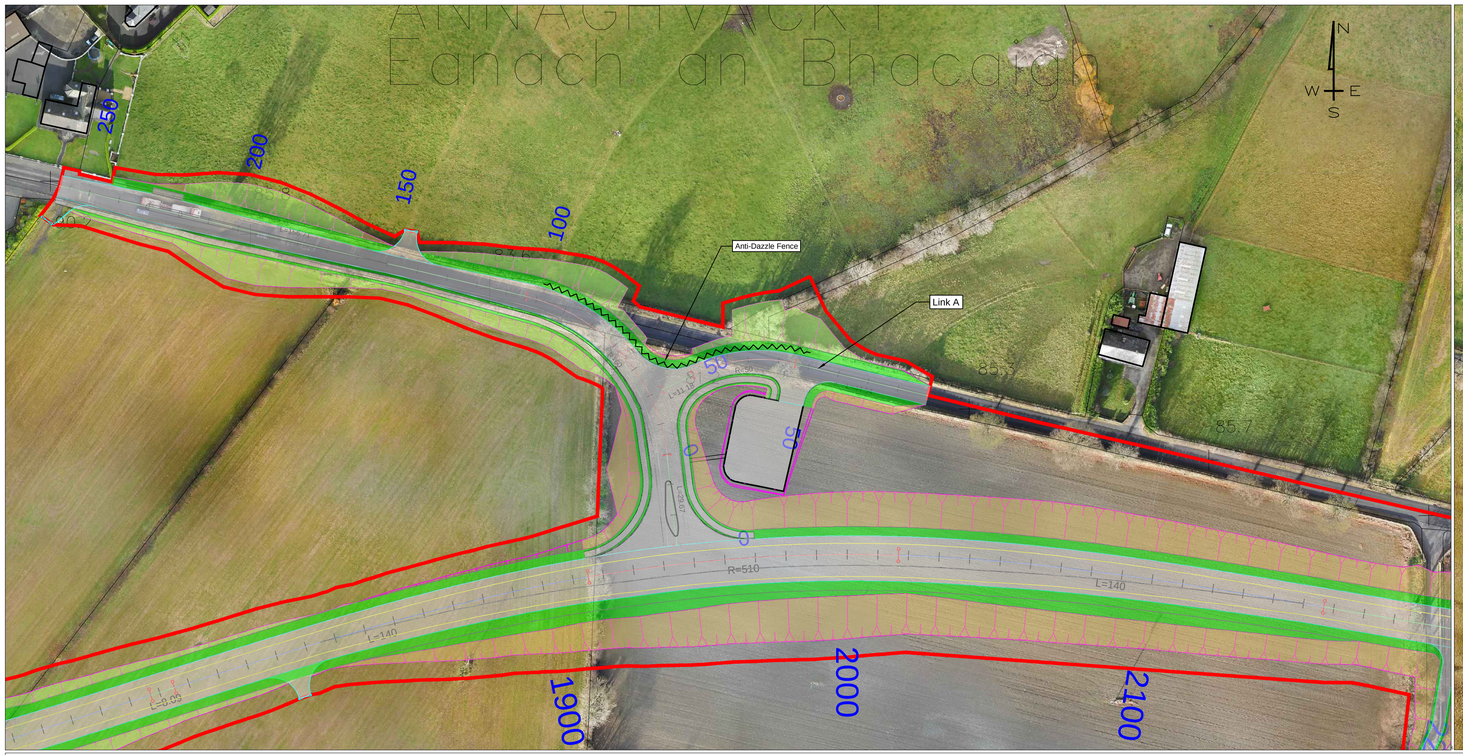
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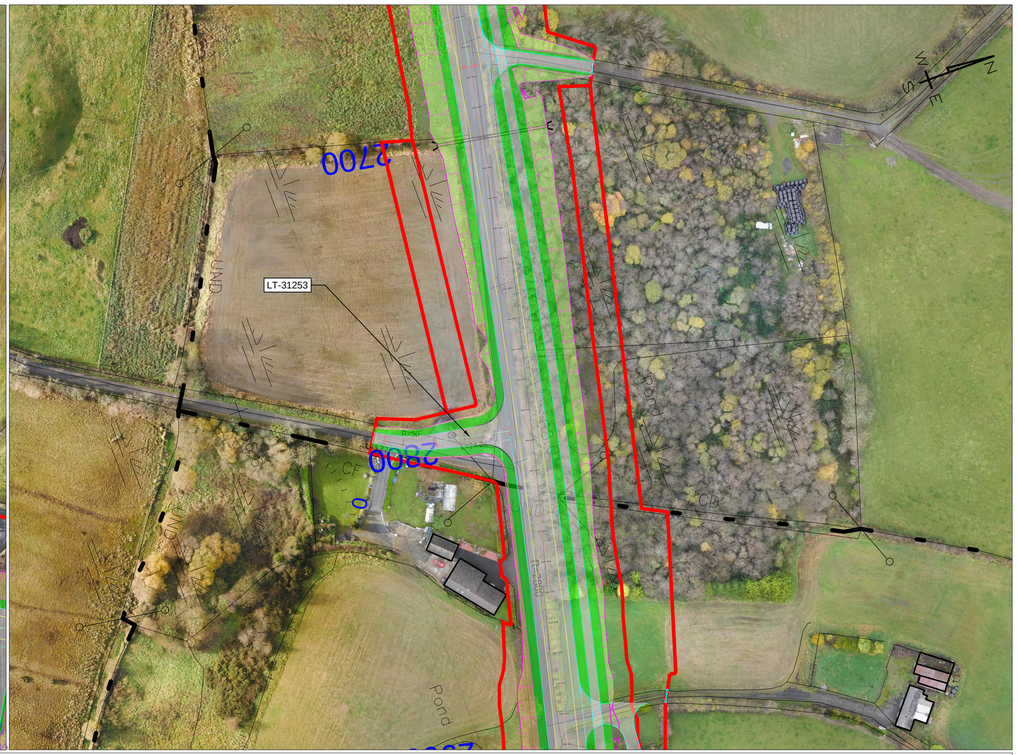
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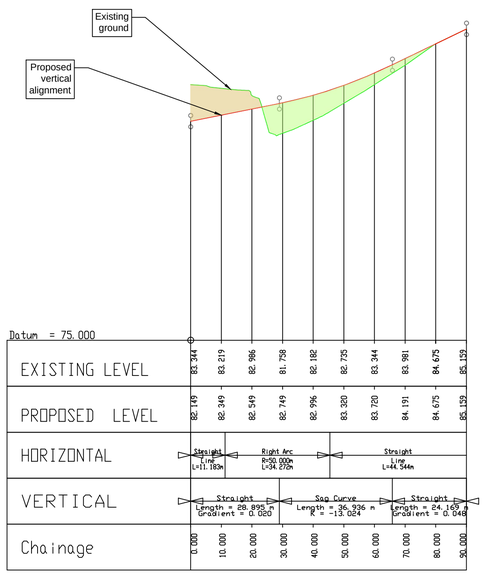
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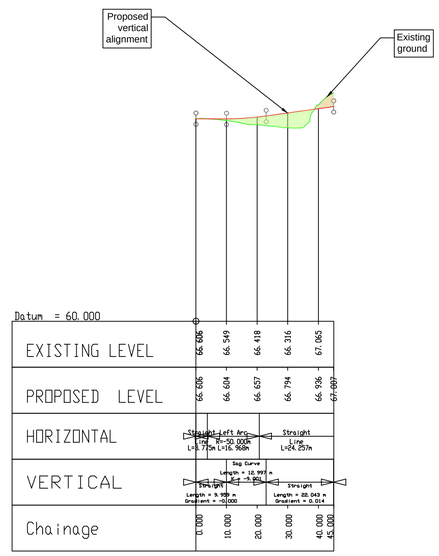






Link A

Scale 1:1,000 horizontal
1:100 vertical
10x vertical exaggeration



LT-31253

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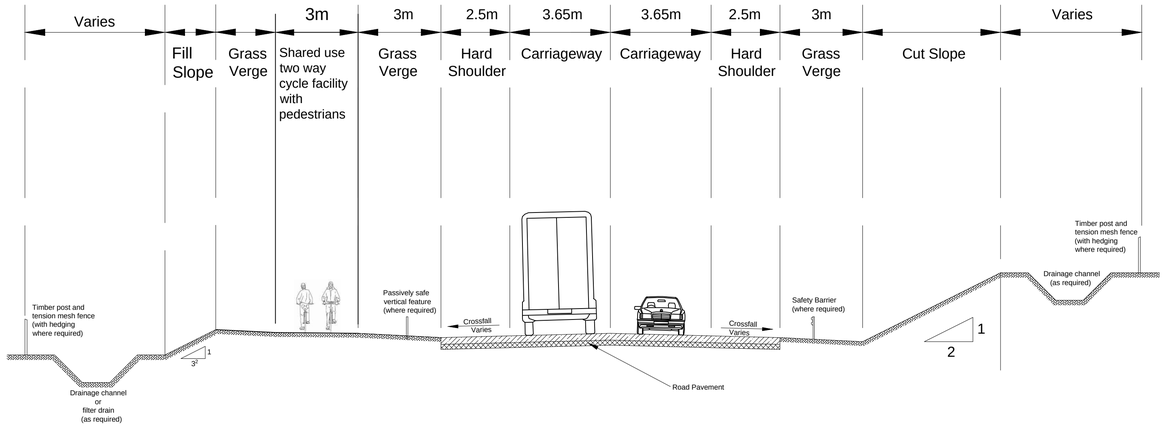
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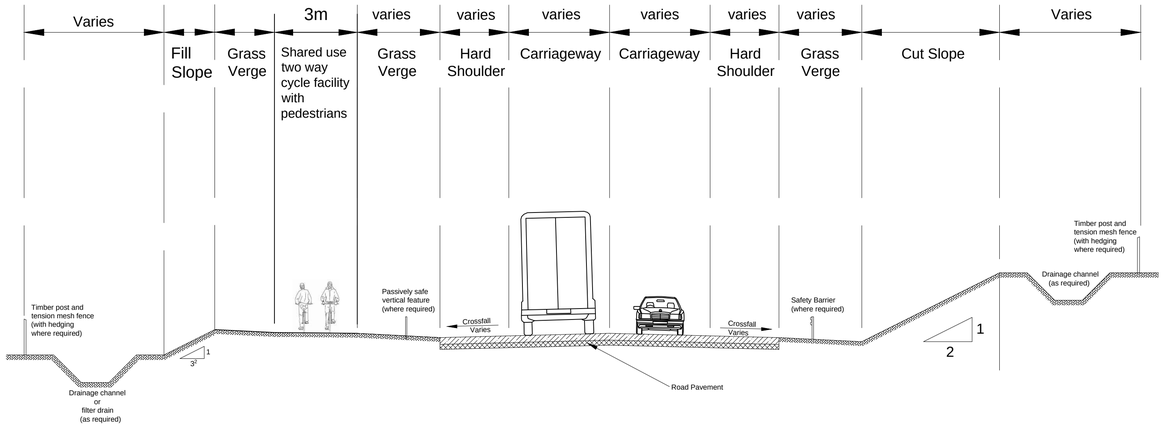
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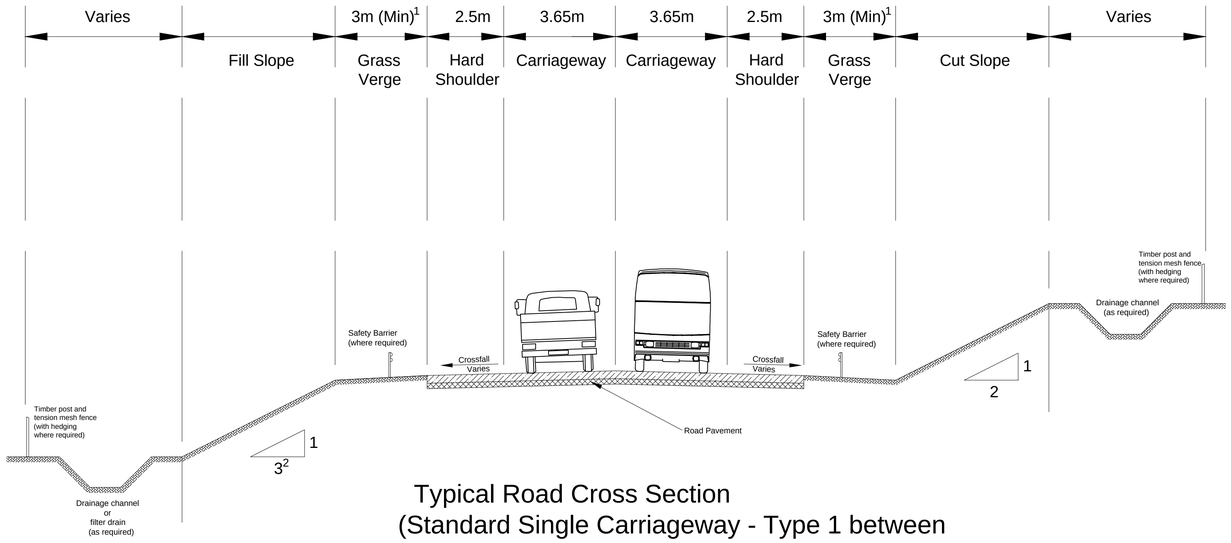
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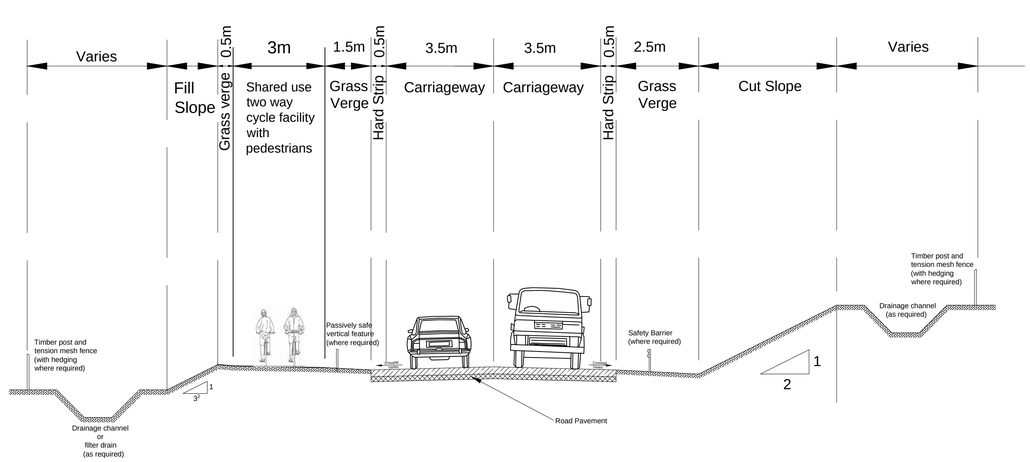
Typical Road Cross Section
(Standard Single Carriageway - Type 1 with shared cycleway between chainage 2530 and chainage 2980)



Typical Road Cross Section
(Transition between - Type 1 and Type 2 carriageway between chainage 2980 and chainage 3100)



Typical Road Cross Section
(Standard Single Carriageway - Type 1 between chainage 0 and chainage 2530)



Typical Road Cross Section
(Standard Single Carriageway - Type 2 between chainage 3100 and chainage 3360)

LOUTH COUNTY COUNCIL
Comhairle Chontae Lú

County Hall
Millennium Centre
Dundalk
County Louth
A91 KFW6

Tel:1890 202 303
www.louthcoco.ie
info@louthcoco.ie

Note:

1. Verge width maybe greater than 3 metres to allow for sightlines.
2. Slopes maybe 1 in 5 to provide clear zones

Rev.	Description	Date	By	Chk'd	App'd

Stage	Date	App'd
PRELIMINARY		
APPROVAL		
TENDER		
CONSTRUCTION		

NATIONAL ROADS OFFICE
Westmeath County Council

National Roads Office,
Westmeath County Council
Culleen Beg, Mullingar,
Co. Westmeath N91 T2PE.
Tel : +353 (44) 9334250
Fax : +353 (44) 9343661
e-mail : all@wccprojectoffice.ie
www.wccprojectoffice.ie

Project: N53 Hackballscross to Rassan

Title: Typical Mainline Road Cross Section

(Sheet 01 of 01)

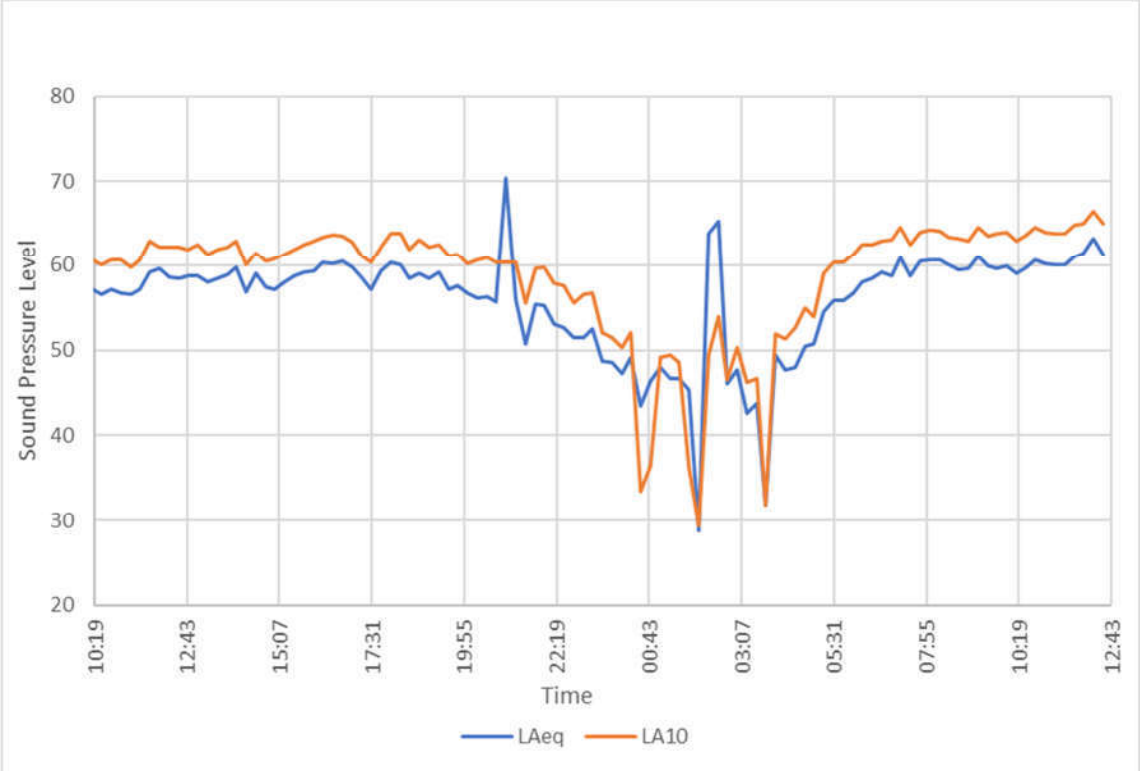
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Drawn: KM	Scale: 1:100 (@A1)		
Checked: TB	Date: 21th May 2021	Drawing No: WH5302-04-005.9	Rev.
Approved: AC	Printed: May 24, 2021 - 9:38am		

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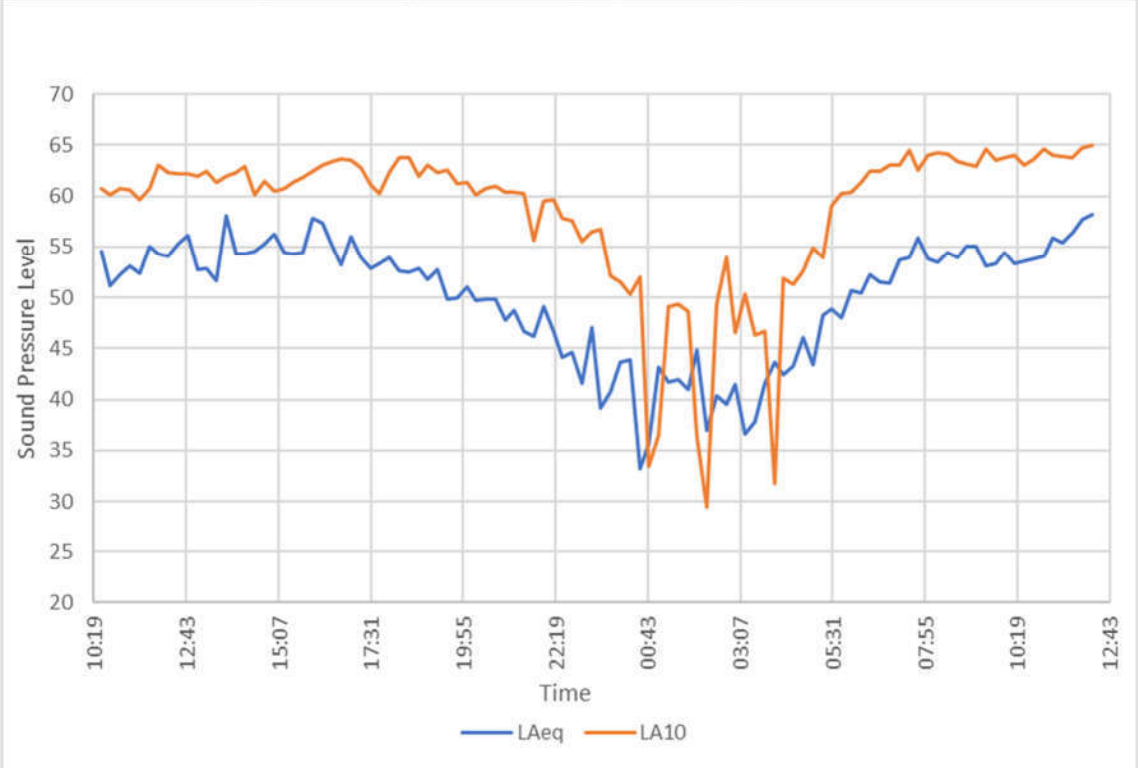
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Appendix 5.1: Noise Monitoring Results

Unattended Noise Survey Results for UN 1



Unattended Noise Survey Results for UN 2



Appendix 5.2: Noise Assessment Locations



Background Mapping from Google Earth

Project

N53 Hackballcross to Rassan

Reference

20/11972/NR01

Noise Assessment Location

Noise Assessment Locations

awnconsulting

The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



Noise Assessment Location

N

Background Mapping from Google Earth

Project

N53 Hackballcross to Rassan

Reference

20/11972/NR01

Noise Assessment Locations

awnconsulting

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Appendix 9: Geophysical Survey Report

N53 Hackballscross to Rassan, Co. Louth

Archaeological Geophysical Survey

Detection Licence No. 20R0133

Licence Holder: Heather Gimson

Survey undertaken on behalf of

Atkins Global / Louth County Council

H. Gimson BA (Hons) MSc MIAI
C. Hogan BSc (Hons) MIAI
U. Garner BSc (Hons) MSc

EARTHSOUND geophysics

EAG 409

08 October 2020

Prospect House, Drumagh, Claremorris, County Mayo, Ireland

earthsound.ie

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Summary of Results

Between the 25th – 28th August and 23rd – 25th September 2020, a series of geophysical surveys were commissioned by Atkins Global on behalf of Louth County Council. The survey comprised of 19.35 hectares to the south of the N53 between the townlands of Hackballscross and Rassan, Co. Louth. The surveys were commissioned to assist with the preliminary design of the realignment of the N53 national secondary road. A magnetometer survey was undertaken at a sample resolution of 0.5m x 0.25m.

The survey was conducted upon a bedrock geology consisting of Clontail Formation calcareous red-mica greywacke, beneath acid brown earths, brown podzolics and some peats and alluvium. The majority of the survey areas were covered in short grass or newly cut crop, some ploughed fields and overgrown areas were however experienced.

The geophysical surveys undertaken for this report have revealed a series of possible archaeological features. The majority of these are likely to represent boundary features or relict agricultural divisions. One oval possible archaeological enclosure was detected to the east of the ring-barrow (LH003-019001). Two anomalies were also identified which match features shown on the historic Ordnance Survey mapping. Other possible archaeological remains include one possible pit and numerous zones of magnetic enhancement.

Evidence of geological activity can be seen throughout the survey areas with the detection of multiple geological dykes. These have created both linear anomalies and zones of high magnetic responses, these responses are so strong that they may have masked any archaeological remains within the area. Evidence for cultivation was also detected as well as areas of high magnetic modern disturbance.

Statement of Indemnity

A geophysical survey is a scientific procedure that produces observations of results which are influenced by specific variables. The results and subsequent interpretation of the geophysical survey presented here should not be treated as an absolute representation of the underlying archaeological features, but as a hypothesis that must be proved or disproved. ***Direct investigations are recommended to confirm the findings of this report.*** *Verification can only be provided via intrusive means, such as Test Trench excavations.*

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1 Introduction

1.1 Brief Description of the Proposed Development

Earthsound Geophysics Ltd. was commissioned by Atkins Global, on behalf of Louth County Council to execute a geophysical survey over eleven pre-selected sites along the proposed N53 realignment scheme. The survey area covered a total of 19.35 hectares between the townlands of Hackballscross and Rassan, Co. Louth.

The proposed scheme is a realignment of the N53 national secondary road between the townlands of Hackballscross and Rassan in Co. Louth, comprising the provision of a new single carriageway road. This geophysical survey is required in order to assist with the preliminary design for the scheme in the context of archaeological constraints. The sites are situated to the south of the existing N53between Hackballscross and Rassan in the townlands of Shanmullagh and Annaghvacky. The geophysical survey was requested to assist with the preliminary design for the scheme in the context of archaeological constraints.

Due to the presence of carrot crop and in agreement with Transport and Infrastructure Ireland, one field (Area 2) was not surveyed. Magnetometer surveys were undertaken over ten of the eleven pre-determined sites encompassing a total area of 17.35 hectares with the intention of detecting any previously unknown archaeological remains. The techniques used were pre-determined by Louth County Council.

1.2 Aims of the Survey

Louth County Council required an archaeological geophysical survey of the proposed route of the N53 between Hackballscross and Rassan. The survey was carried out in accordance with the brief prepared by Atkins Ireland, using a Magnetometer Surveys.

The aims of the Geophysical Survey Services were to:

- identify any geophysical anomalies of possible archaeological origin within the specified survey areas.
- accurately locate these anomalies and present the findings in map format.
- describe the anomalies and discuss their likely provenance in a written report.
- recommend for consideration further investigatory measures to be undertaken with justifications based on the findings of the geophysical survey.
- incorporate all of the above in a report to Louth County Council.

1.3 Description of the Survey Area

The individual survey areas were predesigned and listed in the tender documents (Atkins 2020). They comprised the majority of the proposed route, excluding small sections of fields and overgrown lands. The majority of the survey areas were covered in short grass or newly cut crop, some ploughed fields and overgrown areas were however experienced.

The survey areas are located upon a bedrock geology of Clontail Formation calcareous red-mica greywacke. This was overlain by a number of soils including acid brown earths, brown podzolics and some peats and alluvium.

The climatic conditions were mixed periods of heavy rain and overcast weather. The weather is unlikely to have had an impact on the results.

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1.4 Archaeological Background and Statutory Protections

There are no recorded archaeological monuments within the survey area.

A ring-barrow (LH003-019001) is located to the immedate south of Area 3. It consists of a low circular platform enclosed by a fosse and external bank and situated on a slight knoll in the undulating landscape. A side slab of a cist (LH003-019002) is located in the centre of the barrow (Buckley & Sweetman, 1991).

An enclosure (LH006-003) is marked on OS maps c. 270m to the south of Area 9. There are no visible traces of this monument on the ground.

1.5 Health and Safety requirements

A health and safety statement was submitted to Louth County Council prior to the commencement of work.

2 Methodology

The fieldwork was carried out between the 25th – 28th August and 23rd – 25th September 2020 by C. Hogan and U. Garner of Earthsound Geophysics Ltd.

The survey areas covered a total of 17.35 hectares. Magnetometer surveys were carried out using a LEA MAX Förster gradiometer system. The surveys were undertaken gridlessly with each data point logged using a Trimble RTK GPS VRS Now system.

Detailed magnetometer and electromagnetic surveys were carried out within the survey area. The techniques have been used in commercial and research archaeological projects for many years and are considered the most appropriate techniques for a detailed investigation of the underlying archaeology (Aspinall *et al*. 2008, Clark 1996, Scollar *et al.* 1990, Gaffney & Gater 2003).

2.1 Magnetometer Survey

Instrument	Eastern Atlas LEA MAX^{1505} System
Components	LEA D2, 10-channel digitiser
Data Acquisition Resolution	0.5m x 0.1m
Sensors	8 x Förster FEREX® 4.032 CON650 fluxgate gradiometers
Platform	LEA MAX^{1505} System cart
Data Acquisition Method	Gridless, using a Trimble RTK GPS VRS Now system to an accuracy of 5cm
Sensitivity	<0.2 nT
Data Logger	Panasonic Toughbook CF-H2 Field computer
Calibration	According to manufacturers guidelines (Pilz & Goossens 2015)
Data Processing	Ealdec: Profile decoding Ealmat.m: Normalisation, drift correction Process-it: Surfer 8: Data Gridding (0.5m x 0.25m), using the Kriging Gridding Method
Graphical Display / Dynamic Range	Greyscale -2nT (white) to 2nT (black)

2.2 Reporting, Mapping & Archiving

The geophysical survey and report follow the recommendations outlined by relevant best practice guidance documents as a minimum standard (Bonsall *et al*. 2014; David *et al*. 2008; Gaffney *et al*. 2002, Schmidt *et al*. 2015).

Ordnance Survey of Ireland mapping was supplied by Atkins.

Geophysical data, the figures presented here and the text have been archived following the recommendations of the Archaeology Data Service (Schmidt & Ernenwein 2011).

3 Results & Discussion

The interpretation figures should not be looked at in isolation but in conjunction with the relevant discussion section and with the information contained in the Appendices. Features are highlighted in the interpretation diagrams and are described and interpreted within the text.

3.1 Area 1

Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	693837,810790	**OD height of Survey Area**	86 m OD
Survey Weather Conditions:	Overcast	**Survey Date and Area (Ha):**	25/08/20 1.18 Ha
Site Description:	Short grass on a slight NW-facing slope. Some areas of surface water after heavy overnight rain. Rows of silage bales along eastern field boundary.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
1	Two highly magnetic linear anomalies	693793.424,810807.042 693772.929,810788.552					✓		Caused by a geological feature such as a dyke, running in NE-SW direction.		
2	Curvilinear weakly magnetic anomaly	693833.079,810786.073	✓		✓				A possible ditch, measuring c. 60m NE-SW. May be archaeology or agricultural in nature.	✓	
3	Highly magnetic anomaly	693862.904,810779.696					✓		A geological feature such as a dyke, running in NE-SW direction.		
4	Positively magnetic linear anomaly	693882.930,810752.670	✓		✓				Possible ditch or former field division, c. 32m NW-SE. May be archaeology or agricultural.	✓	
5	Linear weakly magnetic anomaly	693906.545,810772.628	✓		✓				Possible ditch or drain, measuring c. 64m N-S. May be archaeology or an agricultural feature.	✓	
6	Positively magnetic linear anomaly	693930.605,810783.655	✓		✓				Possible ditch or drain, c. 9.7m NE-SW. May be archaeology or agricultural.	✓	
7	Weakly magnetic oval anomaly	693908.383,810764.218	✓		✓				Possible oval ditched feature with a diameter of 32m N-S and 20m E-W. May be archaeology or caused by changes in the soil.	✓	
8	Positively magnetic linear anomaly	693917.962,810761.210	✓		✓				Possible ditch or former field division, c. 67m NE-SW, which may be related to anomaly 104 and 110 which join at perpendicular angles. Possible archaeology or agricultural in nature.	✓	

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Survey Methodology:	**Magnetometer**								**Townland:**	**Shanmullagh**	
ITM Coordinate:	693837,810790								**OD height of Survey Area**	86 m OD	
Survey Weather Conditions:	Overcast								**Survey Date and Area (Ha):**	25/08/20 1.18 Ha	
Site Description:	Short grass on a slight NW-facing slope. Some areas of surface water after heavy overnight rain. Rows of silage bales along eastern field boundary.										
Figure No.:	4 & 5										
No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
9	Positively magnetic linear anomaly	693927.672,810740.288	✓		✓				Possible ditch or drain, measuring c. 52.5m N-S. May be archaeology or agricultural feature.	✓	
10	Weakly magnetic linear anomaly	693941.317,810774.422	✓		✓				Possible ditch or drain, c. 14m NW-SE. May be archaeology or agricultural.	✓	
11	Weakly magnetic linear anomaly	693935.818,810751.010	✓		✓				Possible ditch or drain, c. 9m NW-SE. May be archaeology or agricultural.	✓	
12	Positively magnetic linear anomaly	693933.813,810739.574	✓		✓				Possible ditch or drain, c. 20.4m NE-SW. May be archaeology or agricultural.	✓	
	Multiple linear and curviliear magnetic trends	Multiple locations	✓				✓		Several possible ditches across the survey area. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	A small number of possible cultivation furrows, running in NW-SE direction.		
	Multiple highly magnetic responses	Multiple locations						✓	Modern disturbance along the northern and western field boundaries, may be caused by fencing materials or dumping of ferrous materials along the field boundaries.		

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3.2 Area 2

Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694040,810686	**OD height of Survey Area**	N/A
Survey Weather Conditions:	N/A	**Survey Date and Area (Ha):**	N/A
Site Description:	Field covered in carrot crop. Due to the presence of carrot crop, in agreement with TII the survey was not undertaken in this survey area.		
Figure No.:	4 & 5		

3.3 Area 3

Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	91 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	25/09/20 2 Ha
Site Description:	Pasture field with ring-barrow (LH003-019001) located just to the south of the survey area.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
101	Two zones of very high magnetism	694174.555,810556.577, 694150.071,810637.742					✓		Two bands of high magnetism which are likely caused by a geological dyke.		
102	Linear highly magnetic anomaly	694141.745,810649.411	✓		✓		✓		Linear ditch or cut feature, 28m in length, which could be archaeological, agricultural or geological in origin.	✓	
103	Arcing weakly magnetic anomaly	694156.514,810630.452	✓		✓		✓		Arcing ditch or cut feature, 41m in length. This may be archaeological or geological.	✓	
104	Sub-circular weakly magnetic anomaly	694179.97,810609.901	✓		✓				Sub-circular ditch or cut feature which may be archaeological in origin. Measuring 53m in length and possibly encircling an area c.26m in diameter.	✓	
105	Linear highly magnetic anomaly	694174.865,810584.768	✓		✓		✓		Linear ditch or cut feature, 109m in length which could be archaeological, agricultural or geological in origin.	✓	

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Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	91 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	25/09/20 2 Ha
Site Description:	Pasture field with ring-barrow (LH003-019001) located just to the south of the survey area.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
106	Linear weakly magnetic anomaly	694147.928,810537.759	✓		✓				Linear ditch or cut feature, 54m in length. This could be archaeological, agricultural or geological.	✓	
107	Curvilinear highly magnetic anomaly	694199.827,810583.656	✓		✓				Curvilinear ditch or cut feature, 21m in length which could be archaeological, in origin.	✓	
108	Linear weakly magnetic anomaly	694216.789,810587.104	✓		✓				Linear ditch or cut feature, 155m in length. This anomaly is likely to represent a relict field division.	✓	
109	Linear highly magnetic anomaly	694182.851,810527.604	✓		✓		✓		Linear ditch or cut feature, 75m in length, which runs parallel to anomaly 405 and is likely to be agricultural or geological in nature.	✓	
110	Arcing highly magnetic anomaly	694187.71,810519.514	✓		✓		✓		Arcing ditch or cut feature, 18m in length. This anomaly could be archaeological or geological.	✓	
111	Curvilinear highly magnetic anomaly	694217.347,810532.856	✓		✓		✓		Curvilinear ditch or cut feature, 17m in length. This anomaly could be agricultural or geological in origin.	✓	
112	Curvilinear highly magnetic anomaly	694238.486,810558.184	✓		✓				Curvilinear ditch or cut feature, 40m in length, which appears to represent a boundary feature which may be related to anomaly 113.	✓	
113	Sub-rectangular highly magnetic anomaly	694245.85,810550.563	✓		✓	✓	✓		Sub-rectangular feature which is likely to represent demolished structural remains. Measuring 19m E-W & 20n N-S there appears to be a highly magnetic core which is bounded by two ditches which form a sub-rectangular division with a possible entranceway to the south. The highly magnetic core is likely to contain burnt or metallic remains.	✓	
114	Curvilinear weakly magnetic anomaly	694250.07,810516.068	✓		✓				Curvilinear ditch or cut feature, 25m in length. This anomaly could be archaeological or agricultural and may be related to anomaly 113.	✓	
115	Curvilinear weakly magnetic anomaly	694263.68,810497.977	✓		✓				Curvilinear ditch or cut feature, 24m in length, which may be archaeological or agricultural in origin.	✓	

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Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	91 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	25/09/20 2 Ha
Site Description:	Pasture field with ring-barrow (LH003-019001) located just to the south of the survey area.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
116	Sub-oval highly magnetic anomaly	694251.418,810485.326	✓		✓		✓		Two possible ditch features which appear to form a sub-oval possible enclosure. Measuring 30m E-W and 25m N-S this anomaly could contain burnt remains in the ditch and may be associated with the adjacent zone of ferrous responses. Anomaly 416 is located on the edge of the geological dyke and it is possible that the anomaly has been caused by the dyke.	✓	
	Multiple linear magnetic trends	Multiple locations	✓				✓		Several possible ditches across the survey area. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	A number of cultivation furrows running in three different orientations, related to recent or historical agricultural activities.		
	Multiple highly magnetic responses	Multiple locations						✓	A number of areas of modern disturbance located mostly along the field boundaries and related to fencing materials or dumped ferrous objects. One area of disturbance is located around an upstanding tree near the centre of the survey area and may be related to soil disturbance or dumping.		

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3.4 Area 4

Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	89 m OD
Survey Weather Conditions:	Heavy rain	**Survey Date and Area (Ha):**	27/08/20 2.2 Ha
Site Description:	The northern section of Area 4 contains an open quarry, spoil mounds, trackways and overgrown areas and therefore could not be surveyed. The remainder of the field was covered by short grass and freshly sprayed slurry. The topography of the field is undulating with ground sloping in all directions.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
151	Area of high magnetic responses	694277.096,810474.098					✓		This pattern of highly magnetic responses is typically caused by lightning strikes magnetising the ground.		
152	Weakly magnetic L-shaped anomaly	694318.887,810470.546	✓		✓				Possible wall or ditched feature, measuring c. 12.7m NW-SE and 21.6m SW-NE. Most likely related to historic anomaly 403.	✓	
153	Sub-rectangular positively magnetic anomaly	694320.475,810465.955			✓				Possible structural remains, c. 17.4m NE-SW and 5m NW-SE, corresponding to a building visible on historic OS maps. Multiple farm buildings and walls are visible on the 1837-1842 6in OS maps and only a single structure is marked on the later 25in and Cassini maps.	✓	
154	Positively magnetic linear anomaly	694311.258,810445.228	✓		✓				Possible ditched feature, c. 6.9m NE-SW. May be archaeology, historical or agricultural.	✓	
155	Zone of magnetic enhancement	694326.847,810441.690			✓			✓	An area of possible dumping or demolition rubble, measuring c. 19.5m by 21.6m in diameter. Most likely related to demolition of buildings marked on the historic 1837-1842 6in OS map.	✓	
156	Positively magnetic linear	694346.803,810446.500	✓		✓				Possible ditch, c. 21.3m NE-SW, may be related to anomaly 155.	✓	
157	Negatively magnetic linear anomaly	694368.584,810463.636	✓		✓				Possible stone-filled ditch or drain, c, 59.8m NW-SE. Appears to continue as anomaly 411 to the east of 410. May be archaeology or agricultural.	✓	
158	Weakly magnetic linear	694394.438,810457.003	✓		✓				Possible ditch, c. 64m NE-SW. May be archaeology or an agricultural feature.	✓	
159	Weakly magnetic linear	694359.778,810428.617	✓		✓				Possible ditch, c. 42m NE-SW. May be archaeology or agricultural.	✓	
160	Negatively/weakly magnetic linear anomaly	694390.790,810430.884	✓		✓				Possible ditch, drain or former field division, c. 65.4m NE-SW. Possible archaeology or agricultural feature.	✓	

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Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	89 m OD
Survey Weather Conditions:	Heavy rain	**Survey Date and Area (Ha):**	27/08/20 2.2 Ha
Site Description:	The northern section of Area 4 contains an open quarry, spoil mounds, trackways and overgrown areas and therefore could not be surveyed. The remainder of the field was covered by short grass and freshly sprayed slurry. The topography of the field is undulating with ground sloping in all directions.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
161	Negatively magnetic linear anomaly	694419.314,810439.729	✓		✓				Possible ditch or drain, c. 29m NW-SE. May be a continuation of anomaly 408 to the west of 410. Possible archaeology or agricultural feature.	✓	
162	Weakly magnetic linear	694440.928,810441.276	✓		✓				Possible ditch, c. 85m NW-SE. May be archaeology or an agricultural feature.	✓	
163	Zone of magnetic enhancement	694474.138,810416.456			✓		✓	✓	Area of soil disturbance or dumping of magnetically enhanced materials, c. 19.7m by 11m in diameter. May be of archaeological or agricultural nature.	✓	
164	Zone of magnetic enhancement	694444.452,810414.300			✓		✓	✓	Area of soil disturbance or dumping of magnetically enhanced materials, c. 16m by 6.3m in diameter. May be of archaeological or agricultural nature.	✓	
165	Highly magnetic linear anomaly	694507.471,810419.275	✓		✓		✓		Possible wide ditch with magnetically enhanced fill, c. 4m wide and 12.9m long NE-SW. Continuation of anomaly 416. Possible archaeology.	✓	
166	Highly magnetic curvilinear anomaly	694483.425,810408.661	✓		✓		✓		Possible wide ditch with magnetically enhanced fill, c. 4.3m wide and 55.4m long NE-SW. This is most likely part of the same feature as anomaly 415, with a 3.6m gap between the two. Possible archaeology.	✓	
167	Weakly magnetic linear	694474.138,810398.379	✓		✓				Possible ditch, c. 12.5m NE-SW. May be archaeology or agricultural.	✓	
168	Positively magnetic curvilinear anomaly	694466.011,810389.921	✓		✓				Possible curving ditched feature, measuring c. 14.5m NE-SW. Possible archaeology or agricultural feature.	✓	
169	L-shaped anomaly	694481.822,810386.061	✓		✓				A possible ditched feature, c. 6m NE-SW and 3.3m NW-SE.	✓	
	Multiple curvilinear and linear magnetic trends	Multiple locations	✓				✓		Several possible ditches across the survey area. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	A number of cultivation furrows running in three different orientations, related to recent or historical agricultural activities.		
	Multiple highly magnetic responses	Multiple locations						✓	A number of areas of modern disturbance located mostly along the field boundaries and related to fencing materials or dumped ferrous objects. One area of disturbance is located around an upstanding tree near the centre of the survey area and may be related to soil disturbance or dumping.		

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3.5 Area 5

Survey Methodology:	**Magnetometer**	**Townland:**	**Shanmullagh**
ITM Coordinate:	694195,810555	**OD height of Survey Area**	86 m OD
Survey Weather Conditions:	Sunny	**Survey Date and Area (Ha):**	26/08/20 0.7 Ha
Site Description:	Pasture land divided by a small stream. There is a small hill, with an ESB pole on top, in the northern section and part of the W section could not be surveyed due to an overgrown area which was fenced off and a steep slope at SW.		
Figure No.:	4 & 5		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
201	Zone of very high magnetism	694542.228,810401.926					✓		Most likely caused by a geological dyke.		
202	Zone of magnetic enhancement	694560.968,810385.176			✓		✓	✓	An area of possible soil disturbance or possible rubble including ferrous materials, measuring c. 44m by 12m.	✓	
203	Zone of magnetic enhancement	694605.799,810348.691			✓		✓	✓	An area of possible soil disturbance or possible rubble including ferrous materials, measuring c. 25m by 12.5m.	✓	
	Multiple linear magnetic trends	Multiple locations	✓				✓		A number of possible ditches in the northern part of the field. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	Multiple cultivation furrows running in roughly N-S direction in the northern section of the field.		
	Multiple highly magnetic responses	Multiple locations						✓	Areas of modern disturbance along the field boundaries and the water course which divides the survey area. A circular area of disturbance is caused by an electricity pole in the northern section of the field.		

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3.6 Area 6

Survey Methodology:	**Magnetometer**								**Townland:**	**Shanmullagh**	
ITM Coordinate:	694769,810344								**OD height of Survey Area**	84 m OD	
Survey Weather Conditions:	Sunny								**Survey Date and Area (Ha):**	26/08/20 1.5 Ha	
Site Description:	The W field is a short grass pasture field, slightly soggy after heavy overnight rain. It is separated from the E section by a ditch or water course. The E field could not be surveyed as it is very overgrown with high rushes and weeds and was divided by an E-W running ditch or water course.										
Figure No.:	4 & 5										
No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
251	Positively magnetic linear anomaly	694669.262,810358.736	✓		✓				Possible ditch, c. 15.8m NE-SW. May be archaeology or agricultural.	✓	
252	Positively magnetic curvilinear anomaly	694686.730,810360.800	✓		✓				Possible ditch, c. 31m NW-SE. May be archaeology or agricultural.	✓	
253	Highly magnetic linear anomaly	694703.996,810344.013					✓		A geological feature such as a dyke.		
254	Positively magnetic oval anomaly	694718.203,810339.895	✓		✓				A large possible pit or soil disturbance, c. 6.4m by 4.3m in diameter. Possible archaeology or of agricultural origin.	✓	
	Multiple linear magnetic trends	Multiple locations	✓				✓		A number of possible ditches. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	Multiple cultivation furrows running in roughly NE-SW direction.		
	Multiple highly magnetic responses	Multiple locations						✓	A number of small areas of modern disturbance or buried ferrous objects along the northern and eastern field boundaries.		

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3.7 Area 7

Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695045,810292	**OD height of Survey Area**	85 m OD
Survey Weather Conditions:	Overcast	**Survey Date and Area (Ha):**	26/08/20 2.1 Ha
Site Description:	Undulating short grass field. The W and S sections were divided off by electric fences. Two ESB poles are located within the survey area.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
301	Weakly magnetic linear anomaly	694927.559,810273.873	✓		✓				Possible ditch or drain, c. 34m NW-SE. May be archaeology or agricultural.	✓	
302	Highly magnetic linear anomaly	694961.470,810309.584	✓		✓				Possible ditch, c. 20m in length, running from the western field boundary into an area of disturbance around the electricity pole. May be archaeology but is more likely to be associated with modern services.	✓	
303	Positively magnetic linear anomaly	694966.777,810315.456	✓		✓				Possible ditch, c. 15.7m in length, running parallel to anomaly 302. May be archaeology but is more likely of modern origin.	✓	
304	Zone of magnetic enhancement	694990.732,810333.686			✓				An area of possible soil disturbance or rubble beside the western field boundary, measuring c. 25.5m by 10.9m in diameter. Contains a number of possible archaeological features (305, 306 & 307) and may be related.	✓	
305	L-shaped magnetic anomaly	694983.803,810332.371	✓		✓				Possible disturbed ground or structural anomaly, c. 6.2m by 2.2m in size. May be archaeology, historical or caused by agricultural practices.	✓	
306	L-shaped magnetic anomaly	694976.334,810325.247	✓		✓				Possible disturbed ground or structural anomaly, c. 4.7m by 5.4m in size. May be archaeology, historical or caused by agricultural practices.	✓	
307	Curvilinear magnetic anomaly	694984.000,810325.050	✓		✓				Possible curving feature, opposite anomaly 706 and enclosing a negatively magnetic area measuring c. 8m by 5m in diameter. May be archaeology, historical or caused by agricultural practices.	✓	
308	Linear weakly magnetic anomaly	695015.313,810297.518	✓		✓				Possible ditch or drain, c. 67.6m NE-SW. May be archaeology or agricultural.	✓	
309	Linear weakly magnetic anomaly	695022.554,810272.669	✓		✓				Possible ditch or drain, c. 78m NE-SW. May be archaeology or agricultural.	✓	
310	Linear weakly magnetic anomaly	695035.739,810255.215	✓		✓				Possible ditch or drain, c. 46m NE-SW. May be archaeology or agricultural.	✓	

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Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695045,810292	**OD height of Survey Area**	85 m OD
Survey Weather Conditions:	Overcast	**Survey Date and Area (Ha):**	26/08/20 2.1 Ha
Site Description:	Undulating short grass field. The W and S sections were divided off by electric fences. Two ESB poles are located within the survey area.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
311	Linear positively magnetic anomaly	695052.627,810238.106	✓		✓				Possible ditch or drain, c. 23m NE-SW. May be archaeology or agricultural.	✓	
312	L-shaped positively magnetic anomaly	695060.697,810238.327	✓		✓				Possible ditch or drain, c. 19.9m NW-SE by 7.9m NE-SW. May be archaeology or agricultural.	✓	
313	Linear positively magnetic anomaly	695088.296,810272.877	✓		✓				Possible ditch or former field division, c. 148.5m NW-SE. May be archaeology or agricultural.	✓	
314	Linear positively magnetic anomaly	695121.629,810301.235	✓		✓				Possible ditch or drain, c. 85m NW-SE. May be archaeology or agricultural.	✓	
	Multiple linear magnetic trends	Multiple locations	✓				✓		A number of possible ditches. May be caused by agricultural practices or natural changes in the soil.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	Cultivation furrows running in various orientations throughout the field.		
	Multiple highly magnetic responses	Multiple locations						✓	Areas of modern disturbance along the field boundaries are caused by ferrous fencing materials or dumping along the boundaries. A line of circular magnetic spikes running in NE-SW direction through the field is caused by fence posts dividing the field. Two areas of disturbance near the centre and western section of the field are caused by electricity poles. One large area of disturbance near the SE corner of the survey area may be caused by modern dumping.		

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3.8 Area 8

Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695361,810347	**OD height of Survey Area**	81 m OD
Survey Weather Conditions:	Rain, overcast	**Survey Date and Area (Ha):**	25/08/20 1.9 Ha
Site Description:	Undulating short grass field with some water pooling after overnight rain. ESB pole within survey area.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
351	Curvilinear weakly magnetic anomaly	695279.985,810284.827	✓		✓				Possible ditch, measuring c. 52.7m NW-SE. May be archaeology or agricultural.	✓	
352	Zone of magnetic enhancement	695307.100,810310.698			✓			✓	Possible disturbed soil or a cut feature containing ferrous materials, measuring c. 25.8m N-S and 17m E-W.	✓	
353	Linear highly magnetic anomaly	695339.190,810364.181 695325.757,810309.455					✓		A geological anomaly such as a dyke.	✓	
354	Linear weakly magnetic anomaly	695330.981,810289.554	✓		✓				Possible ditch, c. 17.6m NE-SW. May be archaeology or agricultural. May be associated with historical features identified by 356.	✓	
355	Linear weakly magnetic anomaly	695333.220,810279.355	✓		✓				Possible ditch, c. 18.4m NW-SE. May be archaeology or agricultural. May be associated with historical features identified by 356.	✓	
356	Linear weakly magnetic anomalies	695376.536,810307.769	✓		✓				Possible boundary features, linear anomaly c. 86m N-S, with associated linear anomaly c. 20m NE-SW. May be related to track and homestead on Historic 6" map.	✓	
357	Zone of magnetic enhancement	695394.360,810400.087			✓			✓	Area of soil disturbance or buried rubble containing ferrous materials, measuring c. 38.8m by 12m and may continue beyond the survey area to the north.	✓	
358	Linear weakly magnetic anomaly	695390.074,810387.587	✓		✓				Possible ditch, c.97.8m NE-SW. May be archaeology or agricultural.	✓	
359	Linear positively magnetic anomaly	695435.253,810399.194	✓		✓				Possible ditch, c. 42.5m NW-SE. May be archaeology or agricultural.	✓	
360	Linear weakly magnetic anomaly	695434.003,810373.301	✓		✓				Possible ditch, c. 84m NE-SW. May be archaeology or agricultural.	✓	
361	Linear weakly magnetic anomaly	695394.182,810323.658	✓		✓				Possible ditch, c. 16.1m NE-SW. May be archaeology or agricultural.	✓	

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Survey Methodology:	**Magnetometer**								**Townland:**	**Annaghvacky**	
ITM Coordinate:	695361,810347								**OD height of Survey Area**	81 m OD	
Survey Weather Conditions:	Rain, overcast								**Survey Date and Area (Ha):**	25/08/20 1.9 Ha	
Site Description:	Undulating short grass field with some water pooling after overnight rain. ESB pole within survey area.										
Figure No.:	6 & 7										
No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
362	Linear weakly magnetic anomaly	695408.467,810308.658	✓		✓				Possible ditch, c. 47.5m NW-SE. May be archaeology or agricultural.	✓	
363	Curvilinear positively magnetic anomaly	695395.432,810300.087	✓		✓				Possible curving ditched feature, c. 12.83m NE-SW. Possible archaeology or agricultural feature.	✓	
364	Linear positively magnetic anomaly	695446.205,810318.405	✓		✓				Possible ditch, c. 19.9m E-W. May be archaeology or agricultural in origin.	✓	
365	Two parallel positively magnetic anomalies	695451.682,810341.501 695452.515,810344.596	✓		✓				Two possible ditches, c. 9.4m and 8.7m in length, located between the eastern field boundary and zone of magnetic enhancement 365. Possible archaeology or agricultural features.	✓	
	Multiple linear magnetic trends	Multiple locations	✓				✓		A number of possible ditches. May be caused by agricultural practices or natural changes in the soil.		
	Highly magnetic response	695415.598,810330.905						✓	Disturbance caused by electricity pole.		

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3.9 Area 9

Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695596,810366	**OD height of Survey Area**	76 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	24/09/20 2.5 Ha
Site Description:	A freshly ploughed and rolled field. The land slopes down gently to the eastern edge of the survey area, with a sharp downslope in the northwestern corner.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
401	Linear positively magnetic anomaly	695625.701,810352.250	✓	✓					Field boundary or possible ditch c. 75m NW-SE. Appears on Historic 25" and Cassini 6" maps	✓	
402	Linear magnetic anomaly	695553.013,810400.771			✓				Intersecting linear anomalies, measuring 15m NW-SE by 11m SE-NW.	✓	
403	Curvilinear positive magnetic anomaly	695511.197,810400.076	✓		✓				Possible curving ditch, c. 22.5m in length.		
404	Parallel curvilinear magnetic anomalies	695516.017,810359.005	✓		✓				Roughly concentric positive magnetic anomalies which may be ditches. Eastern anomaly measures 35.8m in length and the western anomaly measures 19.3m in length.	✓	
405	Linear magnetic anomaly	695589.348,810358.959	✓						Possible ditch, c. 96m N-S. May be archaeology or agricultural.		
406	Parallel linear responses	695604.288,810387.551	✓						Possible ditches or other cut features, c. 71m and 28m NE-SW. May be archaeology or agricultural.		
407	Arcing positive magnetic anomaly	695662.979,810354.525	✓		✓				Possible ditch, c. 38.6m in length. May be archaeology or agricultural.	✓	
408	C-shaped positive magnetic anomaly	695690.300,810334.168	✓		✓				Possible cut feature, c. 15m NE-SW by 15.5 SE-NW. May be archaeology or agricultural.	✓	
409	Linear highly magnetic anomaly	695474.040,810379.607					✓		A geological anomaly such as a dyke.		
410	Amorphous area of high magnetic signatures	695595.266,810360.638					✓		Area of geological responses. These are likely to be associated with dyke material.		
	Multiple parallel linear responses	Multiple locations	✓				✓	✓	A number of cultivation furrows running in three different orientations, related to recent or historical agricultural activities.		
	Multiple linear magnetic trends	Multiple locations	✓				✓		A number of possible ditches. May be caused by agricultural practices or natural changes in the soil.	✓	

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3.10 Area 10

Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695852,810314	**OD height of Survey Area**	78 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	24/09/20 1.8 Ha
Site Description:	A freshly ploughed and rolled field. The land slopes down gently rises to the middle of the survey area, with a slope down to the eastern edge.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
451	Linear positively magnetic anomaly	695753.702,810298.187	✓		✓				Possible ditch, measuring c. 34m NW-SE. May be archaeology or agricultural.	✓	
452	Curvilinear positive magnetic anomaly	695774.258,810300.489	✓		✓				Possible cut feature, c. 16m N-S by 15.5 E-W. May be archaeology or agricultural.	✓	
453	Curvilinear positive magnetic anomaly	695744.866,810315.277	✓		✓				Possible cut feature, c. 18m N-S by 26 E-W. May be archaeology or agricultural.	✓	
454	Parallel positive magnetic linear responses	695767.882,810353.392	✓		✓				Possible ditches. They extend for approximately 24m NE-SW and may be archaeology or agricultural.	✓	
455	Linear positively magnetic anomaly	695915.650,810302.559	✓		✓				Possible ditch, measuring c. 75m N-S. May be archaeology or agricultural.		
456	Linear positively magnetic anomaly	695960.204,810300.029	✓		✓				Possible ditch, measuring c. 45m NW-SE. May be archaeology or agricultural.		
457	Amorphous highly magnetic anomaly	695831.214,810309.308					✓		A geological anomaly such as a dyke.		
458	Amorphous highly magnetic anomaly	695864.786,810332.344					✓		A geological anomaly such as a dyke.		
459	Amorphous highly magnetic anomaly	695941.214,810271.629					✓		A geological anomaly such as a dyke.		
	Multiple magnetic trends	Multiple locations					✓		A number of linear and curvilinear anomalies or possible ditches. May be caused by agricultural practices or natural changes in the soil.	✓	

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3.11 Area 11

Survey Methodology:	**Magnetometer**	**Townland:**	**Annaghvacky**
ITM Coordinate:	695852,810314	**OD height of Survey Area**	77 m OD
Survey Weather Conditions:	Cold with periods of rain	**Survey Date and Area (Ha):**	23/09/20 1.3 Ha
Site Description:	An overgrown field with patches of nettles and thistles. Uneven land sloping down slightly towards the northeastern edge of the survey area.		
Figure No.:	6 & 7		

No.	Form of Anomaly	ITM (E,N)	Possible Source(s) of Anomaly						Comment	Recommendation	
			Ditch	**Archaeology**	**Poss. Archaeology**	Ferrous	Geology / Soils	Interference / Modern		Test Excavation	Geophysical Survey
501	Linear positively magnetic anomaly	696014.155,810256.251	✓						Possible ditch, measuring c. 45m NW-SE. May be archaeology or agricultural.	✓	
502	Linear positively magnetic anomaly	696063.441,810264.465	✓						Possible ditch, measuring c. 45m NW-SE. May be archaeology or agricultural.	✓	
503	Curvilinear positive magnetic anomaly	696073.084,810260.893	✓		✓				Possible cut feature, c. 13m in total length. May be archaeology or agricultural.	✓	
504	Linear positively magnetic anomaly	696143.977,810241.251	✓						Possible ditch, measuring c. 45m NW-SE. May be archaeology or agricultural.	✓	
505	Amorphous highly magnetic anomaly	696005.947,810286.689					✓		A geological anomaly such as a dyke.		
506	Linear highly magnetic anomaly	696105.589,810251.689					✓		A geological anomaly such as a dyke.		
	Multiple linear magnetic trends	Multiple locations					✓		A number of possible ditches. May be caused by agricultural practices or natural changes in the soil.	✓	

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4 Conclusion

4.1 Summary of Results

The geophysical surveys undertaken for this report have revealed a series of possible archaeological features. The majority of these are likely to represent boundary features or relict agricultural divisions. One oval possible archaeological enclosure was detected to the east of the ring-barrow (LH003-019001). Two anomalies were also identified which match features shown on the historic Ordnance Survey mapping. Other possible archaeological remains include one possible pit and numerous zones of magntic enhancement.

Evidence of geological activity can be seen throughout the survey areas with the detection of multiple geological dykes. These have created both linear anomalies and zones of high magnetic responses, these responses are so strong that they may have masked any archaeological remains within the area. Evidence for cultivation was also detected as well as areas of high magnetic modern disturbance.

4.2 Dissemination

The results of this survey were submitted to Atkins Global / Louth County Council. Additional copies will be distributed in accordance with the Consent to use a Detection Device (see Appendix 2).

5 Acknowledgements

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7 Figures

Figure 1: Location map
Figure 2: Detailed location map
Figure 3: Magnetometer data – Areas 1 - 6
Figure 4: Magnetometer interpretation – Areas 1 - 6
Figure 5: Magnetometer data – Areas 7 – 11
Figure 6: Magnetometer interpretation – Areas 7 - 11

Technical Appendix

Appendix 1: Anomaly Classifications

Magnetometer

Magnetometer surveys are undertaken using magnetic gradiometers which measure the magnetic content of the underlying soils. Measurements are gained using sensors which calculate the difference between the geological / pedological background and anthropogenic remains associated with archaeological activity.

Positive Magnetic Anomalies
Burnt features, particularly kilns, but also hearths, furnaces and burnt (specifically 'burnt', not 'heated') mounds of stone will create a strongly magnetic anomaly due to thermoremanence. Cut features, such as pits, ditches or wooden postholes will create anomalies that will vary in shape and magnetic intensity depending on which material they were backfilled by (Fassbinder 2015). For cut features backfilled (or 'refilled') by

- magnetically enhanced topsoil – the refill will generate a positive magnetic anomaly
- homogeneous topsoil – the refill will generate an anomaly proportional to the size and volume of the archaeological feature.

The magnetic anomaly shape and intensity will also be determined by concentrations of pottery, ash or burned material, solid rocks or other material.

Negative Magnetic Anomalies
Negative magnetic anomalies have a number of causes (Fassbinder 2015):

- The material remains of the archaeological feature may have a lower magnetic susceptibility (MS) than the adjacent topsoil. In some cases the MS of a ditch may appear as both a positive and negative anomaly, reflecting the variable MS of the refill material. Some stone foundations can also appear as weakly magnetic or negative magnetic anomalies.
- If a cut feature is immediately refilled by the same material e.g. a grave cut excavated before a funeral is (almost) immediately refilled by the human body and the same (unaltered) sediment that was excavated before.
- Geochemical processes (see Fassbinder 2015) can alter the magnetic response, e.g. an archaeological feature identified by a positive anomaly can convert to a negative anomaly due to the combination of stagnant moisture and a changing groundwater table.

Dipolar Anomalies
A dipolar anomaly is a response to buried ferrous objects, often in the topsoil. Iron spikes generally are not removed in geophysical data; although often modern in origin (iron agricultural implements, rubbish), they can be indicative of archaeological material.

Absence of Anomalies
It is also possible that archaeological features exist that exhibit no magnetic contrast and hence cannot be identified by magnetometer survey.

Anomaly classification used to interpret Magnetometer data

After Gaffney & Gater (2003) and Gaffney *et al*. (2000).

A known archaeological feature type e.g. Ditch / Wall / Structure etc: An anomaly with a magnetic gradient that contrasts strongly with the surrounding sub-soil, where the presence of a type of archaeological feature is known from supporting evidence.

Archaeology: A linear, curvilinear or isolated anomaly with a magnetic gradient that contrasts strongly with the surrounding sub-soil, without any supporting evidence from another source.

- **Ditch / Wall:** A linear, curvilinear, annular or penannular anomaly with a magnetic gradient that contrasts strongly with the surrounding sub-soil. A positive polarity suggests a ditch; a negative polarity suggests a stone-filled ditch or wall.
- **Burnt Mound / Spread:** A horseshoe or ovoid shaped anomaly with a positive magnetic gradient that contrasts strongly with the surrounding sub-soil. An associated trough may be observed as a positive/negative anomaly, a hearth may also be expected nearby. Isolated responses in the vicinity could represent spreads of (or ploughed out) heat shattered stones.
- **Hearth:** A small isolated area (<2m diameter) of higher magnetic gradient than the surrounding sub-soil (typically >6nT).
- **Pit:** A small isolated area (>1-2m diameter) of moderate to high magnetic gradient, judged to be caused by a pit-type feature with a fill more magnetic than the surrounding soil.

Industrial: An isolated anomaly with a strong positive gradient (>30nT), judged not to be surface iron. This type of anomaly is typically caused by the remains of kilns or furnaces.

Magnetic Enhancement: A broad area of moderate positive magnetic gradient that contrasts with the surrounding sub-soil. May represent cultural noise associated with occupation or soil disturbance, judged to be of archaeological origin.

Ferrous: Dipolar anomalies indicating ferrous responses, judged to be in the near-surface.

Cultivation: Parallel linear responses of positive or negative polarity. Strong responses may indicate added magnetic material (e.g. burnt deposits) as fertiliser. Lower magnetic gradient anomalies 'beneath' the furrow overprint may be obscured. Higher magnetic gradient anomalies may be visualised *in situ* or ploughed out 'beneath' the furrow overprint.

?Archaeology: A linear, curvilinear or isolated anomaly with a magnetic gradient that contrasts weakly with the surrounding sub-soil, without any supporting evidence from another source. Such categories may represent possible archaeological or geological sources.

Modern Disturbance: Area where the ground has been disturbed in the recent past. Characterised by a high level of noise and very large magnetic gradients, this disturbance is often accompanied by concentrations of dipolar, near-surface ferrous responses. This category also represents anomalies whose source may lie beyond the survey area, such as fencelines, vehicles or modern buildings.

Modern Pipe: Straight, linear anomaly with very large magnetic gradients alternating regularly between positive and negative polarity.

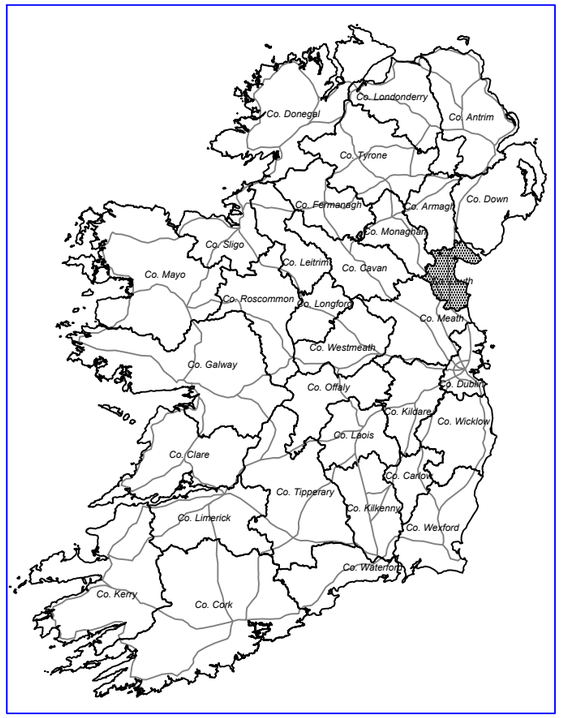
Previous Excavation?: Area of uniform magnetic signal contained within a well-defined boundary in regions otherwise densely covered with archaeological anomalies.

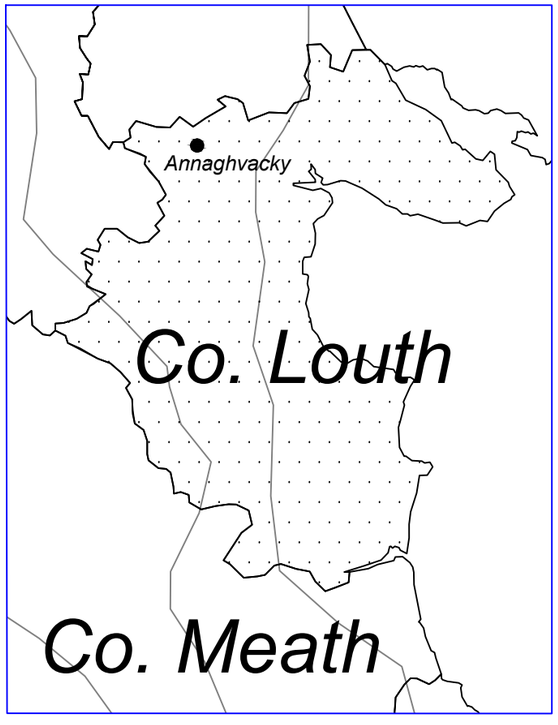
Geology: Anomalies of possible geomorphological origin.

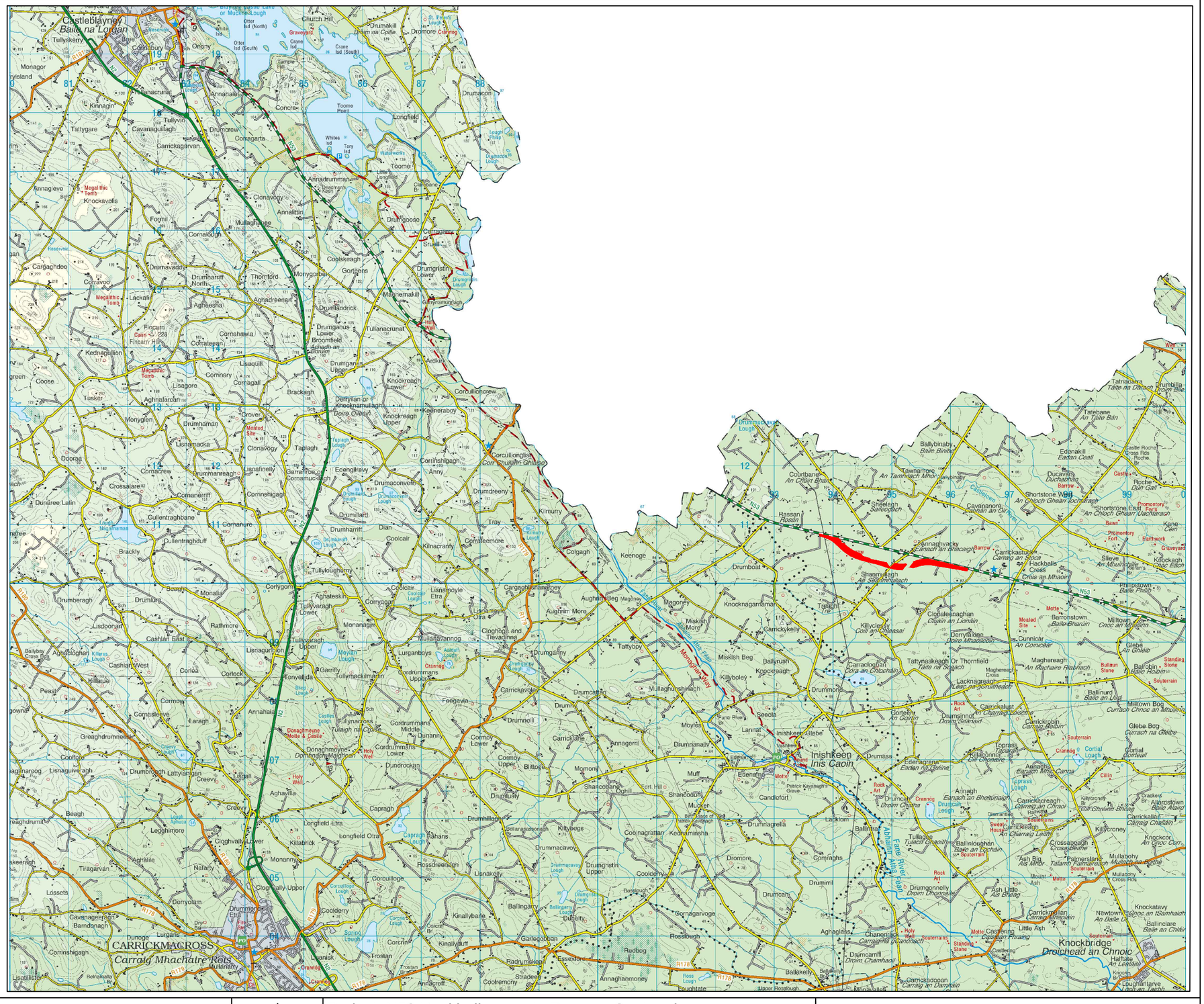
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Appendix 2: Geophysical Archive

- Copies of the archive are held by Earthsound Geophysics Ltd., at separate locations to ensure preservation against accidental damage or theft.
- The Client, Louth County Council, holds further copies of the report.
- A hard copy and a soft copy will be deposited with the Archaeological Licensing Section, National Monuments Service, Department of Culture, Heritage and the Gaeltacht, Room G50, Custom House, Dublin 1.
- A hard copy will be deposited with the National Museum of Ireland, Kildare Street, Dublin 2.







Legend

Geophysical Survey Area

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

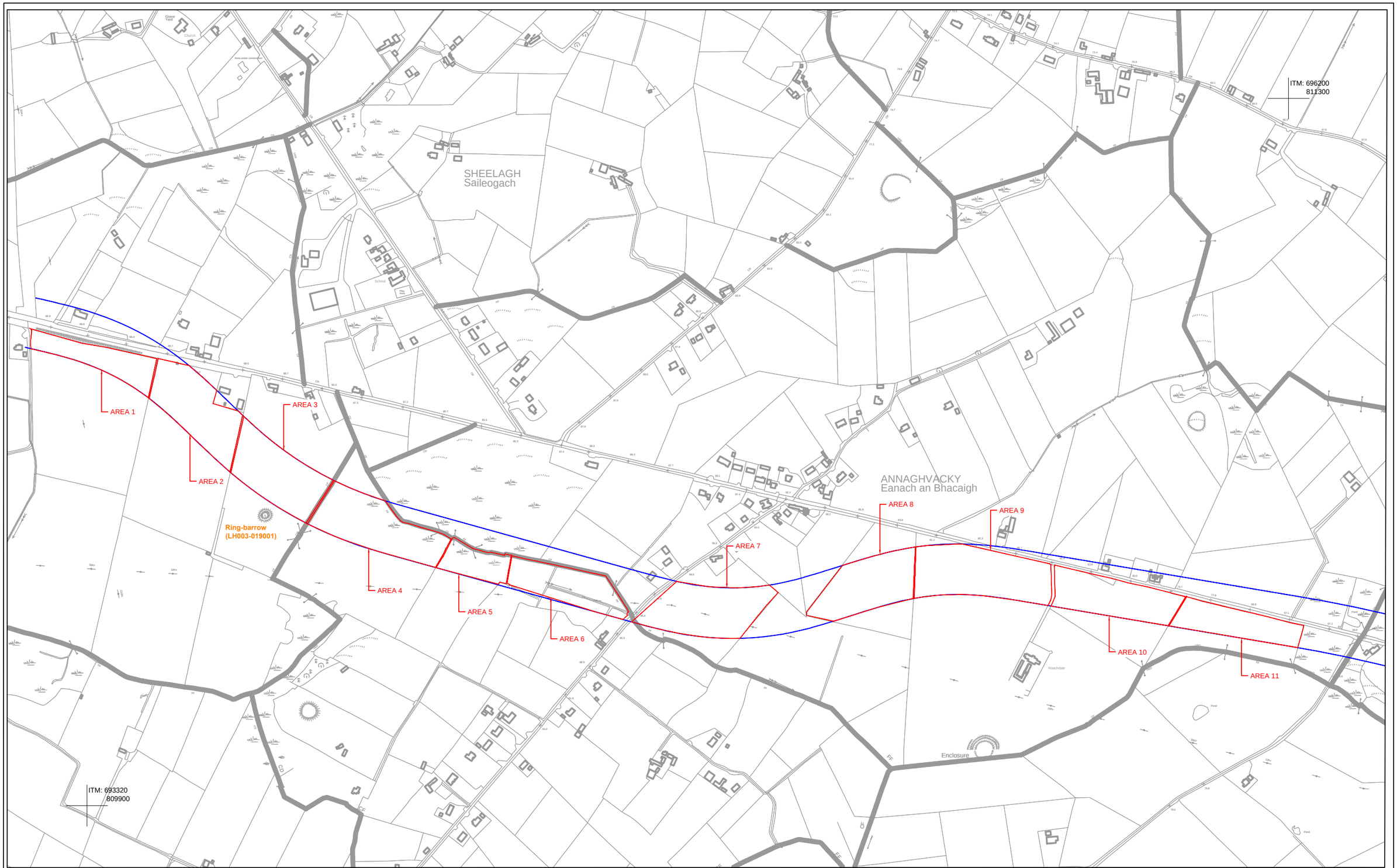
Drawing Courtesy of: Atkins Global / OSI	Date: 24/08/20	Drawing No.: 20-023/01

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0m 2000m 4000m

Figure No. 1: Location Map

EARTHSOUND geophysics



Legend

- Basemap
- Proposed CPO line
- Geophysical Survey Area

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

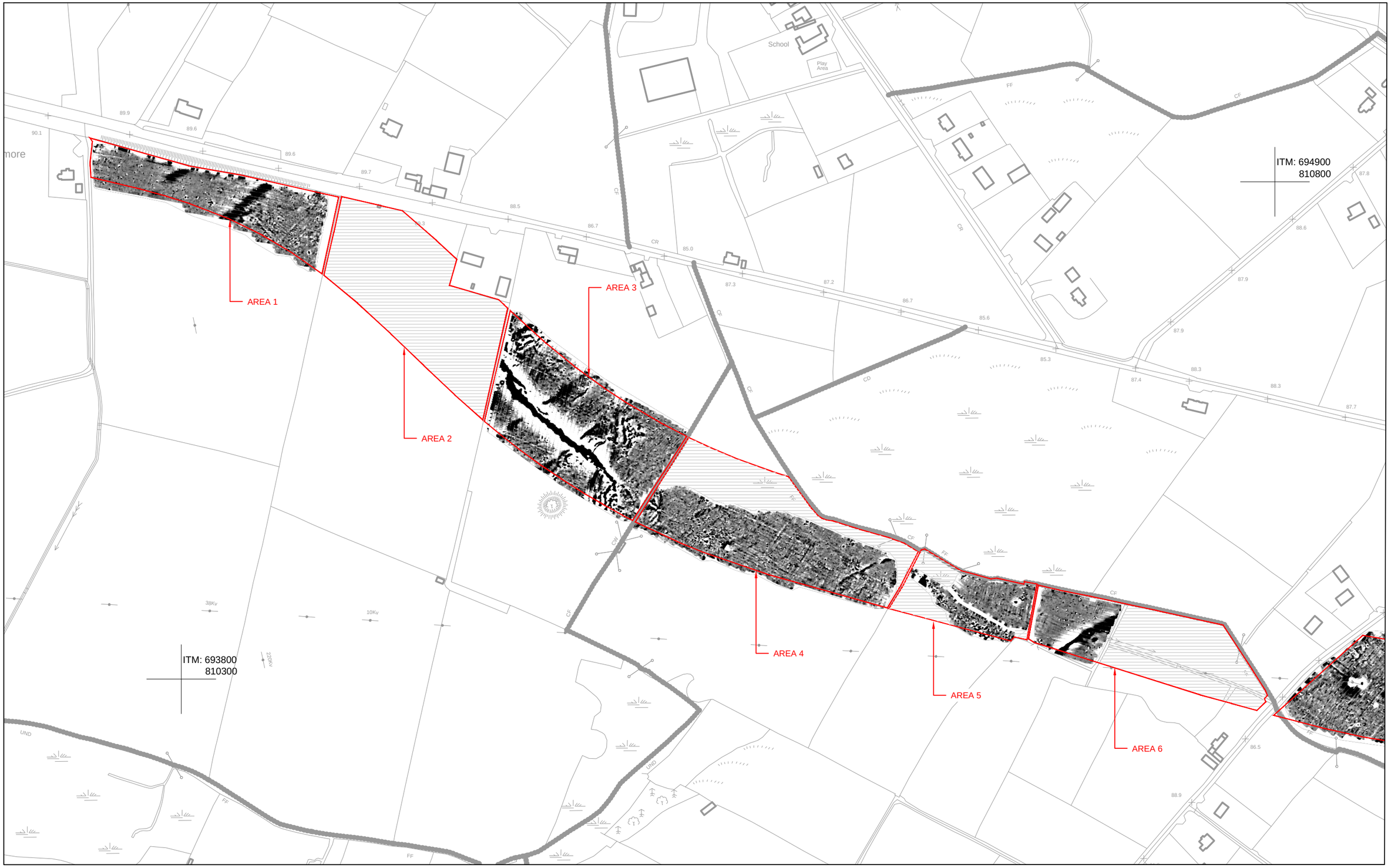
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0m 200m 400m

Figure No. 2: Detailed location Map

EARTHSOUND geophysics



Legend

- Basemap
- Geophysical Survey Area
- Unsurveyable Area

nT

-2 0 2

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

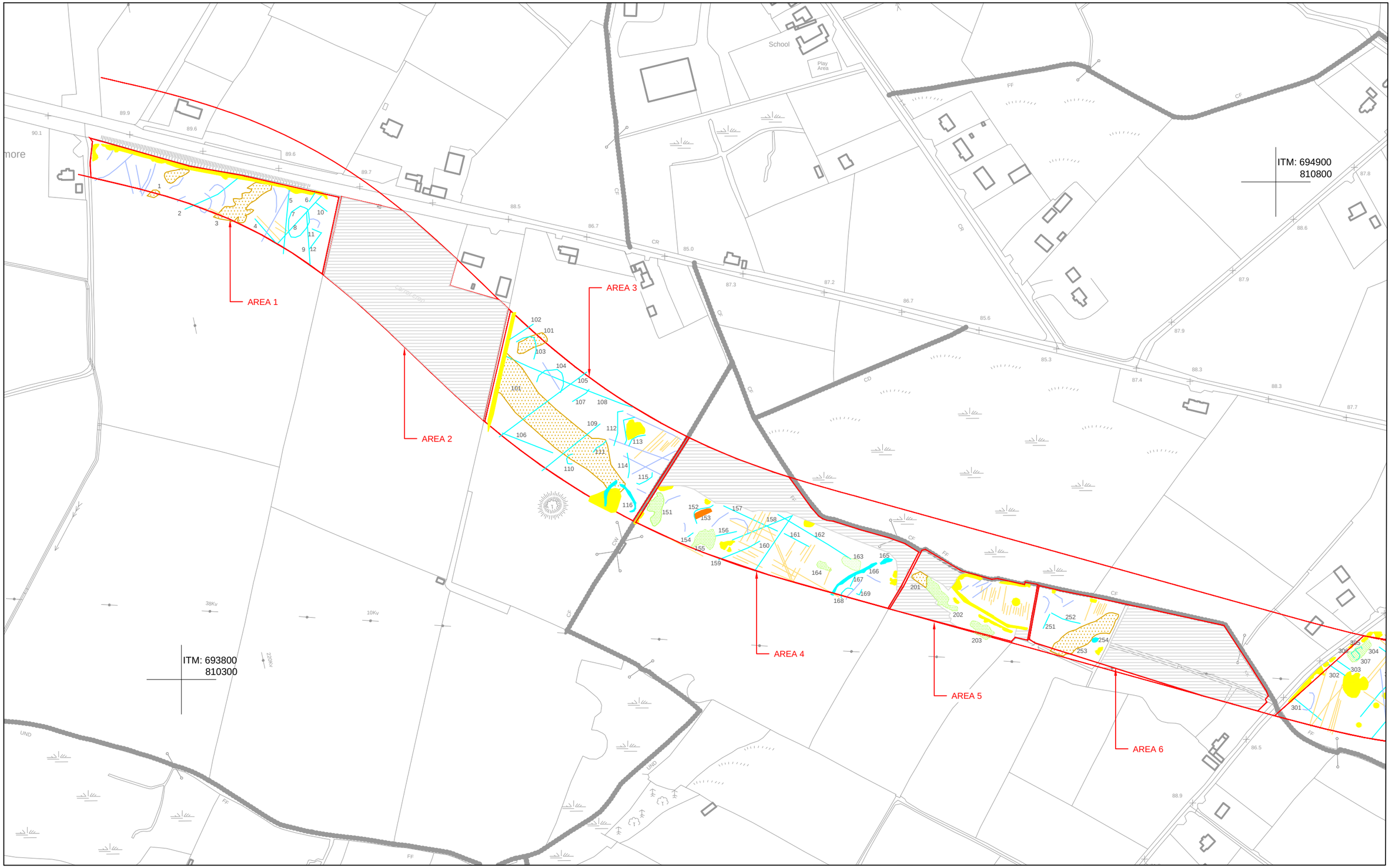
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0m 150m 300m

Figure No. 3: Magnetometer Data - Area 1 - 6

EARTHSOUND geophysics



Legend

- Basemap
- Geophysical Survey Area
- Unsurveyable Area
- Posible Archaeology
- Magnetic Enhancement
- Trend
- Feature on Historic OS
- Cultivation
- Modern Disturbance
- Geology

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

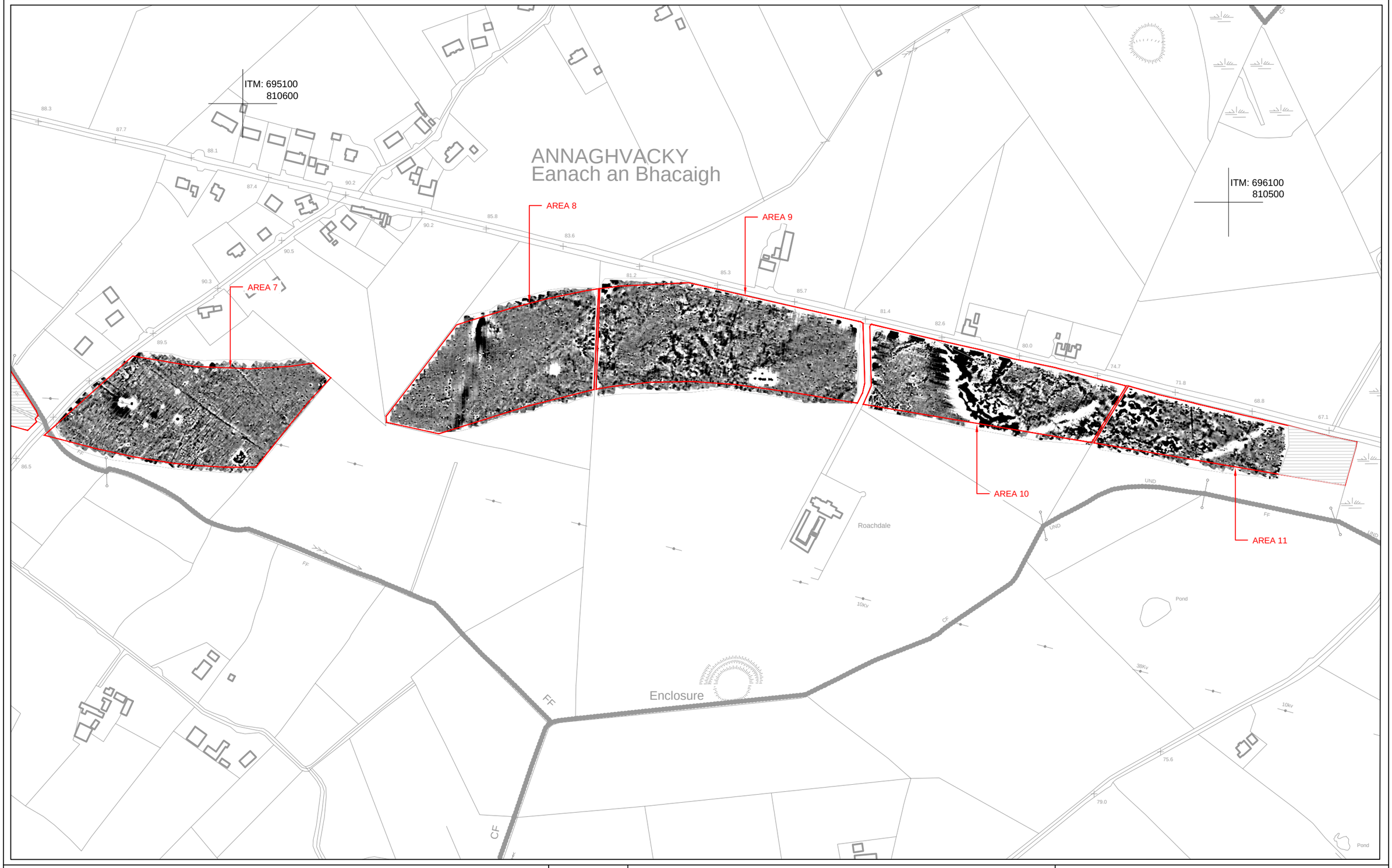
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0m 150m 300m

Figure No. 4: Magnetometer Interpretation - Areas 1 - 6

EARTHSOUND geophysics



Legend

- Basemap
- Geophysical Survey Area
- Unsurveyable Area

nT

-2 0 2

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

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0m 150m 300m

Figure No. 5: Magnetometer data - Area 7 - 11

EARTHSOUND geophysics

ITM: 695100
810600

ITM: 696100
810500

ANNAGHVACKY
Eanach an Bhacaigh

AREA 7

AREA 8

AREA 9

AREA 10

AREA 11

Roachdale

Enclosure

Pond

Pond

FF

CF

UND

10kv

38kv

Legend

- Basemap
- Geophysical Survey Area
- Unsurveyable Area
- Posible Archaeology
- Magnetic Enhancement
- Trend
- Feature on Historic OS
- Cultivation
- Modern Disturbance
- Geology

Project: N53 Hackballscross to Rassan, Co. Louth

Client: Louth County Council

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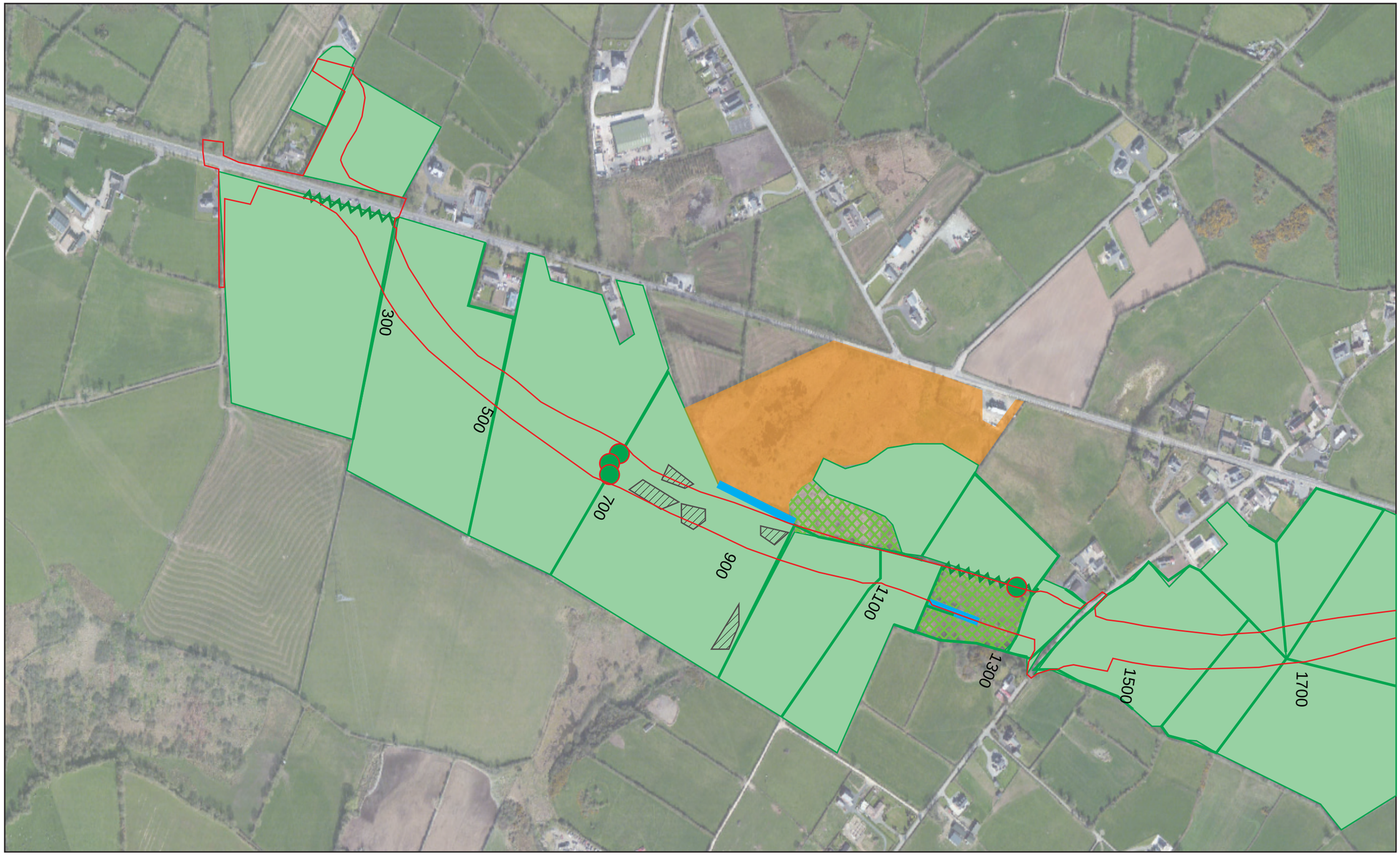
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0m 150m 300m

Figure No. 6: Magnetometer interpretation - Areas 7 - 11

EARTHSOUND geophysics

Appendix 11: Habitat Mapping



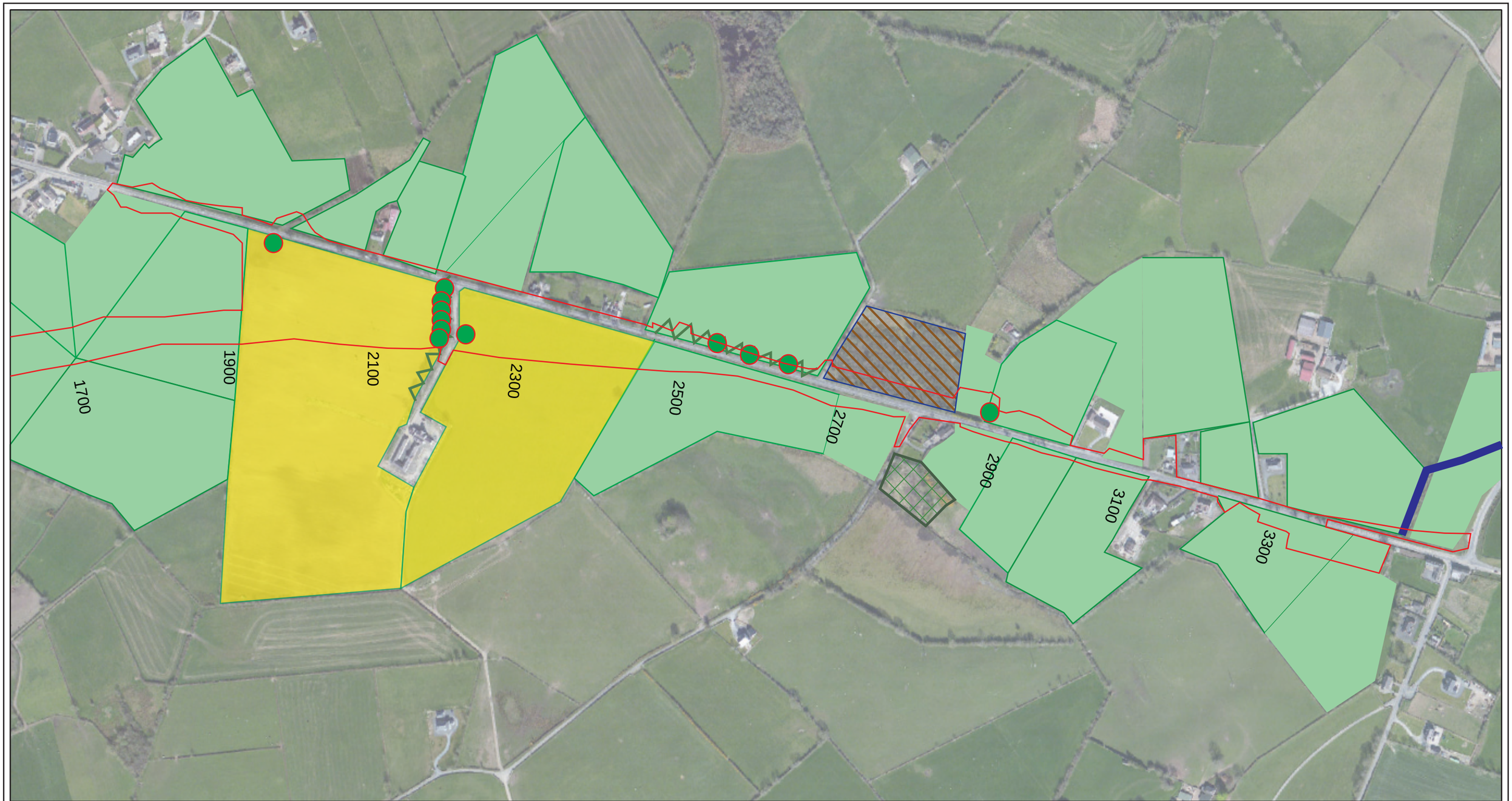
Legend

- Agricultural Grassland - GA1
- Annex I [7140] Transition mire - PF3
- Wet Grassland - GS4
- Recolonising Bare Ground - ED3
- Hedgerows - WL1
- Treelines - WL1
- Drainage Ditch - FW4
- Potential Bat Roost Trees (PBRs)
- Proposed Scheme - indicative boundary

Note; unmapped areas are built ground / private gardens

Client:	Louth County Council		
Project:	N53 Rassan to Hackballscross Road Scheme		
Title:	Habitat Map 1		
Drawn: CW	Checked: PO'D	Authorised: PO'D	
Date: 11/05/2021	Date: 11/05/2021	Date: 11/05/2021	

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Galway - Tel: 353 - 91 786050



Legend

Agricultural Grassland - GA1

Arable Crops - BC1

Reed Swamp - FS1

Wet willow-alder-ash woodland - WN6

Hedgerows - WL1

Treelines - WL1

Potential Bat Roost Trees (PBRs)

Depositing Lowland Rivers- FW2

Proposed Scheme - indicative boundary

Note; unmapped areas are built ground / private gardens

Client:	Louth County Council
Project:	N53 Rassan to Hackballscross Road Scheme
Title:	Habitat Map 2

Drawn: CW	Checked: PO'D	Authorised: PO'D
Date: 11/05/2021	Date: 11/05/2021	Date: 11/05/2021

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