22. Summary of Mitigation Measures and Residual Effects

22.1 Introduction

As set out in Chapter 1 of this updated EIAR, this is an update to Chapter 20 of the EIAR submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended). The summary of mitigation measures and residual impacts now falls under Chapter 22 of this updated EIAR, as air quality and climate are now considered separately in standalone chapters, as does waste, all of which precede this chapter. It forms part of the response to the request by ABP for further information in December 2023 where they (in addition to a number of other requests) requested GCC to "*Update the Environmental Impact Assessment Report*". It provides a summary of the mitigation measures and residual effects identified in each of the environmental assessments presented in this updated EIAR which has taken cognisance of information presented in the 2019 RFI Response and during the oral hearing in 2020 and additional studies undertaken to inform this updated EIAR. Where there have been any changes or updates have been made since the 2018 EIAR these have been set out in this updated chapter.

An objective of the design of the Project, as described in Chapter 5 of this updated EIAR, has been to reduce the adverse effects of the Project on the environment to a practical minimum. Design measures and mitigation measures have been incorporated into the design of the Project and will be applied during the construction and operation of the Project.

Where unavoidable environmental effects have been identified during the environmental impact assessment process, measures have been proposed to mitigate these effects as much as reasonably possible. These mitigation measures are detailed in the respective chapters of this updated EIAR and are also presented in summary format in this chapter. These mitigation measures along with the design measures required for the Project are presented in Chapter 23, Schedule of Environmental Commitments (which is an updated of the Schedule of Environmental Commitments submitted to ABP on 4 November 2020 at the end of the Oral Hearing[1]) for ease of reference and inclusion in contract documents at a later stage.

Implementation of mitigation measures reduces the extent of effects occurring. However, there will be effects which are residual, after avoidance and mitigation have been considered i.e. residual effects. All of the residual effects are comprehensively detailed in the relevant chapters of this updated EIAR however, this chapter summarises the likely significant residual environmental effects associated with the Project.

22.2 Construction Phase

Table 22.1 below sets out the mitigation measures proposed in respect of each environmental factor along with a summary of the likely significant residual effects predicted for the construction phase of the Project.

[1] https://www.n6galwaycityringroad.ie/sites/default/files/media/GCRR-4.04-019_002%20Chapter%2021%20SoC_I2%20-%20Final%2004112020%20-tracked.pdf

Table 22.1 Assessment of Potential Effects and Mitigation Measures – Construction Phase

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Traffic		
Construction Traffic	The construction of the Project will cause temporary short term traffic effects on the local road network. The Construction Environmental Management Plan (CEMP), included in Appendix A.7.5, shall ensure that construction traffic effects are minimised through the control of site access/egress routes and site access locations.	No likely significant residual impact.
General Construction Activity		
General Construction Activities	Mitigation measures for effects to air quality (i.e. from dust), noise and vibration effects, diversion of services and specific measures for soils and water are included in the respective sections of this table below. Every effort will be made to ensure that any negative environmental effects will be avoided, prevented or reduced during the construction phase. Any effects to the existing environment such as deterioration of public roads used as haul routes will be repaired. Any structural damage caused to buildings/structures/wells as a result of the construction will undergo a full stabilisation and rehabilitation works. A CEMP has been prepared and is included in Appendix A.7.5. The CEMP will be updated and finalised by the Contractor prior to construction commencing and it will be updated with any additional measures which are required by the conditions attached to An Bord Pleanála's decision. All of the content provided in the CEMP will be implemented in full by the Contractor and its finalisation by the Contractor will not affect the robustness and adequacy of the information presented and relied upon in this updated EIAR. The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 5th Edition (CIRIA 2023). The plan also has regard to the TII Guidelines for the Creation, Implementation and Maintenance of *an Environmental Operating Plan*. The CEMP summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the Project. The purpose of the CEMP is to demonstrate how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase of the Project. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The CEMP has been prepared in conjunction with the updated Environmental Impact Assessment Report (EIAR) and updated Natura Impact Statement (NIS), having regard to consultations with a range of specialists and environmental organisations, in particular, the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI). The CEMP supports the information already provided in this updated EIAR and must be read in conjunction with the information already provided in this updated EIAR. In addition to the controls and mitigation presented is this table (Table 22.1) and in the CEMP (Appendix A.7.5 of this updated EIAR), please also refer to the following documents for additional details on construction methodologies for the significant structures: • River Corrib Bridge Constructability Report Appendix A.7.1 • Menlough Viaduct Constructability Report Appendix A.7.2 • Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3 • Galway Racecourse Tunnel Constructability Report Appendix A.7.4 A construction management team shall be appointed for the duration of the construction phase. This team will supervise the construction of the Project, including monitoring the performance of the Contractors to ensure that the proposed construction phase mitigation measures are implemented and that construction effects and nuisance are minimised. The construction management team will liaise with neighbours and the general community during the construction phase to ensure that any disturbance is kept to a minimum. In order to help ensure the successful development, implementation and maintenance of the CEMP, the Contractor will be obliged to appoint an Environmental Manager (EM). The EM will possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken. In particular, the EM will require suitably qualified ecological experts to oversee ecologically sensitive elements of the construction works, ecological derogation licensing requirements and ecological monitoring. Further details on the roles and responsibilities of the EM are provided throughout the CEMP document in Appendix A.7.5. The CEMP also outlines the communications strategy which will be adopted during the construction phase which ensures that awareness, education and information sharing procedures are adopted and implemented. Finally, the CEMP outlines the inspections, auditing and monitoring compliance strategy that will be adopted by the Contractor.	No likely significant residual impact.
Debris	The following are the measures that will be taken to ensure that the construction site and surroundings are maintained to a high standard of cleanliness: • Daily inspections will be undertaken to monitor tidiness • A regular program of site tidying will be established to ensure a safe and orderly site • If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind • Food waste will be strictly controlled on all parts of the site • Wheel wash facilities will be provided for vehicles exiting the construction site. Wheel wash run off will be stored in an onsite storage tank and will be disposed of by permitted waste haulage company at a permitted or licensed facility • In the unlikely event that mud is carried from the construction site to the public road, it will be cleaned as required and will not be allowed to accumulate • Loaded lorries and skips will be covered if required • Surrounding roads used by trucks for access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required • In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner	No likely significant residual impact.
Biodiversity		
General	All of the mitigation measures detailed below are included in the Schedule of Environmental Commitments (Refer to Chapter 23, Schedule of Commitments) and have been updated to take cognisance of additional measures recommended within the Ecological Impact Assessment Report prepared by the ecologist appointed by ABP, Dr Arnold, [appended (as Appendix 4) to the ABP Inspector's Report, dated 22 June 2021].	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	These measures will be implemented by the Contractor under the supervision of the Project Ecologist (employed by the Employer) and/or the Ecological Clerk of Works (employed by the Contractor). Galway County Council (GCoC) /Transport Infrastructure Ireland (TII) will have a Site Monitoring Team which will include the Project Ecologist, who will be available for the duration of the construction phase for the Project. GCoC will ensure that the results of monitoring will be used to inform the long-term ecological mitigation programme and any necessary timely corrective action. During construction, monitoring and any required corrective action, will be GCoC's responsibility. All the relevant requirements in relation to monitoring and maintenance of the ecological mitigation measures over the lifetime of the project, will be included as conditions in the contract(s) entered into with the appointed contractor. GCoC shall ensure that provision is made, in the contract(s) entered into with the appointed contractor, for corrective action to be undertaken if any aspects of the implementation of the ecological mitigation measures and monitoring commitments proposals are not effective. These provisions shall include a requirement for a suitably qualified ecologist/biodiversity expert to review the efficacy of any corrective actions required. It will be the responsibility of the Site Environmental Manager (SEM) to procure the advice and services of suitably qualified ecological experts to oversee ecologically sensitive elements of the construction works, ecological derogation licensing requirements and ecological monitoring. Any non-performance, non-compliances or other issues that arise shall be promptly addressed to ensure compliance with the mitigation strategy and all derogation licence requirements. Any new considerations that may arise as a result of pre-construction surveys will be addressed and managed in accordance with the mitigation measures as discussed in this section. In response to the requests for real-time/live mapping systems, making reports on the implementation and monitoring of measures available, mapping locations of key ecological mitigation measures and interfacing with the planning authority's GIS and planning systems, and monitoring of the wildlife overpass and hedgerow planting to continue for five years, GCoC proposes the following: • A GIS mapping system will be developed, to allow the Project Ecologist to track the progress, completion and monitoring of the ecological mitigation measures • At the end of each month, any mapping relating to ecological mitigation measures, including results of pre-construction surveys (e.g. locations of badger setts) or design changes for mitigation measures (e.g. change in location of artificial badger sett), will be uploaded to the dedicated project website. In addition, at the end of each month any ecological monitoring reports will be uploaded to a dedicated project website • Notwithstanding the point above ecological monitoring reports will be submitted to the Planning Authority and copied to the NPWS • The Project Ecologist in conjunction with 'permits to work' will sign off the correct completion and functioning of the measures, where works are in ecologically sensitive locations and/or are ecologically sensitive activities, which are likely to include, but may not be limited to, the following: – works involving vegetation removal/site clearance – works involving installation of site fencing – works in or adjacent to the Lough Corrib SAC – works in or adjacent to any watercourses – works in or adjacent to any known breeding, resting or hibernating locations of any species protected under either the Birds and Habitats Regulations 2011 or Wildlife Act, in particular bats and otter – works in areas where mitigation measures (including either habitat creation/mitigation or provision of nest and bat boxes) are proposed – works in or adjacent to donor and receptor sites identified for the creation of habitats, until such time as any donor material required for the receptor sites has been transported • Once ecological mitigation measures have been implemented and installed, GIS mapping files of their final as-built locations will be sent to the Project Ecologist to be uploaded into the Local Authority's GIS and planning systems • Interactive or real-time/live mapping systems would be onerous to provide and manage. It is not deemed either necessary or appropriate to provide such systems given the above proposals which together will achieve the same function, purpose and results as a real-time/live mapping system • GCoC and Transport Infrastructure Ireland will be responsible for implementing and delivering the post-construction monitoring programme, and any maintenance required in relation to same, for the lifetime of the Project.	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Designated Areas for Nature Conservation	**European Sites** The mitigation measures that are specifically required to ensure that the Project will not result in a likely significant effect (i.e. adversely affect the integrity of) on the European sites within its ZoI are presented in Section 10 of the Natura Impact Statement (NIS). Following an assessment of the Project on the identified relevant European sites, mitigation measures were developed to address the following potential effects that were identified: • Habitat loss/fragmentation: mitigation measures to minimise habitat loss in Lough Corrib SAC and to avoid loss of QI habitats within Lough Corrib SAC during construction (refer to section below on habitats and the CEMP Appendix A.7.5, River Corrib Bridge Constructability Report Appendix A.7.1, Menlough Viaduct Constructability Report Appendix A.7.2, Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3) • Habitat degradation – tunnelling/excavation: mitigation measures to maintain the structural integrity of the rock mass supporting QI habitats in Lough Corrib SAC during the construction of the proposed Lackagh Tunnel (and its western approach) (refer to Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3) • Habitat degradation – hydrogeology: mitigation measures to avoid habitat degradation in Lough Corrib SAC as a result of potential hydrogeological effects during construction (refer to Hydrogeology section below and the CEMP Appendix A.7.5) • Habitat degradation – hydrology: mitigation measures to protect water quality in receiving watercourses during construction (refer to Hydrology section below and the CEMP Appendix A.7.5) • Habitat degradation – air quality: mitigation measures to control dust emissions during construction to prevent effects on vegetation in Lough Corrib SAC (refer to Hydrogeology section below) • Habitat degradation – non-native invasive species: mitigation measures to avoid the introduction or spread of non-native invasive species to European sites during construction (refer to the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5) • Disturbance/displacement: mitigation measures to avoid/reduce the disturbance/displacement effects of blasting on wintering birds using Ballindooley Lough (refer to wintering birds section below) • Barrier effect: mitigation measures to avoid the proposed N6GCRR restricting Otter movement within the Bearna Stream catchment (refer to Otter section below) • Mortality risk: mitigation measures to avoid mortality of the QI species of Lough Corrib SAC. These include both measures to ensure that construction materials are not introduced into the River Corrib Construction-related traffic: Mitigation measures to ensure that habitats are not degraded through impacts related to construction-related traffic on the wider, existing road network (Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC, Inner Galway Bay SPA, Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC and Cregganna Marsh SPA)	No likely significant residual effect on any European sites.
	Natural Heritage Areas and proposed Natural Heritage Areas The potential for the Project to significantly affect Lough Corrib pNHA, Galway Bay Complex pNHA, Cregganna Marsh NHA, Castletaylor Complex pNHA, Kiltiernan Turlough pNHA, Logh Fingall Complex pNHA, Rahasane Turlough pNHA, Connemara Bog Complex pNHA, East Burren Complex pNHA, Moneen Mountain pNHA, Black Head- Poulsallagh Complex pNHA, Gortnandarragh Limestone Pavement pNHA, Ross Lake and Woodland pNHA, Maumturk Mountains pNHA, The Twelve Bens/Garraun Complex pNHA and Inishmore Island pNHA is as per the corresponding European sites. Therefore, the mitigation measures outlined above for European sites and as detailed in Section 10 of the NIS, will prevent the Project resulting in a significant negative effect on Lough Corrib pNHA or Galway Bay Complex pNHA at the national geographic scale. The mitigation measures that are required to ensure that the Project will not significantly affect Moycullen Bogs NHA are as follows: • Measures to control dust emissions during construction to prevent effects to vegetation/habitats within Moycullen Bogs NHA at Tonabrocky – see Air Quality and Climate below. These include control measures such as spraying of exposed earthwork activities and site haul roads during dry weather, wheel washes, control of site vehicle speeds, road sweeping and dust screens • Measures to avoid the introduction or spread of non-native invasive species to Moycullen Bogs NHA during construction. These are detailed in the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5 • Measures to ensure that the planting and sowing scheme does not include non-native tree species in proximity to Moycullen Bogs NHA • Measures to control surface water runoff from the construction site to prevent an accidental pollution event affecting peatland habitats within Moycullen Bogs NHA at Tonabrocky – see Hydrology below • In the unlikely event of significant flow paths (fault or fracture zones) being encountered in the Galway Granite Batholith during construction, measures set out in the Karst Protocol included in the CEMP in Appendix A.7.5 will be implemented The Project also has the potential to significantly affect Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA as a result of effects of construction-related traffic. Measures to control dust emissions during construction to prevent impacts to vegetation/habitats within these pNHAs are presented in Section 8.6.3.3 below and Chapter 16, Air Quality of this updated EIAR. These include control measures such as spraying of exposed earthwork activities and site haul roads during dry weather, wheel washes, control of site vehicle speeds, road sweeping and dust screens.	No likely significant residual effects on either Lough Corrib pNHA or Galway bay Complex pNHA or on any nationally designated areas for nature conservation
Habitats Habitats	**Mitigation Measures to Minimise Habitat Loss** To minimise the loss of Annex I habitat, areas of these habitat types within the Assessment Boundary but which are not required to construct the Project will be retained and fenced off for the duration of construction. A proportion of one area of wet heath [4010] to be retained (*c.* 0.08ha, accounting for 32.5% of the total area to be retained at Ch. 3+000 of the proposed N6 GCRR) is likely to be affected by operational air quality effects and this area may not retain its Annex I classification. These are shown on Figures 8.38.1 to 8.38.15 of Chapter 8, Biodiversity. There will be no fencing within Annex I habitats that are located within Lough Corrib SAC either during construction. To minimise the loss of habitat associated with the Project, there are also areas within the Assessment Boundary which are included for mitigation planting where general construction works will not be undertaken. These are shown on Figures 8.38.1 to 8.38.15 of Chapter 8, Biodiversity. The minimum working area to facilitate the construction of the supporting structures associated with the proposed River Corrib Bridge will be used. This area will be clearly delineated and fenced off at the outset of works and maintained for the duration of the construction programme. No works for the construction of the River Corrib Bridge within Lough Corrib SAC boundary will be undertaken outside of this zone. Where possible, woodland, scrub, treelines and hedgerows which lie within, or along the boundary of the Project, that are not directly impacted by the proposed road alignment or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Vegetation to be retained is shown on Figures 8.38.1 to 8.38.15 and on Figures 12.1.01 to 12.1.15 (landscape design).	Despite these mitigation measures, the Project will result in permanent area loss of the following Annex I habitat types, which are discussed further below: • Petrifying springs [*7220] • Active Blanket Bog [*7130] • Wet heath/Dry heath/Active Blanket Bog • Residual alluvial forest [*91EO] • Limestone pavement [*8240] • Limestone pavement/Calcareous grassland [*8240/6210] • Wet heath [4010] • Dry heath [4030]

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	Areas of river channel and bankside vegetation which lie within, or along the boundary of the proposed N6 GCRR, that are not directly impacted by the proposed road alignment or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at a distance of 5m from the stream/river bank. The Petrifying spring feature present in Lackagh Quarry, which lies c.25m to the north of the mainline of the Project at Ch. 11+400, will be retained and shotcrete[2] will not be used as part of the quarry face stabilisation measures at the spring site. Moreover, there is potential for new petrifying spring features to develop in Lackagh Quarry as they occur where recharge pathways through the limestone have been intersected by the quarry face, which can mitigate the loss of the non-annex calcareous springs at the location of the proposed access road c.30m south of the mainline at Ch. 11+380 and between Ch. 11+700 and Ch. 11+750, as well as the potential loss of the Petrifying spring feature which lies c.25m to the north of the mainline at Ch. 11+400. The construction works at the quarry face comprise of the MDA placement and the slope stability measures and both facilitate the development of new petrifying springs in the following manner: • As part of the MDA placement the groundwater regime (both discharge and recharge) will be maintained by the inclusion of a free draining material where the MDA is in contact with the rock face and the quarry base • As part of the slope stability measures for the exposed rock face the groundwater regime will be maintained through existing cracks and fissures as much as possible or through weep holes where shotcrete is required. These weep holes will permit free drainage of groundwater from the rock face and are likely to form new spring locations Equally, there are existing water inflows into the quarry, as shown in Appendix A.8.21 - Part 2, which have the potential to become petrifying springs as the natural hardness of the recharge waters will lead to CaCO3 precipitation and petrification will occur. This process could take up to 10 years. Finally, if required by ABP, new spring features will be created by installing drill holes (<5cm diameter and c.1-2m in length) from the quarry face into the rock mass. These drill holes will be installed in accordance with the rock bolt measures as set out in the CEMP in Appendix A.7.5. Where these drill holes intersect natural recharge pathways then the flow will be diverted, and new springs will occur. The natural hardness of the recharge waters will lead to CaCO3 precipitation and petrification will occur. Precipitation is expected to commence from new springs with the build-up of the CaCO3, to a comparable thickness to the existing petrification, expected to take c.10 years. Excavated blocks of limestone pavement will be retained for reuse for general wildlife and habitat creation within those lands along the east bank of the River Corrib in Menlough which are proposed for habitat retention, enhancement and creation. **Measures to Reduce the Potential for Impacts on Vegetation to be retained** Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the Assessment Boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority, 2006b), as follows: • All trees along the Assessment Boundary that are to be retained, both within and adjacent to the Assessment Boundary (where the root protection area of the tree extends into the Assessment Boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. The RPA will be defined based upon the recommendation of a qualified arborist • Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it • The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) or concrete washout areas will not be undertaken within 10m of any retained trees, hedgerows and treelines • A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the Assessment Boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist • A buffer zone of at least 5m will be maintained between construction works and retained hedgerows to ensure that the root protection areas are not damaged The planting and sowing scheme will not include non-native tree species. Scots pine, which is invasive in heathland, will not be used for landscape planting west of the River Corrib.	• Dry heath/Wet heath mosaic [4030/4010] • Wet heath/Dry heath/*Molinia* mosaic [4010/4030/6410] • Calcareous grassland [6210] • *Molinia meadow* [6410] None of the areas of Annex I habitat that will be permanently lost are located within any European sites. In the case of the priority Annex I habitats lost outside European sites, this results in a likely significant residual effect at the international geographic scale. The exception is the loss of four Petrifying springs feature which results in a likely significant negative residual effect at the county geographic scale. For non-priority Annex I habitat types, the habitat loss is considered to constitute a likely significant negative residual effect at the national geographic scale, as loss of habitat area affects the conservation status of each of these habitats nationally. The habitat types, and areas lost, are summarised in Table 8.45 of Chapter 8, Biodiversity. Similarly, despite the mitigation measures the Project will result in likely significant residual effects, at the local geographic scale, on the following habitat of a local biodiversity value: • Calcareous springs (FP1) - 18 features • Dry calcareous and neutral grassland (GS1) – c.14.86ha • Dry meadows and grassy verges (GS2) – c.7.85ha • Dry-humid acid grassland (GS3) – c.5.24ha • Wet grassland (GS4) – c.9.43ha • Marsh (GM1) – c.042ha • Dry calcareous and neutral grassland/Scrub mosaic (GS1/WS1) – c.4.87ha • Rich fen and flush (PF1) – c 0.2ha • Poor fen and flush (PF2) – c.1.3ha • (Mixed) broadleaved woodland (WD1) - c.2.09ha • Mixed broadleaved/conifer woodland (WD2) – c.0.04ha • Mixed conifer woodland (WD3) – c.0.01ha • Oak-ash-hazel woodland (WN2) – c. 2.93ha • Scrub (WS1) – c. 26.53 ha • Scrub/ Dry meadows and grassy verges (WS1/GS2) – c. 2.89 ha • Scrub/Oak-ash-hazel woodland/ Exposed calcareous rock (WS1/WN2/ER2) – c. 0.49ha • Reed and large sedge swamps (FS1) – c. 0.03ha • Drainage ditches (FW4) – c. 0.08ha • Hedgerows (WL1) – c.7.88km • Treelines (WL2) – c.4.05km

[2] A concrete product which is sprayed at high velocity into a rock face as a structural/stabilising component.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		• Sections of stream/River Channel (FW1) – c.120m of Sruthán na Líbeirtí, c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary), c.475m of the Tonabrocky Stream
	Important Habitat Clusters 1-12 All of the mitigation measures included within Section 8.6.3 and 8.6.4 of Chapter 8, Biodiversity apply to habitat Clusters 1-12. The specific mitigation measures are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster, Habitat clusters considered include: Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+6001 of the proposed N6 GCRR) Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the proposed N6 GCRR) Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the proposed N6 GCRR) Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the proposed N6 GCRR) Cluster 5 East of Ballymoneen Road (Ch.5+750 to Ch. 5+950 of the proposed N6 GCRR) Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the proposed N6 GCRR) Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the proposed N6 GCRR) Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100 of the proposed N6 GCRR) Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the proposed N6 GCRR) Cluster 10 Castlegar (Ch. 13+500 of the proposed N6 GCRR) Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the proposed N6 GCRR) Cluster 12 Ardaun (Ch. 16+950 to Ch. 17+150 of the proposed N6 GCRR)	The residual impact of the loss of c.0.01ha of *7130 active blanket bog within Habitat Cluster 1 has a likely significant residual effect at the international geographic scale. The loss of c.0.11 ha of 4010 Wet heath and c.0.78ha 4030 Dry heath within this habitat cluster has a likely significant residual effect at the national geographic scale. The entire area of 6410 Molinia meadow habitat within this habitat cluster (c.0.09 ha) and a section of 4030 Dry heath (c.0.10ha) is to be retained in Habitat Cluster 1. The residual impact of the loss of c.0.07ha of Marsh (GM1), c.0.30ha of Dry meadows and grassy verges (GS2), c.1.79ha of Dry humid acid grassland (GS3), c.3.18ha of Wet grassland (GS4), c.0.13ha of Poor fen and flush (PF2), c.0.35ha of mixed broadleaved woodland (WD1), c.0.83ha of Scrub (WS1), c.0.01 km of hedgerows (WL1) and c.0.19 km of treelines (WL2) and c.120m of Sruthán na Líbeirtí stream on Habitat Cluster 1 Forramoyle has been assessed as significant at the local geographic scale. The loss of Imbricate bog-moss Sphagnum affine and Red bog-moss *Sphagnum capillifolium* within this cluster has been assessed as significant at the National and county geographic scale respectively. The loss of c.0.57ha of 4010 Wet heath and c.0.22ha 4030 Dry heath within Habitat Cluster 2 has a likely significant residual effect at the national geographic scale. The residual impact of the loss c.0.04ha of Dry meadows and grassy verges (GS2), c.0.47ha of Dry humid acid grassland (GS3), c.0.56ha of Wet grassland (GS4), c.0.03ha of mixed broadleaved/conifer woodland (WD2), c.0.01ha of mixed conifer woodland (WD3), c.2.41ha of Scrub (WS1) on Habitat Cluster 2 Troscaigh has been assessed as significant at the local geographic scale. The loss of c.1.28ha of 4010 Wet heath (including c.0.2ha which occurs in a mosaic with rich fen and flush (PF1) and poor fen and flush (PF2)), c.0.13 ha 4030 Dry heath, c.0.02ha of 4010 Wet heath/6410 Molinia meadow mosaic and c.0.18ha of 4030 Dry heath/4010 Wet heath/6410 Molinia meadow mosaic within Habitat Cluster 3 has a likely significant residual effect at the national geographic scale. A section of 4030 Dry heath/4010 Wet heath/6410 Molinia meadow mosaic (c.0.26ha) is to be retained in Habitat Cluster 3. The residual impact of the loss of c.0.30ha of Marsh (GM1), c.0.28ha of Dry meadows and grassy verges (GS2), c.1.34ha of Dry humid acid grassland (GS3), c.2.86 ha of Wet grassland (GS4), c.0.22ha of mixed broadleaved woodland (WD1), c.1.22ha of Scrub (WS1), c.0.11km of hedgerows (WL1) and c.0.40km of treelines (WL2) as well as c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary) on Habitat Cluster 3 Cloughscoltia has been assessed as significant at the local geographic scale. The loss of Woodsy thyme moss *Plagiomnium cuspidatum* within this cluster has

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		been assessed as significant at the county geographic scale. The loss of c.0.57 ha of 4010 Wet heath, c.0.59ha 4030 Dry heath c.0.88ha of 4030 Dry heath/4010 Wet heath mosaic within Habitat Cluster 4 has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.18ha of Dry calcareous grassland (GS1), c.0.31 ha of Dry meadows and grassy verges (GS2), c.0.21ha of Wet grassland (GS4), c.0.02ha of oak-ash-hazel woodland (WN2), c.0.42ha of Scrub (WS1), c.0.23km of hedgerows (WL1) and c.0.37km of treelines (WL2) on Habitat Cluster 4 Cappagh Road to Ballymoneen Road has been assessed as significant at the local geographic scale. The loss of Downy oat-grass Avenula pubescens within this cluster has been assessed as not significant at any geographic scale. The residual impact of the loss of c.0.02ha of Wet grassland (GS4), c.0.79ha of Scrub (WS1) and c.0.03km of treelines (WL2) on Habitat Cluster 5 East of Ballymoonen Road has been assessed as significant at the local geographic scale. The loss of c.0.14ha of 4010 Wet heath within Habitat Cluster 6 has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.95ha of Dry calcareous grassland (GS1), c.1.79ha of Dry humid acid grassland (GS3), c.0.74ha of Wet grassland (GS4), c.0.97ha Poor fen and flush (PF2), c.3.06ha of Scrub (WS1), c.0.17km of hedgerows (WL1) and c.0.25km of treelines (WL2) on Habitat Cluster 6 Knocknabrona/Knocknafrosca has been assessed as significant at the local geographic scale. The loss of Downy oat-grass *Avenula pubescens* within this cluster has been assessed as not significant at any geographic scale. The loss of c.1.23ha of *8240 Limestone pavement, c.0.005ha *8240 Limestone pavement/6210 Calcareous grassland mosaic and c.0.14ha *91E0 Alluvial woodland in Habitat Cluster7 has a likely significant residual effect at the international geographic scale. A section of *8240 Limestone pavement (c.0.27ha), *8240 Limestone pavement/6210 Calcareous grassland mosaic (<0.01ha) and the entire *3180 Turlough is to be retained in Habitat Cluster 7. The residual impact of the loss of c.0.78ha of Dry calcareous grassland (GS1), c.1.94ha of Dry meadows and grassy verges (GS2), c.0.16ha of Wet grassland (GS4), c.0.82ha of mixed broadleaved woodland (WD1), c.1.59ha oak-ash-hazel woodland (WN2), c.0.34ha of Scrub (WS1), c.0.28km of hedgerows (WL1) and c.0.46km of treelines (WL2) on Habitat Cluster 7 Menlough has been assessed as significant at the local geographic scale. The loss of Lesser striated feathermoss *Plasteurhynchium striatulum* within this cluster has been assessed as significant at the county geographic scale. The loss of c.0.11ha of 6210 Calcareous grassland within Habitat Cluster 8 has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.08 ha of Dry calcareous grassland (GS1), c.0.43ha of Oak-ash-hazel woodland (WN2), c.1.68ha of Scrub (WS1) and

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		c.0.67km of hedgerows (WL1) on Habitat Cluster 8 Lackagh has been assessed as significant at the local geographic scale. The loss of c.0.28ha of 6410 Molinia meadows within Habitat Cluster 9 has a likely significant residual effect at the national geographic scale. A section of 6410 Molinia meadows (c.0.65ha), and a section of Oak-ash-hazel woodland (WN2) (0.03 ha), and the entire area of Eutrophic lake (FL5) and Reed and large sedge swamps (FS1) is to be retained in Habitat Cluster 9. The residual impact associated with the loss of c.0.03ha of Oak-ash-hazel woodland (WN2), c.0.005ha of Scrub (WS1) and c.0.67km of hedgerows (WL1) from Habitat cluster 9 Ballindooley Lough has been assessed as significant at the local geographic scale. The residual impact of the loss of c.0.24km of hedgerows (WL1) will have a residual impact on Habitat Cluster 10 Castlegar. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale. The loss of c.0.26ha of *8240 Limestone pavement in Habitat Cluster 11 has a likely significant residual effect at the international geographic scale. A few areas of *8240 Limestone pavement (c.0.36ha) is to be retained in Habitat Cluster 11. The residual impact of the loss of c.2.76ha of Dry calcareous grassland (GS1), c.0.23ha of Dry meadows and grassy verges (GS2), c.0.24ha of mixed broadleaved woodland (WD1), c.0.22ha oak-ash-hazel woodland (WN2), c.2.31ha of Scrub (WS1), c.0.46 km of hedgerows (WL1) and c.0.24km of treelines (WL2) within Habitat Cluster 11 Briarhill has been assessed as significant at the local geographic scale. The residual impact of the loss of c.0.04ha of Dry meadows and grassy verges (GS2) and c.0.03km of hedgerows (WL1) within Habitat Cluster 12 Ardaun has been assessed as significant at the local geographic scale.
	Local Biodiversity Areas All of the mitigation measures included within Section 8.6.3 and 8.6.4 of Chapter 8, Biodiversity apply to local biodiversity areas. The specific mitigation measures are related to and dependent upon the potential impacts of the proposed N6 GCRR on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area. All of the local biodiversity areas traversed by the Project include: • The Coast Road (R336) to the N59 Moycullen Road (which includes the Cappagh – Ballymoneen and the Ballagh – Barnacranny Hill local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024) • Rusheen Bay – Barna Woods – Illaunafamona • The River Corrib and the Coolagh lakes (which includes the River Corrib and adjoining wetlands local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024) • Menlough to Coolough Hill (including Lackagh Quarry) • Ballindooley – Castlegar (which is linked to the River Corrib by the Terryland River valley) • Galway Racecourse, Ballybrit • Doughiska • Galway Bay (which includes the Mutton Island and Nearby Shoreline local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024) • City Canal System • Waterbody • Terryland Glenanail Cooper's Cave Terryland	Likely significant effects from local up to the international geographic scale The residual impact of the loss of c.0.14ha of Residual alluvial forest [*91E0] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the international geographic scale. The residual impact of the loss of c.1.54ha of Limestone pavement [*8240] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area and the Doughiska local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the international geographic scale. The residual impact of the loss of c.5.63ha of peatland habitat mosaic (Blanket bog [*7130], Wet heath [4010], Dry heath [4030] and Molinia meadow [6410]) will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale. The residual impact of the loss of c.0.25ha of Calcareous grassland [6210] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area and the Doughiska local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale. The residual impact of the loss of c.0.29ha of Molinia meadow [6410] habitat will have a residual impact on the Ballindooley – Castlegar local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale. The residual impact of the loss of 18 calcareous springs (FP1) and four Petrifying springs [*7220] at Lackagh Quarry will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local and county geographic scales, respectively. The residual impact of the loss of c.5.24ha of dry-humid acid grassland (GS3) and c.1.30ha of Poor fen and flush habitat (PF2) will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale. Hedgerows and treelines will be impacted throughout the local area with the greatest concentrations affected in parts of the Coast Road (R336) to the N59 Moycullen Road local biodiversity area around Ballagh, in the Menlough to Coolough Hill local biodiversity area, and in the Doughiska local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale. The residual impact of the loss of Broadleaved woodland (WD1) and Oak-ash-hazel woodland (WN2) will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale. The residual impact on the local Lesser horseshoe bat population will have a residual impact principally on the Menlough to Coolough Hill and Cooper's Cave Terryland local biodiversity areas, but is also likely to affect the River Corrib and the Coolagh Lakes local biodiversity area, the Cooper's Cave Terryland local biodiversity area, Ballindooley – Castlegar local biodiversity area, and the Terryland Glenanail local biodiversity area. This residual impact associated has been assessed as potentially significant at the national geographic scale. The residual impact on all other bat species recorded within the study area will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area, the River Corrib and the Coolagh

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		Lakes local biodiversity area, the Menlough to Coolough Hill local biodiversity area, the Ballindooley – Castlegar local biodiversity area, and the Doughiska local biodiversity area, the City Canal System local biodiversity area, the Waterbody local biodiversity area and the Terryland Glenanail local biodiversity area.. This residual impact associated has been assessed as significant at the local geographic scale. The residual impact on the local Peregrine falcon population will have a residual impact on the Menlough to Coolough Hill local biodiversity area. This residual impact associated has been assessed as significant at the county geographic scale.
Measures to Reduce the Potential for Air Quality Impacts on biodiversity receptors during Construction	To control dust emissions during construction works standard mitigation measures shall include: spraying of exposed earthwork activities and site haul roads during dry and/or windy conditions; provision of wheel washes at exit points; control of vehicle speeds and speed restrictions (20km/h on any un-surfaced site road); covering of haulage vehicles; and, sweeping of hard surface roads. These procedures will be strictly monitored and assessed on a daily basis. Dust screens will be implemented at locations where there is the potential for air quality impacts during the construction phase i.e. at locations where sensitive receptors are located within 100m of the works. In addition, a 2m dust screen will be provided at the locations in the areas of the overlap of the Project and the Lough Corrib SAC and adjacent to Moycullen Bogs NHA.	No likely significant residual impact
Mitigation Measures to Reduce the Potential for Impacts to Water Quality in Receiving Watercourses	The mitigation measures to protect surface water during construction are detailed below in the Hydrology section and in the CEMP included in Appendix A.7.5 and in turn protect many of the biodiversity receptors.	No likely significant residual impact
Measures to Protect Groundwater Quantity and Groundwater Quality and potential impacts on biodiversity receptors	The mitigation measures to protect groundwater quantity and quality during construction are detailed in the Hydrogeology section below and in turn protect many of the biodiversity receptors. Mitigation measures are also included below for Soils and Geology to restrict the use of fill material in areas where there is the potential for run off/infiltration to affect pH levels in adjoining peatland habitats within the operational hydrogeological Zone of Influence (ZoI) of the Project.	No likely significant residual impact
Measures to Control and Prevent the Spread of Non-native Invasive Species	The mitigation strategy in relation to non-native invasive plant species is based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010) with the objectives of managing non-native invasive plant species within the working area and preventing the spread of any established populations present within the Assessment Boundary (a legal requirement for species such as Japanese knotweed). A Non-native Invasive Species Management Plan has been prepared and is included in the CEMP (see Appendix A.7.5) and will be implemented sufficiently far in advance of the proposed construction works commencing so as to allow time to adequately control all target non-native invasive species populations within the ZoI of the Project, having regard to the specific timing/seasonal constraints that apply in relation to each individual species. The Non-Native Invasive Species Management Plan will direct the construction Contractor in implementing the specific mitigation measures required in relation to individual non-native invasive plant species and are required to protect many of the biodiversity receptors. As species may have spread, or their distribution may have changed, between the habitat surveys carried out for this updated EIAR and the commencement of construction works, the implementation of the Non-native Invasive Species Management Plan will include a pre-construction re-survey within the Assessment Boundary. In accordance with the NRA guidance this survey will include accurate 1:5,000 scale mapping for the precise location of non-native invasive plant species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned. In accordance with the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010), where cut, pulled or mown noxious weed or non-native invasive plant species material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 0.5m in the case of noxious weeds, or by incineration (at a licenced facility having regard to relevant legislation) or disposal to licensed landfill in the case of non-native invasive plant species. The taproots of docks and roots of creeping thistle are not suitable for composting or shallow burial, requiring disposal to landfill, incineration or burying at a depth of no less than 1.5m (practical only during the construction phase). Where burial is being used to dispose of Japanese knotweed, the material will be buried to a depth of 5m and overlain with a suitable geotextile membrane. All disposals will be carried out in accordance with the Waste Management Acts 1996-2024. In relation to aquatic non-native invasive plant species all construction works, and any aquatic survey work that may be carried out (e.g. electrofishing), will comply with best practice biosecurity protocols for aquatic work – for example IFI's Biosecurity Protocol for Field Survey Work (IFI, 2010).	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Rare and Protected Plants and Species	The extent of the following plant species will be recorded and mapped, pre-construction, to ensure impacts to local populations are minimised and, where retained, are safeguarded by use of fencing, signs and ensuring workforce are aware (toolbox talks, etc) of the locations: • Woodsy thyme moss Plagiomnium cuspidatum • Lesser striated feather-moss *Plasteurhynchium striatulum* • Imbricate bog-moss *Sphagnum affine* • Red bog-moss Sphagnum capillifolium s. capillifolium • Spring gentian *Gentiana verna* • Brown beak-sedge *Rhynchospora fusca* Where *Plagiomnium cuspidatum* and *Plasteurhynchium striatulum* plants are directly impacted and are growing on moveable substrates (rocks or logs) then the substrates will be relocated to areas of retained vegetation, with precisely the same environmental conditions as the donor site, with follow-up monitoring to confirm success or failure. Some populations of these plant species (i.e. three of the six records of Lesser striated feather-moss *Plasteurhynchium striatulum* within the Assessment boundary and all records of Spring gentian *Gentiana verna* within the Assessment boundary) will be retained within the areas of habitat to be retained. Pre-construction, check the identification and native status of meadow oat-grass *Helictotrichion pratense* and marsh valerian Valeriana dioica and implement protection measures, if appropriate. Where grassland seeding will be used, it will be suitable for the soil types and avoid negative indicator species for grassland Annex I habitats, aiming for dry heath/acid grassland to the west of the River Corrib and calcareous grassland to the east of the River Corrib. Grassland habitat creation approaches will favour natural regeneration rather than the use of seed mixes, wherever soil erosion is not a major risk.	The 2018 EIAR predicted no residual impacts on rare and protected plant species. However the ABP's Inspector's Report dated June 2021 disagreed with this valuation and determined likely significant negative residual effects on four rare and protected plant species, i.e., Woodsy thyme moss, Lesser striated feather-moss, Imbricate bog-moss, and Red bog-moss, at the National geographic scale. There is also a potential significant residual effect on Eyebright at a local geographic scale. The residual impact for this updated EIAR has been revised to a county geographic scale for Red bog-moss, Woodsy thyme moss, Lesser striated feather-moss. Remaining residual impacts remain due to potential indirect hydrological and hydrogeological impacts for Imbricate bog-moss Sphagnum affine, Red bog-moss, as well as potential indirect air quality impacts on Imbricate bog-moss, Red bog-moss, Woodsy thyme moss and Lesser striated feather-moss and Eyebright
Otters	***Habitat degradation - water quality*** The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology. ***Loss of breeding/resting sites*** As Otter could potentially establish new holt or couch sites within the ZoI of the Project in the future, a pre-construction check of all suitable Otter habitat will be required within 12 months of any constructions works commencing. ***Otter passage facilities*** Safe passage will be ensured for otters along all watercourses bisected by the Project during construction, and will include either mammal ledges within a culvert or two dry 600mm culverts parallel to the watercourse, one each side. Mammal underpasses and Otter passage facilities will be checked and fully inspected before the relevant sections of the proposed N6 GCRR become operational to ensure they are constructed in accordance with the Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (National Roads Authority, 2008c).	No likely significant residual effect on Otter, at any geographic scale.
Bats	***Bat Derogation Licence*** It is an offence under Section 23 of the Wildlife Acts 1976-2017 and under Section 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 to kill a bat or to damage or destroy the breeding or resting place of any bat species. Under the European Communities (Birds and Natural Habitats) Regulations it is not necessary that the action should be deliberate for on offence to occur. This places an onus of due diligence on anyone proposing to carry out works that might result in such damage or destruction. Under Section 54 of S.I. 477 of 2011, a derogation may be granted by the Minister where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range. Given the impacts on bats that are predicted for the Project, a derogation licence under Section 54 of S.I. 477 of 2011 will be required. As the 2024 bat derogation licence expired on 31st December 2024, a new derogation licence application was submitted to the NPWS on 1 April 2025 (included in Appendix A.8.25 Part 2 of this updated EIAR). Derogation licences granted by the NPWS are published, along with the application and any supporting documentation, on their website at https://www.npws.ie/licensesandconsents/disturbance/application-for-derogation/bat-derogations-issued. **Please note, ABP will be able to see when the Bat Derogation Licence is granted, and obtain a copy of the final granted licence, by clicking on this link.** A copy of the Bat Derogation Licence Application is included in Appendix A.8.25. ***Measures to Protect Bats during removal of Roosts*** The following mitigation measures are proposed in relation to structures either confirmed as supporting bat roosts or considered to have the potential to support roosting bats: • Prior to demolition of the 19 structures containing confirmed bat roosts, replacement artificial roosts will be in place to ensure that bats are able to access alternative resting places at the earliest opportunity. • Where possible, buildings with the confirmed bat roosts will not be demolished during the breeding period or hibernation period (April to mid-August and November-March) as the risk of accidental death or injury is higher at this time. Bats may use roosts in smaller numbers in winter but may nevertheless be present. Outside of these periods, the approach to demolition of bat roosts will determined on a case-by-case basis and subject to relevant licence conditions. • Buildings confirmed as bat roosts proposed for demolition will be marked on the ground with agreed paint marking to permit identification by Contractors. • Prior to demolitions, all structures that were confirmed as either having bats or having high potential for bats will be re-examined immediately prior to demolition to assess whether bats are present at the time of demolition. This will be an all-night examination to determine if bats enter the building during the night or early morning. This will provide adequate information to proceed with demolitions unless weather conditions were unsuitable for feeding bats. If bats are present, then they will require exclusion from the property over several nights or if possible physical removal by hand by a licenced bat specialist to be placed in a bat box or similar for release in the evening after capture. For structures which have not been confirmed as bat roosts but regarded to have high potential for bats, a bat detector assessment of the property to be demolished will be carried out (note demolitions will not be permitted during the period May to August (the breeding period) in the case of the confirmed bat roosts, as the risk of accidental death or injury to bats is too great at this time). This will be an all-night examination to determine if bats enter the building during the night or early morning. This will provide adequate information to proceed with demolition unless weather conditions were unsuitable for feeding bats. If bats are present, then they will require exclusion from the property over several nights or if possible physical removal by hand by a licenced bat specialist to be placed in a bat box or similar for release in the evening after capture.	Significant residual impacts will still remain as some of the activities are unavoidable and can only be mitigated to a certain level of certainty: • Demolition of 19 buildings within the Assessment Boundary which will affect 23 bat roosts of Soprano pipistrelle bats, Common pipistrelle bats, Brown long-eared bats and Lesser horseshoe bats, Leisler's bat roosts and unidentified Myotis species including: - One satellite roost for Lesser horseshoe bats will be demolished at Aughnacurra (PBR178) (a satellite roost for the Menlo Castle (PBR06) Lesser horseshoe maternity roost) and the loss of another Lesser horseshoe bat night roosts (PBR210) within their foraging area could result in an impact on the Lesser horseshoe bat at a national geographic scale, in the absence of any measures to address this impact. • Trees will be felled (PTR48, PTR45, PTR43) that have been confirmed as supporting bats (Leisler's bat (PTR48) and Pipistrelle bats, respectively (PTR45 and PTR43) and an additional 13 trees have high (or category 1 as per 2014 – 2018 classification) potential to support bats and will also be felled

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Once structures containing roosts are deemed to be clear of bats, the bat specialist will be on site to supervise the demolition procedure until the structure is no longer deemed able to support a bat roost. Bats may re-enter a partially demolished structure overnight so the bat specialist may be required to be present during demolition works until they are completed. The following mitigation measures are proposed in relation to those trees identified as having high potential to support roosting bats. These include the three trees confirmed to have had bats present (PTR43, PTR48, and PTR45) and the 13 other trees to have high suitability, where either obvious potential roosting features are present, or where obscured by dense ivy cover, the tree is of an age and condition that there is a high chance that roosting features are present. Figures 8.25.1 to 8.25.15 and Figures 8.26.1 to 8.26.15 shows the locations of these trees but a more detailed drawing will be provided to the contractor prior to any felling works. Bats could occupy suitable roosting features at any time prior to the commencement of works. Therefore, there is an inherent risk that bats could be affected by the proposed felling works. The following mitigation procedures will be followed: • Felling of confirmed and potential tree roosts will be undertaken during the period September – October as during this period bats are capable of flight and may avoid the risks from tree felling if proper measures are undertaken, but also are neither breeding nor in hibernation • Use of detectors alone may not be sufficient to record bat emergence and re-entry in darkness. Therefore, prior to felling of confirmed and potential tree roosts, an emergence survey using infra-red illumination and video camera(s) and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present • Where it is safe and appropriate to do so for both bats and humans, such trees may be felled using heavy plant to push over the tree. In order to ensure the optimum warning for any roosting bats that may still be present, the tree will be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist • Trees should only be felled "in section" or "soft felled" where the sections can be rigged to avoid sudden movements or jarring of the sections • Where remedial works (e.g. pruning of limbs) is to be undertaken to trees deemed to be suitable for bats, the affected sections of the tree will be checked by a bat specialist (using endoscope under a separate derogation licence held by that individual) for potential roost features before removal. For limbs containing potential roost features high in the tree canopy, this will necessitate the rigging and lowering of the limb to the ground (with the potential roost feature intact) for inspection by the bat specialist before it is cut up or mulched. If bats are found to be present, they will be removed by a bat specialist licenced to handle bats and released in the area in the evening following capture • Prior to felling the three confirmed tree roosts (PTR43, PTR48, PTR45) and any other trees with potential for a bat roost, at least two replacement bat boxes will be installed on trees, as close to each felled tree as possible, with potential for a bat roost, as close as possible but away from the carriageway of the proposed road and before the end of July in the year of felling. These boxes will be a mixture of hollow (for Liesler's) and crevice types (for pipistrelles) in accordance with the potential roost that is lost. The location of the bat boxes in these instances will be within the Assessment Boundary but will be decided by the bat specialist. Where a suitable tree cannot be identified in close proximity to a known bat tree roost/potential bat tree roost, the next most suitable tree, within the Assessment Boundary, in an appropriate location (i.e. avoiding the roadside) will be selected by the bat specialist. ***Measures to preserve flight paths across Construction areas*** It has been identified that during the construction phase, the removal of woodland and hedgerows and other intervention in the landscapes used by bats can open up habitats to the extent that bats will not want to risk crossing the new open space to reach other roosts and foraging areas on the other side. This severance of flight paths will continue throughout the construction phase. The *Report WC1060 Development of a Cost-Effective Method for Monitoring the Effectiveness of Mitigation for Bats* crossing linear infrastructure includes best practice principles to address the general lack of evidence to show that many "conventional" mitigation measures work. These principles are reproduced below and have been adopted in the mitigation strategy for the Project: • *"Mitigation should be integrated into the scheme from the earliest opportunity: mitigation should be considered during the planning and design stage of the infrastructure so that it can be incorporated effectively* • *Crossing structures should be placed on the exact location of existing bat commuting routes: attempts should not be made to divert bats from their existing commuting routes* • *Crossing structures should not require bats to alter flight height or direction: this will depend on the topography of the site: If the road is to be elevated above ground level an underpass may be used to preserve the commuting route below it, or if the road is in a cutting a green bridge may be used to carry the commuting route over the road* • *Crossing structures should maintain connectivity with existing bat commuting routes: connectivity must be maintained with undisturbed bat flight paths (e.g. treelines, hedgerows, woodland rides and streams), and bat habitat (e.g. woodland) within the surrounding landscape. Crossing structures should not be exposed or sited within open ground* • *Over-the-road structures such as green bridges should be planted with vegetation: vegetation should be continuous and connected (see above) and sufficiently mature before road construction (e.g. by planting either relatively mature trees or fast growing tree species in advance of construction commencing)* • *Underpasses should be of sufficient height: underpasses should be as spacious as possible with height being the critical factor. The minimum requirements for underpass height will be species-specific. Required heights will generally be lower for woodland-adapted species (~3 m) compared to generalist edge-adapted species (~6 m), but larger underpasses will accommodate more species* • *Green bridges should be of sufficient width: In addition to being vegetated, green bridges should be as wide as possible, to provide a large area for bats to commute across. Further research is needed to determine exact dimensions. We found a 30m wide green bridge to be effective in this study* • *Crossing structures should be unlit: The effects of light on bats are species-specific and lighting should be avoided* • *Access and connectivity must be maintained: It is important that access to crossing structures is maintained (e.g. grilles should not be installed on underpasses) and that connecting vegetation is retained indefinitely or for as long as the mitigation structure is required* • *Disturbance should be minimised during installation of mitigation structures: For example, by limiting noise and light pollution along the bat flight path, minimising vegetation clearance, installing suitable temporary crossing structures (which should also be subject to monitoring and evaluation), completing the installation as quickly as possible and ideally avoiding the summer months when bats are most active"* The installation of temporary fencing across sites to replace connecting features has been used and appears to have only been monitored as part of one project in Switzerland (Britschgi et al, 2004). In this study, a 1m wide x 1.5-2m high artificial hedgerow was recorded to be followed by a proportion of the bats in a roost. It is proposed to apply similar measures in key locations to ensure that there are linear features to connect habitats across the construction footprint. In order to inform siting of mitigation measures, including the temporary fencing described above during the construction phase, a series of infra-red/thermal camera surveys using a series of cameras and bat detectors along linear features in the following locations will be carried out in the optimum activity season. This will help to identify the preferred crossing points at the following sections: • Area 1: North of Bearna Woods • Area 2: Aughnacurra	• Loss of foraging habitat is regarded to be most significant in the Menlough area where woodland-pasture-hedgerow habitat is being lost and is within the CSZ for the nationally-important population of Lesser horseshoe bats. • Inevitable elevated mortality rates due to vehicle collisions • Mortality and severance/barrier effects caused by the Project on individual bats. Whilst best practice has been followed in the design of the Project and the inclusion of underpasses/culverts and a wildlife overpass, a small proportion of the local bat population will inevitably fly over the Project and be vulnerable to vehicle collisions. A small proportion of the population will also be adversely affected by the barrier effect posed by the Project across the landscape. The effect of this residual impact on Lesser horseshoe bats is predicted to be significant at a national geographic scale. The impact on other bat species is predicted to be significant at a local geographic scale. • Design measures are proposed to minimise the potential for significant negative effect at a local geographic scale from compound lighting effects These residual impacts have been addressed further by the proposal for specific compensatory measures, which are further discussed in Section 22.4.2 below.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Area 3: River Corrib to Coolough Road • Area 4: West of N84 Headford Road • Area 5: Ballindooley to Castlegar Each area will be surveyed three times to record bats in flight in these locations with the precise vantage points for cameras to be determined during daytime surveys. Any existing features that are identified as preferred crossing points and are scheduled for removal will be retained until the last moment and a portable artificial crossing structure put alongside it prior to its removal, so at no stage there is a gap across the construction site at night. The use of the temporary fence as an artificial crossing structure will be monitored three times over two weeks following installation. If the artificial crossing structure is not at the same location as a proposed permanent crossing point (e.g. the wildlife overpass at Castlegar) then it shall be moved gradually over several nights to realign it with the permanent crossing point. The nature of the artificial crossing structure may comprise lengths of camouflage netting, recycled Christmas trees roped together, portable planters or artificial plants that can be easily moved at morning and evening to ensure that the crossing is in place each night. No artificial lighting will be used at any watercourse crossings during construction to ensure that bats are not displaced or prevented from using the riparian corridors for commuting or foraging. ***Proposed monitoring programme*** As the baseline level of bat activity and roost occupancy can change over time, pre-construction monitoring will be carried out in advance of construction works commencing to ensure that the data against which the post-construction monitoring will be compared to is as up-to-date as possible (refer to Bat Derogation Licence included in Appendix A.8.25). Monitoring of the effectiveness of the bat mitigation and compensation measures will also be undertaken during and post-construction. Where the monitoring identifies issues with either the mitigation or compensation measures, these will be remediated to ensure that those measures will achieve their aims with respect to mitigating or compensating for impacts on the local bat populations (refer to Bat Derogation Licence included in Appendix A.8.25). *Pre-construction monitoring* Pre-construction monitoring is required to provide data against which the post-construction monitoring can be compared. Parameters will include: • Occupancy levels in roosts (Menlo Castle, proposed artificial roost buildings including retrofitted retained buildings, bat boxes) • Bat passage structures (culverts, underpasses and the Castlegar Wildlife Overpass) • Diversity of bat species and abundance of bat activity adjacent to the Project Occupancy levels in Menlo Castle will be measured by emergence surveys using infra-red video camera recording monthly from mid-April to September in the year of or immediately prior to construction commencing (whichever of the two is closer to the construction commencement). Monitoring for bat usage of proposed bat passage structures will focus on recording bats using existing flight paths at proposed underpasses near Menlo Castle, the N59 Letteragh Junction and the proposed Castlegar Wildlife Overpass. Pre-construction baseline data is required on numbers of bats and flight height so that this can be compared to a post-construction scenario. Such data will be collected using focused infra-red camera and detector surveys carried out at least on three separate occasions at each location in the optimum survey period. In accordance with CEDR (2016) guidance it is proposed that this pre-construction monitoring involves a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for two bat activity seasons (May-August) following completion of the construction of the Project. The risk of adverse effects on bat diversity and abundance adjacent to the Project can never be ruled out completely; but not all populations will be affected in the same location in the same way and therefore ongoing monitoring is regarded to be good practice to enhance our understanding of the effects of road developments and the effectiveness of mitigation measures. Diversity of bat species and abundance of bat activity adjacent to the Project will be monitored using standardised survey transects from the edge of the Assessment Boundary outwards as described by Berthinussen & Altringham (2015). These transects will be used to record bat activity across the lands flanking the corridor of the Assessment Boundary. It is proposed that six transects are surveyed pre-construction in locations of high bat activity where underpasses or an overpass are proposed. Refer to the Operational Biodiversity section below in relation to ***"During and Post Construction Monitoring"***	
Badger	Badger, and their breeding and resting places, are protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure a Badger or to wilfully interfere with or destroy their breeding or resting places (setts). A comprehensive suite of mitigation measures has been incorporated into the Project to ensure that Badgers are not intentionally killed or injured and that any impacts to their breeding or resting places will not affect their conservation status, at any geographic scale, and will not give rise to any likely significant effects on the species. The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (National Roads Authority, 2006)*. These guidelines set out the best practice approach in considering and mitigating impacts on Badgers during construction works. A detailed summary of the mitigation measures as they relate to each of the Badger setts within the ZoI of the Project is presented in Appendix A.8.26. The non-interference zones (30m, 50m and 150m), as they relate to each of the Bader setts within the ZoI of the Project, are shown on Figures 8.38.1 to 8.38.15. As the usage of setts by Badgers can change over time, a pre-construction check of the activity status of all setts will be required within 12 months of any constructions works commencing within the ZoI of the setts discussed below. ***Disturbance/displacement*** In order to prevent any disturbance to Badger setts not directly affected by the Project, no heavy machinery shall be used within 30m of Badger setts at any time. No works shall be under taken within 50m of active setts during the breeding season. Lighter machinery (generally wheeled vehicles) shall not be used within 20m of a sett entrance. Neither blasting nor pile driving shall be undertaken within 150m of active setts during the breeding season (December to June inclusive). Prior to works commencing, a non-interference zone of 30m will be established around each of the Badger setts within the ZoI of the Project, as shown on Figures 8.38.1 to 8.38.15. If the sett is active, a non-interference zone will be extended to 50m during the breeding season (December to June inclusive). The fencing shall be as noted in Chapter 7, Construction Activities of a sufficient durability to maintain the exclusion zone throughout the construction period or, if required, until such time as the sett in question is excluded/removed.	No likely significant residual effect on Badger, at any geographic scale.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	The mitigation measures, as they relate to each of the Badger setts within the ZoI of the Project, are summarised in Table 8.43 of Chapter 8, Biodiversity and illustrated on Figures 8.38.1 to 8.38.15. Badger passage facilities will be checked prior to the operation of the Project to ensure they are constructed in accordance with the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006a). ***Loss of breeding/resting sites*** Where setts require exclusion and removal, or temporary exclusion for the duration of the construction period, this will be undertaken in accordance with the methodology detailed in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (National Roads Authority, 2006a)*: • All Badger setts requiring exclusion and removal will require a monitoring period of at least five days to confirm activity status in advance of any construction works commencing • If the sett is active, then it shall not be removed within the Badger breeding season (December to June inclusive). To exclude or remove an active Badger sett outside of this period, inactive entrances shall be soft and hard-blocked with one-way gates installed on active entrances. One-way gates will be tied open for three days before being set to exclude, and then monitored for a period of at least 21 days before the sett is deemed inactive and destroyed. If at any time during the monitoring period the sett becomes active, the exclusion process/programme must commence again from day 1 of the 21-day monitoring period • For inactive setts, entrances will be soft-blocked (lightly blocked with vegetation and soil) and if all entrances remain undisturbed for a period of five days the sett should be destroyed immediately. This can be undertaken at any time of the year for inactive setts • An artificial sett is required to mitigate for the loss of the main sett (S9), in conjunction with a subsidiary sett (S11), of the Lackagh Badger group. The requirements relating to the provision and design of the artificial sett are set out in Appendix A.8.26. The location of the artificial sett is shown on Figures 8.38.1 to 838.15[3]. • Inaccessible areas (see Figures 8.4.1 to 8.4.15 and Figures 8.5.1 to 8.5.15) will require a pre-works survey for badger setts in advance of site clearance. If a sett is uncovered, works must cease and a non-interference zone of 30m established; extended to 50m during the breeding season if set is active (December to June inclusive). Sett removal will follow the process outlined above	
Other Mammal Species	***Habitat degradation - water quality*** The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined are outlined below for hydrology.	No likely significant residual impact on any other mammal species, at any geographic scale.
Invertebrates	***Swan Mussell*** <u>Habitat Degradation – Surface Water Quality</u> The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology. ***Marsh whorl snail*** <u>Habitat Degradation – Surface Water Quality</u> The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology. <u>Habitat Degradation – Groundwater</u> The mitigation measures relating to the protection of the groundwater resource during construction are outlined below for hydrogeology. ***Marsh fritillary butterfly*** <u>Mortality Risk</u> To avoid the destruction of Marsh fritillary eggs or the mortality of Marsh fritillary caterpillars, the following mitigation strategy will be implemented in relation to the site clearance works: • All areas within the Assessment Boundary, which have been identified as suitable habitat to support the Marsh fritillary butterfly, will be subject to a pre-construction larval web survey. This will be undertaken during the mid-August to the end of September window immediately preceding site clearance works • If larval webs are present, they will be translocated to another area of suitable habitat; either outside of the Assessment Boundary or, if within, to an area of suitable habitat that will remain unaffected by construction works for the duration • If larval webs are present, the larval webs will be moved by translocating vegetation turves which contain the host plant species (*Succisa pratensis*) with larval webs present • The vegetation turves will be moved to the receptor site(s) immediately following excavation to ensure they do not dry out. The translocated turves will be set into existing vegetation immediately adjacent to the area of *Molinia* meadow and/or Wet heath habitat being retained (locations described below) and will be fenced off to prevent any accidental damage from construction works. Care will be taken to ensure that any specimens of *Succisa pratensis* with larval webs present will be at the centre of the turves. Turves will be fully bedded in at the receptor site(s) to ensure there are no exposed edges vulnerable to drying out • Four locations within the Assessment Boundary that are suitable receptor sites. The first location is at Ch. 0+900, an area of wet grassland (GS4)/Annex I Molinia meadow [6410] habitat that is being retained within the proposed development boundary (Figure 8.38.1 of this updated EIAR). The second location is at is at Ch. 3+000, a mosaic of Annex I Wet heath [4010], wet grassland (GS4) and Annex I Dry heath [4030] habitat that is being retained within the proposed development boundary (Figure 8.38.3 of this updated EIAR). The third location is at is at Ch. 3+000 of the proposed N6 GCRR, a mosaic of Annex I Wet heath [4010], wet grassland (GS4) and Annex I Dry heath [4030] habitat that is being retained within the Assessment Boundary (Figure 8.38.3). The fourth location is between Ch. 12+20 and Ch. 12+400 of the proposed N6 GCRR, an area of wet grassland (GS4)/Annex I Molinia Meadows [6410] habitat that is being retained within the Assessment Boundary (Figure 8.38.9) • Once all larval webs have been removed from the affected areas, or if no larval webs were recorded, the vegetation will be immediately cleared or cut to ground level to render the area unsuitable for the species to recolonise. The vegetation shall be maintained in this state until such time as the topsoil is removed	***Swan Mussell*** No likely significant residual impact on the swan mussell, at any geographic scale. ***Marsh whorl snail*** No likely significant residual impact on the Marsh whorl snail, at any geographic scale. ***Marsh fritillary*** No likely significant residual impact on the Marsh fritillary butterfly, at any geographic scale. ***Other Invertebrate Species*** The Project will remove some habitats in the Menlough-Coolagh area that may support local bees, but these habitats are of low diversity and less important for bees compared to species-rich meadows. No likely significant negative effects on bees are predicted during operation and no mitigation measures are required. Significant residual effects on the local bee populations are not predicted to occur.

[3] The closer an artificial sett is to the main sett being removed, the more likely it is to be used by the affected Badger group. Therefore, the artificial sett is proposed to be located approximately 60m to the north of S9. As the sett must be in place several months before works commence and the sett S9 is removed, the affected Badgers will have sufficient time to either adjust to the construction works in the vicinity of the artificial sett (which will involve blasting and rock breaking), relocate to another sett (e.g. S10), or construct a new sett elsewhere within their territory. Any disturbance from the construction works will be short-term and, even if the artificial sett is vacated during construction, its proximity to the operational road is not likely to deter badgers from occupying the sett at that time.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Birds	**Breeding Birds** ***Habitat Loss, Disturbance and Destruction of Breeding Habitat*** <u>General</u> Where feasible, vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed, between the 1 March and the 31 August, to avoid direct impacts on nesting birds. Where the construction programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within 3 days of the nest survey, otherwise repeat surveys will be required. **Barn owl** The mitigation measures to reduce the negative impacts of roads on Barn owls are set out in the Survey and Mitigation Standards for Barn owls to inform the Planning, Construction and Operation of National Road Projects (TII, 2021). The mitigation measures are designed to: • Reduce the direct effects, disturbance and displacement of breeding Barn owls during the construction phase of National Road Projects; and • Reduce incidents of mortality of Barn owls during the operational phase of National Road Projects. To minimise the potential for construction works to affect the nest site at Menlo Castle, all works which have the potential to cause disturbance will be undertaken outside of the Barn owl breeding season (i.e. when there is no breeding activity at the nest site). The Barn owl breeding season is typically from February to July, but can extend into October/November. Shawyer (2011) recommends a protective buffer zone of 150 – 175m for construction activity involving commercial vehicles and heavy machinery. Based on the specifics of the nature, scale and proximity of the Project to the nest site, the disturbance free zone (i.e. exclusion buffer) will be a minimum of 150m from the nest site during the Barn owl breeding season. Construction works can be carried out outside of this zone at any time of the year as this will not constitute a disturbance to the breeding pair or nest site. Construction works must only be carried out in proximity to the nest (i.e. within the defined disturbance free zone) when it is confirmed that there is no breeding activity at the nest, which is typically during the months of September to February. However, the breeding status at this site must be assessed by a Barn owl specialist in advance of the commencement of works (within the defined disturbance free zone) to determine breeding activity at the time as Barn owls can breed at any time of the year. If any potentially suitable Barn owl sites are to be directly affected or lie within 175m of the Project by the construction of the Project (including enabling or site investigation works such as ground investigations), a Pre-Construction survey will be undertaken according to the methods as outlined in the Survey and Mitigation Standards for Barn owls to inform the Planning, Construction and Operation of National Road Projects (TII, 2021). The purpose of the pre-construction survey is to determine Barn owl occupancy and breeding status at a site in advance of the initiation of works, where the construction activities could cause disturbance to a breeding pair, if present. The timing of works will be planned to avoid the main nesting period of Barn owls so that the potential of breeding activity at these sites is considered low. A single visit, according to best practice methods is usually sufficient to determine breeding status. The Pre-Construction survey must be carried out in advance of but in the same year (and timed accordingly to determine breeding activity at a particular time in that year). If breeding activity is recorded, then works which would cause disturbance or negatively impact a site or breeding attempt must not be carried out until after the breeding season (which should be assessed by the Barn owl Specialist). If no breeding activity is recorded, then works can proceed. Barn owls can use sites (particularly buildings) throughout the year and may be present outside of the breeding season, however, if it is confirmed that there is no breeding activity then works can continue. To further minimise the effects of current levels of disturbance to the Barn owl nest site at Menlo Castle, and thereby reduce any cumulative effect that construction activities nearby may have, alternative nesting sites will be provided in the vicinity. Three Barn owl nest boxes will be erected across the area shown on Figures 8.38.1 to 8.38.15, at least 500m from the road edge, and will consist of either nest boxes erected on suitable trees or pole-mounted nest boxes. Preference will be given to erecting nest boxes on suitable trees, where possible. Tree mounted boxes will be erected at least 3m above ground level on a mature tree with few or no low branches to obscure the nest box. The selected tree shall be either isolated in a hedgerow or situated on a woodland edge with the access hole facing open ground. Pole-mounted nest boxes will be erected at a minimum height of 4.5m above ground. The nest box design (e.g. entrance hole size, floor area and depth from the bottom of the entrance hole to the nest) shall be in accordance with the design requirements published by The Barn Owl Trust (http://www.barnowltrust.org.uk/). Nest boxes will be inspected annually for defects/damage and cleaned out/repaired as required to ensure waterproofness and the internal box depth. ***Peregrine falcon*** Both of the former Peregrine falcon nest sites in the northeast corner of Lackagh Quarry will be retained. The precise locations have not been divulged in this updated EIAR due to the risk of persecution to the species. Galway County Council and/or BirdWatch Ireland will need to be consulted to ascertain their precise locations to ensure their retention and protection from works. To minimise the potential for construction works near Lackagh Quarry to disturb the Peregrine falcon nest site, works from the Lackagh Tunnel to the N84 Headford Road Junction will commence prior to mid-February. This will ensure that any construction related disturbance, if its magnitude displaces Peregrine from the quarry for the duration of construction works, can influence the selection of the nest site and will not impact upon an incubating female on the nest. Rock-bolts will not be installed in the immediate vicinity of an active peregrine falcon nest site during the breeding bird season (1 March to 31 August). An alternative nest site for Peregrine falcon will be provided on Galway City Council owned lands to the southeast of Lackagh Quarry as indicated on Figure 8.38.16. This artificial nest site will be in place prior to the commencement of works which have the potential to disturb or displace breeding Peregrine falcon in Lackagh Quarry. The alternative nest site will be provided in accordance with the design requirements set out in the report prepared by BirdWatch Ireland (Appendix A.8.16 - Part 4). An artificial peregrine falcon nest box will be installed at each of the two former nest sites in Lackagh Quarry. Remediation works will be carried out at the two ledges to create a level and stable substrate for the nest boxes. The artificial nest boxes will be securely anchored to the cliff face at each location and will be provided in accordance with the design requirements set out in the report prepared by BirdWatch Irelan. The objective of the mitigation is to ensure that Peregrines, if displaced from the previously used nesting ledges in the quarry, can remain and breed in the area. Although it is not possible to guarantee uptake of the artificial nest site, the provision of this site will increase the likelihood of the continued occupation of breeding Peregrine in Lackagh Quarry and its surrounds which would mitigate the significant negative residual effect on Peregrine at the local and county geographic scale.	**Breeding birds** No likely significant residual impact on breeding bird species, at any geographic scale, with the exception of the Barn owl and the Peregrine falcon. Due to the likely permanent loss of Lackagh Quarry as a nesting site, the Project is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale. In the absence of an evidence regarding the efficacy of the mitigation measures to reduce mortality risk, there remains the potential for permanent impacts on the Menlo Castle Barn owl nest site due to its proximity to the Project and local Barn owl population as a result of the mortality risk which may result a significant negative residual effect on Barn owl, at the local geographic scale

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	The combination of providing an alternative nest site in advance of construction works commencing, in conjunction with construction works in Lackagh Quarry commencing in advance of the breeding season, as well as not temporarily making existing nesting ledges unavailable for nesting Peregrine for the duration of construction, will allow the Peregrine falcon a choice of nest sites during the construction period. This strategy will maximise the opportunities for the local breeding pair of Peregrine falcon to retain occupancy of their breeding territory throughout the duration of the construction period. Monitoring of Peregrine falcon breeding activity at both Lackagh Quarry and the proposed alternative nest site will be undertaken throughout each breeding season over the entire construction period to ascertain any nest success/failure of the local breeding pair and if blasting is affecting numbers of common Peregrine falcon prey species. Use of the artificial nest sites will also be monitored during operation of the Project for a period of three years. **Wintering Birds** **Measures to Protect Wintering Birds during Construction** Construction noise will be kept to a minimum in accordance with BS 5228 (2009). The contract documents will specify that the Contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (National Roads Authority, 2014). Blasting associated with the eastern approach to Lackagh Quarry (Ch. 11+800 to Ch. 12+100) will be carried out between the months of April to September (inclusive) to minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance. Blasting associated with the cutting at Castlegar (Ch. 12+550 to Ch. 13+650) will take approximately nine months to complete, with an estimated five blast events per week. To minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance, all of those nine months must be in the April to September period (inclusive) within consecutive years.	**Wintering birds** No likely significant residual impact on wintering bird species, at any geographic scale.
Amphibians	***Habitat Loss, Disturbance & Mortality Risk*** If works to clear any of the habitat features suitable to support amphibian species are to begin during the season where frogspawn or tadpoles may be present (February – mid-summer), or where breeding adult newts, their eggs or larvae may be present (mid-March – September), a pre-construction survey will be undertaken to determine whether breeding amphibians are present. In the case of Common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Project. In the case of Smooth newt, individuals will be captured and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Project. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating Smooth newt. If the size or depth of the habitat feature is such that it cannot be determined whether all amphibians have been captured, it will be drained under the supervision of a suitably experienced ecologist to confirm that no amphibian species remain before it is destroyed or infilled. Any mechanical pumps used to drain the habitat feature will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism. Any capture and translocation works shall be undertaken immediately in advance of site clearance/construction works commencing. ***Habitat Degradation – Surface Water Quality*** The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for Hydrology.	No likely significant residual impact on the Common frog or the Smooth newt, at any geographic scale.
Reptiles	**Measures to Protect Reptiles during Construction** ***Habitat Loss, Disturbance & Mortality Risk*** In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, Common lizard the following schedule of site clearance works will be followed in the areas highlighted on Figures 8.14.1 to 8.14.8 and Figures 8.15.1 to 8.15.8, where the presence of Common lizard has been confirmed: • Grass, scrub or heath vegetation will be removed during the winter period, where possible, avoiding potential Common lizard hibernacula sites (dry sites which provide frost-free conditions e.g. stone walls, underground small mammal burrows, piles of dead wood or rubble) • Where this is not possible and clearance will be undertaken during the active season (March through to September, inclusive), vegetation will be cut first to approximately 15cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area • Stone walls (or other potential hibernacula sites) will be removed during the active season (March through to September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards	No likely significant residual impact on the Common lizard, at any geographic scale.
Fish	**Measures to Protect Fish Species during Construction** ***Habitat Loss*** The structures have been designed in consultation with IFI and in accordance with the design criteria set out in *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (National Roads Authority, 2005) and the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016). These measures, which include, in broad terms replicating the existing channel profile and substrate, will likely minimise the effects of habitat loss to a degree but it is acknowledged that this will be limited by the fact that they are artificial channels within a light limiting box structure. To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the Assessment Boundary, but not within the footprint of the Project and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 5m from the river bank and within this zone the natural riparian vegetation will be retained. ***Habitat Degradation – Surface Water Quality***	No likely significant negative residual impact on fish species, at any geographic scale.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology. ***Habitat Degradation – Groundwater*** The mitigation measures relating to the protection of the groundwater resource during construction are outlined below for Hydrogeology. ***Mortality Risk & Disturbance/Displacement*** To minimise the potential effects of construction works on fish species the following mitigation measures will be implemented: • No instream works will be carried out between the months of October and June (inclusive) to avoid the most sensitive time for fish species and fish species movements • Design of new sections of river channel shall be in accordance with the principles outlined in *Channels & Challenges. Enhancing Salmonid Rivers* (O'Grady, 2006) • Immediately prior to rivers/streams being diverted into a newly constructed river channel or culvert, they will be electrofished (if required) to capture and transfer fish from the original channel to the new one. Once the watercourse has been diverted this will be followed by a manual search of the original watercourse to transfer any remaining fish to the new river/stream channel • Any water abstraction points required for dust suppression will be agreed with IFI and the suction head shall be screened to ensure that fish are not removed during the abstraction process ***Habitat Severance/Barrier Effect*** All temporary crossing structures used to cross watercourses during construction will be designed in accordance with the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016) and *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (National Roads Authority, 2005) to maintain fish and macroinvertebrate passage, and to prevent sedimentation and erosion.	
Soils		
Earthworks construction	Construction techniques that comply with the requirements of statutory bodies in terms of noise, vibration, soil and groundwater contamination and disposal of contaminated material for both soil and rock cuttings will be adopted. **Loss of Topsoil and Subsoil, and Loss of Solid Geology** All earthworks will be undertaken in accordance with a project-specific earthworks specifications ensuring that all excavated material and imported material is classified appropriately so as to allow maximum opportunity for the reuse of materials on the Project. As outlined in Appendix A.9.3, careful handling is essential to retain any existing structure and integrity of the excavated materials, where minimising agitation of the acrotelm will safeguard important processes such as carbon sequestration. The following principles will be employed when handling peat at the construction phase of the Project: • Minimise plant movements and haul distances in relation to any peat earthworks activities by utilising the nearest available Material Deposition Area (MDA) (where peat is permitted) • Appropriate temporary storage areas for excavated peat close to the excavation will be developed • Peat placement will occur as soon as possible after excavation where practicable Excavated topsoil will be stockpiled using appropriate methods to minimise the effects of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. To reduce the compaction and erosion of topsoil outside the areas of direct construction, haul routes will be along predetermined routes as detailed in Chapter 7, Construction Activities of this updated EIAR, and deliveries will be along predetermined routes outside the Project extents. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practical, compaction of any soil or subsoil which is not part of the works or to remain in-situ within the site will be avoided. The contractor will ensure that any excavated topsoil, subsoil or rock is assessed for re-use within the Project ensuring the appropriate handling, processing and segregation of the material. Where practical the removal of excavated material from the Project will be avoided. Any surplus suitable excavated material that is not required in the Project, will be reused on other projects where possible. The reuse of this material as a by-product on other construction sites would be subject to Regulation 27 notification to the EPA. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to earthworks specifications of the source and destination sites. Alternatively, the surplus excavated material will be disposed of at suitable authorised waste facilities. Where appropriate, excavated material, including topsoil, subsoil, and crushed rock shall be reused as construction fill within the Project or placed in deposition areas. Excavated material will contribute to the construction material requirements for the Project. **Introduction of Material derived from a different Lithology** The CEMP included in Appendix A.7.5 of this updated EIAR, which is a working document and will be updated and finalised by the Contractor following appointment and prior to the commencement of the construction works, so as to include any additional measures required pursuant to any decision to grant approval. It includes within it details of the requirements of a construction earthworks programme which the Contractor will implement prior to earthwork activities taking place. The earthworks programme will categorise the source of material for each fill section which have been set out and assessed in this updated EIAR at Sections 9.4.2.1 and 9.5.3. The detailed construction earthworks programme will outline the use of all cut material on the haulage routes are identified on Figures 7.1.001 and 7.1.002 and assessed throughout this updated EIAR and will set out the continuous monitoring of earthwork movement. During the finalisation of this programme, the Contractor shall adhere to the fill limitations outlined below. To prevent impact to the local peatland habitats, described in Chapter 8, Biodiversity, of this updated EIAR the following fill limitations will be incorporated at the locations identified Table 9.19 of Chapter 9, Soils and Geology. • Only pavement and capping layers protected from surface water runoff and groundwater movements are permitted to be derived from non-native material • All other acceptable fill material will be derived from native material or other pH compatible material	The small loss of the Limestone pavement (all outside European designated sites) will result in a significant/moderate residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	Flood Barrier A drainage layer or starter layer, in accordance with the TII publication CC-SCD-00606, will be implemented for the construction of embankments in areas prone to flooding. The introduction of a drainage layer will ensure hydraulic conductivity exists across the flood plain and removes the risk of the embankment acting as a flood barrier. **Earthworks Haulage** Earthworks haulage will be along predetermined routes within and outside the Assessment as shown on Figures 7.101 to 7.123 of this updated EIAR. The identified haulage routes are along existing national, regional and local routes or within the Project extents. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain in-situ along the Project will be avoided. **Washout of Fines/Sediment Runoff** The use of granular fill material in embankment construction will remove the likelihood of the washout of fines. However, in the event the embankment will be constructed of local material in areas prone to flooding, the introduction of a drainage layer or starter layer (as discussed in Flood Barrier section above) will reduce the likelihood of run-off of fine material. Alternatively, the introduction of a geotextile separator will reduce the potential impact in areas. A composite system, combining a drainage layer and a geotextile separator will be implemented in embankments constructed with cohesive fill material. Sediment control methods are outlined in the CEMP in Appendix A.7.5 of this updated EIAR and in the Hydrology and Hydrogeology sections below. **Effect on Surrounding Ground** Where appropriate, ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations. The design limitations will ensure no cosmetic damage to adjacent properties. In situations where the site specific blast design has determined that blasting is not feasible in a particular location due to excessive ground vibrations, a blast exclusion zone, where blasting is not permitted, will be implemented. In such situations, alternative extraction methods such as hydraulic breaking, hydraulic splitting, chemical splitting and electrical disintegration may be implemented and monitored. Monitoring will be implemented during blasting, during excavation of cuts, for overburden slopes steeper than 1V:2H (V= vertical slope, H = horizontal slope) and rock slopes steeper than 1V:1.5H. As a precaution, prior to vibration and movement related construction works commencing (including blasting), pre-condition surveys will be undertaken for all receptors within a zone of influence. In line with best practice, a geotechnical expert will be appointed by the contractor and will be present to monitor the surrounding ground vibrations near sensitive receptors (including domestic dwellings) during blasting works. The Employer's Site Monitoring Team will be monitoring the reports on a weekly basis to ensure compliance with the commitments in relation to vibration limits. In the unlikely event that the blast vibration limit at the surface is exceeded, blasting works will cease on site until it is understood the basis for the increased vibration. The blast design will then be recalibrated and blasting works will proceed with continued monitoring. As per the 2018 EIAR, a key contact person will be appointed during the construction phase to facilitate communications between affected property owners, informing them of proposed works in their area, including blasting. After vibration and movement related construction works have ceased, a post condition survey will be undertaken for all receptors within a zone of influence. In the highly unlikely event that damage from vibration is observed, the damage will be repaired. Allowable distances for the various construction methods are given in the section below on Noise and Vibration. Construction of structures will be completed in accordance with the CEMP in Appendix A.7.5. The construction of the River Corrib Bridge, Menlough Viaduct, Lackagh Tunnel and Galway Racecourse Tunnel will meet the requirements of Appendices A.7.1, A.7.2, A.7.3, and A.7.4 of this updated EIAR respectively. Ground settlements and movement will be controlled through selection of the foundation type and method of construction which are suitable for the particular ground conditions. To minimise soil movements due to pile operations in the vicinity of sensitive receptors, each pile shall be constructed sequentially in a direction away from the sensitive receptor. Previously installed piles act as a shield as soil movements are greater in a direction away from a stiff zone, for example away from the piles and sensitive receptors.	
Reuse and processing of site material	A construction earthworks programme will be implemented for the Project as part of the CEMP, as outlined in Appendix A.7.5 of this updated EIAR, which categorises the source of material for each fill section. During the finalisation of this programme the fill limitations outlined in Section 9.6.2.1 will be incorporated at the locations presented in Table 9.19 of Chapter 9 of this updated EIAR.	No likely significant residual impact.
Importation, exportation and disposal of materials	Importation of materials from outside the site will be minimised by ensuring that materials arising within the site area are used to the greatest extent possible. Any surplus material remaining which cannot be incorporated into the construction fill activities shall be placed in material deposition areas within the Project. This will significantly reduce the deposition of material off-site. Hazardous material will be transported off site for disposal or recovery at appropriately licenced or permitted sites as outlined above in Construction Activities.	No likely significant residual impact.
Tunnelling	The adopted construction techniques will comply with the requirements of statutory bodies in terms of noise, vibration, soil and groundwater contamination and disposal of contaminated material. Engineering design solutions that reduce the effect on the integrity of the geological feature include sufficient rock above the tunnel bores, a suitable pillar between the bores to protect the tunnel from collapse and suitable blasting sequences. The site control measures include probing ahead of the tunnel and mapping of the tunnel blast face and monitoring of the blast. Where required the introduction of stability measures will be implemented including rock bolts, and a robust steel tunnel lining. These engineering design solutions will be monitored during construction. During the construction of Lackagh Tunnel the supported rock face of Lackagh Quarry Face and retaining walls for the Western Approach will be monitored for movement. A geotechnical expert will be appointed by the Contractor and will be present to monitor the rock mass stability during their construction period. In the unlikely event that instability within the rock mass is observed, additional support measures will be installed to ensure that there is no impact to the surface above. The additional rock support measures comprise ground anchors, rock bolts, rock dowels, rock mesh, shotcrete or a combination of these measures, designed to the relevant design standards and best practice guidance documents (Eurocode 7, BS8081). However, based on the conservative design approach it is considered that the risk of instability will be avoided and additional support measures will not be required.	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	A geotechnical expert will be appointed by the Contractor and will be present to monitor the vibrations at the surface, including the areas of Limestone pavement, during blasting works for the construction of Lackagh Tunnel and the Western Approach. The blast target vibration limit is defined as 20mm/sec, which is 20% more conservative than the conservative design approach vibration limit of 25mm/sec at the ground surface which includes areas of Limestone pavement, which provides an added factor of safety to the construction works to ensure that blasting will not impact the structural integrity of the Limestone pavement. In the unlikely event that the blast target vibration limit at the surface is exceeded, blasting works will cease on site until it is understood the basis for the increased vibration. The blast design will then be recalibrated and blasting works will proceed with continued monitoring. Further information on Lackagh Tunnel is presented in Appendix A.7.3 of this updated EIAR.	
Construction of Structures	Construction of structures will be completed in accordance with the CEMP in Appendix A.7.5 of this updated EIAR and as described in the following: • River Corrib Bridge Constructability Report Appendix A.7.1 of this updated EIAR • Menlough Viaduct Constructability Report Appendix A.7.2 of this updated EIAR • Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3 of this updated EIAR • Galway Racecourse Tunnel Constructability Report Appendix A.7.4 of this updated EIAR Ground settlements will be controlled through selection of the foundation type and method of construction which are suitable for the particular ground conditions. To minimise soil movements due to pile operations in the vicinity of sensitive receptors, each pile shall be constructed sequentially in a direction away from the sensitive receptor. Previously installed piles act as a shield as soil movements are greater in a direction away from the stiffer zone i.e. away from the piles and sensitive receptors. With respect to the Menlough Viaduct, the magnitude of the loss of the Limestone pavement was minimised during the design stage, where the number of piers and size of the pier footings were kept to a minimum. During construction, the Limestone pavement at Menlough Viaduct will be protected and will not be affected by implementing a protection system comprising of geogrid, protection geotextile and layers of material as shown on Plate 9.2 in Chapter 9, Soils and Geology. This will be removed once construction is complete. Refer to Menlough Viaduct Constructability Report in Appendix A.7.2 of this updated EIAR for further details.	The small loss of the Limestone pavement (all outside European designated sites) will result in a significant/moderate residual impact.
Contaminated ground	No known areas of contaminated ground were located within the study area. Samples of ground suspected of contamination will be tested for contamination during the detailed investigation and ground excavated from these areas will be disposed of to a suitably licenced or permitted site(s) in accordance with the current Irish Waste Management legislation. Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the site, and the proper use, storage and disposal of these substances and their containers will prevent soil contamination. For all activities involving the use of potential pollutants or hazardous materials, material such as concrete, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall also be adequately secured against vandalism and will be provided with proper containment according to codes of practice. Any spillages will be immediately contained and contaminated soil removed from the site and disposed of to an appropriately permitted or licenced site according to the current Irish Waste Management Legislation by the Contractor. The Contractor will make provision for removal of any concrete wash water. Concrete trucks will be directed back to their batching plant for washout. The arrangement for concrete deliveries to the site will be discussed with suppliers before commencement of work, outlining the agreed assessed routes, prohibiting on site washout and discussing emergency procedures. Good construction management practices will be employed to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater. Measures to be implemented to minimise the risk of spills and contamination of soils and waters will include: • Employing only competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures. • Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system, e.g., by a roll-over bund, raised kerb, ramps or stepped access. • The location of any fuel storage facilities will be considered in the design of all construction compounds and will be fully bunded. These are to be designed in accordance with relevant and current guidelines and codes of best practice at the time of construction. • All concrete mixing and batching activities will be located in designated areas away from watercourses and drains. • Potential pollutants will be adequately secured against vandalism in containers in a dedicated secured area. • Provision of proper containment of potential pollutants according to relevant and current codes of practice and legal requirements. • Thorough control during the entire construction stage to ensure that any spillage is identified at early stage and subsequently effectively contained and managed. • Spill kits to be provided and to be kept close to the temporary construction compounds. Staff to be trained on how to use spill kits correctly. Best construction management practices, as outlined in the Construction Industry Research and Information Association (CIRIA) Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters-Williams et al. 2001) will be reflected in the CEMP in Appendix A.7.5 of this updated EIAR. This 2001 guidance remains the most relevant guidance at the date of this updated EIAR. An Emergency Response Plan has been prepared and included in the CEMP in Appendix A.7.5 and will be further developed by the appointed contractor prior to the commencement of works and regularly updated, identifying the actions to be taken in the event of a pollution incident. The Emergency Response Plan will address the following: • Secure oil and chemical storage in over-ground bunded areas, limited to the minimum volume required to serve immediate needs with specified delivery and refuelling areas • No refuelling or fuel storage within 50m of waterways and only on a sealed surface • Emergency spill kits will be retained at sensitive locations, with portable kits provided to plant and equipment operators • Cessation of work and development of measures to contain and/or remove pollutant should an incident be identified • Silt traps will be employed and maintained in appropriate locations • Temporary interception bunds and drainage ditches will be constructed up slope of excavations to minimise surface runoff ingress and in advance of excavation activities • Excavation and earthworks will be suspended for review as required during and immediately following periods of heavy rainfall to minimise sediment generation and soil damage	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Karst features	As a minimum, the carriageway drainage network will be sealed in areas where the Project crosses rock particularly prone to karstification. Through the use of engineered solutions, including an impermeable barrier, cement slurry or grout, direct run-off from the paved surface of the Project will be prevented from entering into the rock along the proposed alignment, as this could cause further deterioration and instability of the rock mass. Individual mitigation measures will be assessed on a case by case basis by the designer, determined by the extent of karst and make-up of the Project as outlined in the karst protocol which is part of the CEMP in Appendix A.7.5 of this updated EIAR. Inspections of karst features will be undertaken by a hydrogeologist and/or geotechnical expert in order to determine the appropriate remediation measure. These remedial measures include but are not limited to the removal of all loose, soft, weak or voided soil material, backfilling voids with an agreed combination of boulders cobbles/chunk rock/cement slurry and installation of a high strength geosynthetic to form a competent, safe foundation platform. Mitigation measures for the protection of karst features are further outlined in the section below on Hydrogeology and included in the CEMP in Appendix A.7.5 as part of the karst protocol.	No likely significant residual impact.
Geological Heritage Areas	Prior to backfilling/removal of portions of the existing exposed rock face for the existing road cutting along the existing N6 in Doughiska (GC001), the Contractor shall notify the GSI to ensure a site visit can be arranged for an assessment of the rock face prior to backfilling/removal. Where the design permits (including environmental mitigation measures, safety requirements and engineering constraints), significant bedrock cuttings will be designed to remain visible. Where this cannot be achieved, digital photographic records of significant new excavations will be recorded by the Contractor and/or visits from GSI will be facilitated by the Contractor. In addition, the Contractor shall notify the GSI of bedrock cuttings to facilitate a site visit prior to any backfilling.	The small loss of a portion of a Geological Heritage Area (existing N6 Rock Cutting in Doughiska) will result in a significant/moderate residual impact.
Hydrogeology		
Groundwater Quantity and Quality	Through the evolution of the design of the Project measures were included in the design to reduce or avoid specific impacts where possible. The following measures were incorporated into the design of the Project: • No dewatering of the bedrock aquifer will occur during construction at Menlough Viaduct or Lackagh Tunnel (or its approaches). Furthermore, the construction sequence will take into account the seasonal groundwater fluctuation. During the winter groundwater high it may be necessary to limit the depth of works so that dewatering is not required. • Galway Granite Batholith EW01, 02 (three cuttings), 04, 07 and 09: Groundwater intercepted will be collected and piped to the surface water receptor it would naturally have drained to. • Limestone: Construction dewatering of the bedrock aquifer may seasonally be required in EW27 during peak groundwater levels. Any dewatering will be discharged to the same GWB. • Construction of the Galway Racecourse Tunnel and its approaches will require dewatering of the bedrock aquifer. All groundwater intercepted will be managed and discharged within the same GWB. • EW27: Groundwater will be controlled within the excavation by collection in drains or sumps. If groundwater is intercepted, it will be piped and discharged at an infiltration basin within the same GWB. Intercepted groundwater is controlled and infiltrates back to the same groundwater body. • Where infiltration basins are used for discharge of site runoff during construction the runoff will be managed on site, collected and treated as per the Sediment Erosion and Pollution Control Plan (Refer to Section 8 of the CEMP in Appendix A.7.5). • Where the zone of influence of groundwater dewatering extends below existing buildings then a property condition survey will be undertaken at the property prior to and during the construction period in accordance with commitment C18.19 of Chapter 23, Schedule of Commitments. • Commitment that all buildings within 50m of the Assessment Boundary or the zone of influence of dewatering (whichever is greater) are offered a property condition survey (as per ABP's Inspectors Report Section 11.9.120 dated 22 June 2021) The design of the Project includes dewatering of the bedrock aquifer in cuttings in the Galway Granite Batholith and in cuttings in the Visean Undifferentiated Limestone. The drawdown from these cuttings has been assessed. Drawdown impacts are limited in extent and do not impact on European sites or National Heritage Areas. No hydrogeological mitigation is proposed with regard to the design of construction dewatering. For the Visean Undifferentiated Limestone due to the risk of karst features being intercepted in excavations for earthworks (including viaducts, bridges and tunnels) and infiltration basins, mitigation measures have been developed to preserve the hydraulic connectivity of the feature and then seal it from the excavation. The Karst Protocol mitigation measure will ensure that there is no impact on groundwater flow paths to water dependant receptors. Karst mitigation plan is detailed in the CEMP in Appendix A.7.5 and is summarised below in the section below on Aquifer Specific Mitigation Measures. Those infiltration basins in the Lough Corrib Fen 1 (Menlough) GWB (S19a and S19b) shall have additional measures incorporated into their construction to provide further protection to the groundwater body. Infiltration basin S19a and S19b include lining the sides of the excavation to ensure vertical groundwater infiltration so that all discharges drain through the placed subsoil for the full thickness of the unsaturated zone. Mitigation of potential construction impacts will be achieved through the stringent implementation of good construction practice procedures and environmental controls so as minimise the opportunity for contaminated releases of construction runoff as set out in the CEMP (Appendix A.7.5). Such practices will include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance. The following measures included in the CEMP will be implemented to control the potential for pollution from accidental spillages on site: • Stockpiling of contaminated material is not permitted • Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the site during construction, and the proper use, storage and disposal of these substances and their containers will prevent groundwater contamination • For all activities involving the use of potential pollutants or hazardous materials, under the CEMP, the Contractor will be required to ensure that material such as concrete, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall also be adequately secured against vandalism and will be provided with proper containment according to codes of practice. Any spillages will be immediately contained and contaminated soil removed from the site and properly disposed of. • The Contractor will finalise the Incident Response Plan in the CEMP in Appendix A.7.5 prior to work commencing and regularly update it for pollution emergencies which will be developed by the appointed Contractor. The plan will identify actions to be taken in the event of a pollution incident as per CIRIA guidance. As recommended in the CIRIA guidance, the contingency plan for pollution emergencies includes the following: – Containment measures	There are no residual hydrogeological impacts to European sites and no residual impacts associated with Groundwater Dependant Terrestrial Ecosystems (GWDTE) on the Visean Undifferentiated Limestone. Profound residual hydrogeological impacts remain for groundwater level drawdown impacts below the location of five Annex I habitats and four non-Annex I habitats which are located on the Galway Granite Batholith: • Na Foraí Maola Thoir Annex I (Ch. 1+250 to Ch. 1+500) • Troscaigh Thiar Annex I (Ch. 1+850 to Ch. 2+400) • Aille Annex I (Ch. 3+600 to Ch. 3+850) • Ballyburke Annex I (Ch. 4+650 to Ch. 4+800) • Knocknabrona Annex I (Ch. 7+700 to Ch. 7+750) • An Baile Nua non-Annex I (Ch. 0+150) • Na Forai Maola Thoir non-Annex I (Ch. 1+150) • Barna non-Annex I (Ch. 3+100 and Ch. 3+400) • Knocknabrona non-Annex I (Ch. 7+850 to Ch. 8+150)

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Groundwater dependant receptors	– Emergency discharge routes – List of appropriate equipment and clean-up materials – Maintenance schedule for equipment – Details of trained staff, location and provision for 24-hour cover – Details of staff responsibilities – Notification procedures to inform the Environmental Protection Agency (EPA) or environmental department of the Galway County Council – Audit and review schedule – Telephone numbers of statutory water consultees – List of specialist pollution clean-up companies and their telephone numbers – No direct untreated point discharge of construction runoff to groundwater will be permitted. – Where a pollution incident is detected, construction works will be stopped until the source of the construction pollution has been identified and remedied. – Pollution control facilities and procedures set out in the Sediment, Erosion and Pollution Control Construction Management Plan included in the CEMP in Appendix A.7.5 will be implemented if required. – The pollution control and treatment facilities will be installed and the monitoring network including instrumentation and procedures established prior to construction activities taking place on the ground in the vicinity of watercourses and sensitive surface and groundwater receptors. It is envisaged that the pollution control facilities will be monitored daily to ensure their continued function. The above mitigation measures will ensure measures are in place to reduce accidental spills of fuels and oils and mobilisation of sediment as suspended solids. By undertaking the above measures, the risk of contaminants being mobilised offsite can be safely managed. In this regard, for all aquifers those areas downgradient of the Project that were identified as being at risk to groundwater quality impacts during the construction phase (pre-mitigation) are reduced. The spatial extent of the potential impact is reduced to the construction footprint. A number of mitigation measures have also been developed specifically for groundwater dependent receptors. These are detailed below for aquifer, supply wells and habitats. **Aquifer** Aquifer specific mitigation measures are implemented where karst or high permeability zones are encountered during the construction programme. In the event of karst being encountered the Karst Protocol shall be implemented, which is documented in the CEMP (Appendix A.7.5). Application of the Karst Protocol are summarised below to detail where they will be implemented: • Where karst features are encountered during construction works these will be assessed by a hydrogeologist and an engineering geologist. These features will require their extent across the Project to be delineated. In the case of excavations (road cuttings, tunnels, bridge pier excavations) then the karst feature shall be excavated and backfilled with course fill and sealed. This will prevent runoff draining into the feature and therefore protect against accidental spillage. On this basis, construction runoff will not discharge to a karst pathway and will receive natural attenuation and dilution in the aquifer • With regard to karst features being intercepted in excavations for earthworks (including viaducts, bridges and tunnels) and infiltration basins. The Karst Protocol preserves the hydraulic connectivity of the feature using granular material to fill but then seals the karst from the excavation using a liner (geotextile and or concrete depending on the site specifics) that will prevent linkage between excavation and the karst • Where dewatering of the bedrock aquifer is proposed, groundwater level monitoring will be installed before construction, during the construction phase and 12 months following construction to enable potential effects from dewatering to be identified. In the shallow cuts of the Project there will be minimal dewatering of the bedrock aquifer required; nonetheless, a monitoring programme will be in place. If the monitoring indicates there is a measurable impact beyond that stated in this updated EIAR, then work with the potential to increase drawdown will be made safe and cease until the hydrogeological assessment is revised based on the site conditions and mitigation employed if appropriate • In order to reduce potential contamination impacts, stockpiling of contaminated material and leachate generation will be prohibited. In the situation that potential contaminated material is encountered it will be tested and disposed of in an appropriate manner and in line with current water management legislation. If it is not possible to immediately remove contaminated material, then it will be stored on, and covered by, polythene sheeting to prevent rainwater infiltrating through the material. The time frame between excavation and removal will be kept to an absolute minimum Although the Galway Granite Batholith is a Poorly productive aquifer it is anticipated that faulting and fracturing will occasionally be encountered that may provide a flow path of up to a maximum distance of 100m. The implementation of the CEMP considers pathways in the granite like those that occur in limestone. On this basis, by implementing the CEMP contingency plan for pollution emergencies all accidental contaminant spills will be prevented from entering pathways in the granite. This will limit the extent of any fuel spill to the immediate site and limit the potential for contaminants solely to the construction footprint. **Supply Wells** The mitigation measures listed below will be adopted during the construction phase of the Project: • Nine wells (W50-10, W50-12, W50-13, W50-14, W50-15, W50-16, W50-17, W50-18, W50-19) will be decommissioned during the construction of the Project. These will each be mitigated by providing a replacement well, connecting to mains supply where available or by financial compensation. Where wells must be abandoned as part of the Project they will be sealed and abandoned in general accordance with Well Drilling Guidelines produced by the Institute of Geologists of Ireland (IGI 2007) • Replacement wells, storage tank, associated pumping equipment and pipework for Wells W50-13 and W50-14 will be commissioned and tested to ensure adequate yield rates in advance of wells W50-13 and W50-14 being decommissioned • Four wells (W50-02, W50-20, W500-01 and W1000-03) are listed in Chapter 10 of this updated EIAR have potential water quality impacts. The standard mitigation measures as part of the CEMP to reduce the risk of pollution reduce the risk to these wells so that the significance of impact is reduced to insignificant • Wells outside of the Assessment Boundary but within the drawdown zone of influence may be impacted by reduced groundwater levels during construction. All wells within 150m of the proposed development boundary (or 50m from the calculated drawdown ZoI if greater) will be monitored for water level monthly for 12 months before construction, during construction and for 12 months after construction. If the monitoring indicates that the Project has impacted on a supply or geothermal well then mitigation will be applied • Standard mitigation measures and aquifer specific mitigation measures are employed for protection of groundwater. To ensure the protection of quality of groundwater potable supplies, all wells within 150m of the proposed development boundary will be monitored for water quality monthly	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• All wells will be monitored for standard drinking water quality parameters monthly for 12 months before construction, during construction and for 12 months after construction. If the monitoring indicates that the Project has impacted on a supply, then mitigation will be applied **GWDTE** Those GWDTE that have been flagged as being at risk are all in areas where the groundwater pathways are karstic. In this regard the Karst Protocol (in the CEMP Appendix A.7.5), as detailed in the previous sections above, forms part of mitigation to prevent groundwater quality or quantity being impacted. Additional mitigation is also employed to ensure that European sites are not impacted. Construction activities represent a potential source of impact on the water quality of the Coolagh Lakes, which form part of the Lough Corrib SAC, from uncontrolled construction site runoff and potential contamination of the groundwater from construction spillages. There will be no surface water discharges to the Coolagh lakes and all runoff will be treated before being discharged to ground at infiltration basins. Infiltration basins are designed to include settlement to remove sediment and have an appropriate thickness of subsoil below invert level. Pouring of the concrete in excavations (River Corrib Bridge, Menlough Viaduct and Lackagh Tunnel) will only be undertaken when the excavation has been inspected by a qualified hydrogeologist. Inspection of the full depth and extent of each excavation will be undertaken to identify if any significant flow paths, such as the karst enhancement of the bedrock permeability, are present. If no significant flow paths are present, then the hydrogeologist will document accordingly and confirm that there is no risk to groundwater from concrete leakage. If significant pathways are present then impacts which may arise from flow along these pathways shall be designed by the hydrogeologist based on the karst mitigation plan, these may comprise of installing a high permeability zone to replace the groundwater pathways which would be removed by the foundations and/or sealing the linkage from excavation to protect the karst. The design of the mitigation measures shall be approved by a qualified hydrogeologist to confirm that there will be no negative impacts to groundwater. These above measures will ensure that the risk of pollution of groundwater bodies is controlled.	
Hydrology		
Drainage, general flood risk water quality, channel morphology and key ecological receptors	As is normal practice the CEMP included in Appendix A.7.5 will be finalised by the Contractor in advance of the commencement of construction and the following will be implemented as part this plan: • An Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, logging of non-compliance incidents and any such risks that could lead to a pollution incident, including flood risks (Refer to Section 10 of the CEMP in Appendix A.7.5) • A Sediment Erosion and Pollution Control Plan (Refer to Section 8 of the CEMP in Appendix A.7.5). This shall include water quality monitoring and method statements to ensure compliance with environmental quality standards specified in the relevant legislation (i.e. surface water regulations and Salmonid Regulations 1988) • All necessary permits and licenses for instream construction works associated with the provision of culverts, bridges and outfalls. OPW Section 50 consent has been received for all culverts and bridges proposed in this updated EIAR. Changes to these structures as part of the detailed design and construction stage will require new Section 50 consent to be obtained • Inform and consult with OPW Western Arterial Drainage Section who have responsibility for the Corrib-Mask Arterial Drainage scheme and the ongoing control of river and lake levels at the Salmon Weir Barrage in Galway City • Continue to inform and consult with Inland Fisheries Ireland (IFI) • Continue to inform and consult with National Parks and Wildlife Service (NPWS) • All construction works will be carried out in accordance with best practice construction guidance and as such will eliminate the risk of spillage to the River Corrib • All works will also be carried out in accordance with Irish Water Standards and Specifications, in line with standard processes and procedures for obtaining connection consent and build over agreements with the utility provider • Future proofing sleeves in the vicinity of Ardaun can be easily accommodated and their location will be agreed with Irish Water prior to commencement of construction • Irish Water (IW) will be consulted in the updating of the CEMP and specifically the and the incident response plan (IRP) for construction and operation stages • Provision will be made for Irish Water Staff to visit the construction site if deemed necessary by Irish Water • Ongoing liaison with Irish Water will be provided at construction stage and procedures for regular project dates will be established during the construction stage in a timely manner so as to enable Irish Water to assess potential increased risk to the water quality of their potable water supply source Construction activities will be required to take cognisance of the following guidance documents for construction work on, over or near water: • Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016) • Shannon Regional Fisheries Board – Protection and Conservation of Fisheries Habitat with particular reference to Road Construction • Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board) • Central Fisheries Board Channels and Challenges – The Enhancement of Salmonid Rivers • CIRIA C793 The SuDS Manual • CIRIA C624 Development and Flood Risk – guidance for the construction industry • CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors • CIRIA C648 Control of Water Pollution from Linear Construction Projects, technical guidance • CIRIA C649 Control of Water Pollution from Linear Construction Projects, site guide • Guidelines for the Crossing of Watercourses during the Construction of National Road schemes (NRA, 2006) • Road Drainage and the Water Environment DN-DNG-03065 (TII, June 2015) • Vegetated Drainage Systems for Road Runoff DN-DNG-03063 (TII, June 2015) Based on the above guidance documents concerning control of construction impacts on the water environment, the following outlines the principal mitigation measures that will be prescribed for the construction phase in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts:	There will be no significant residual negative hydrological impacts on drainage and flood risk, water quality, channel morphology or key ecological receptors.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• All constructional compound areas will be required to be located on dry land and set back from river and stream channels and out of floodplain areas. Floodplain areas include the Flood Risk Zones A and B and therefore all construction compound areas need to be on lands above the 1000year return period flood level • The storage of oils, fuel, chemicals, hydraulic fluids, etc. will not occur within 100m of the River Corrib or within the floodplain area • Surface water flowing onto the construction area will be minimised through the provision of temporary berms, diversion channels and cut-off ditches, where appropriate • Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and the diversion of runoff water off these stockpiles to the construction settlement ponds and avoiding stockpiling of material in vicinity of sensitive watercourses • Where construction works are carried out adjacent to turloughs, fens, stream and river channels and lakes, protection of such waterbodies from silt load shall be carried out through use of reserved grassed buffer areas, timber fencing with silt fences or earthen berms. These measures will provide adequate treatment of constructional site runoff waters before reaching the watercourses • Use of settlement ponds, silt traps and bunds and minimising construction activities within watercourses. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap or sedi-mat • All watercourses that occur in areas of land that will be used for site compound/storage facilities will be fenced off at a minimum distance of 5m. In addition, measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound site does not discharge directly to the watercourse. Compounds shall not be constructed on lands designated as Flood Zone A or B in accordance with the OPW's The Planning System and Flood Risk Management Guidelines (November 2009). Site compounds will not be permitted in a European Sites (i.e. Lough Corrib SAC) • Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 10m from watercourses and floodplain areas • Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution • The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses • Riparian vegetation along the identified sensitive watercourses will be fenced off to provide a buffer zone of a minimum distance of 5m except for proposed crossing points for its protection • The use and management of concrete (which has a deleterious effect on water chemistry and aquatic habitats and species) in or close to watercourses will be carefully controlled to avoid spillage. Where on-site batching is proposed, this activity will be carried out well away from watercourses. Washout from such mixing plants will be carried out only in a designated contained impermeable area • All material deposition areas must be adequately bunded and compartmentalised such that the rainwater outflow from these facilities is adequately controlled and treated prior to reaching the receiving surface watercourses. The sediment control requirements are set out in the in the Sediment, Erosion and Pollution Control Construction Management Plan section of the CEMP (refer to Appendix A.7.5) To minimise the risk of contamination to the Galway Bay Complex SAC a detailed Sediment, Erosion and Pollution Control Management Plan for the construction phase has been developed and included in the CEMP in Appendix A.7.5, which provides for avoidance, reduction, mitigation and monitoring. Construction hydrological and water quality impacts on the Galway Bay Complex SAC and Inner Galway Bay SPA will be avoided. <u>Material Deposition Areas</u> A total of 32 site areas have been identified as MDAs along the route of the Project. These material deposition areas will be bunded or excavated sites and will have double erosion control fencing (silt fence) and a sediment settlement pond at the outlet which will be constructed in advance of their use as deposition areas. In addition, wheel wash facilities will be provided at the entrance/exit as outlined in the CEMP – see Appendix A.7.5. Runoff from the material deposition areas will be treated in temporary settlement ponds which will be provided upstream of the outfall to the receiving watercourse or sewer. These ponds will be maintained until the material deposition areas have stabilised and become adequately vegetated. In addition, the specific construction sequence for these areas (described below) will allow for settlement of sediment prior to discharge to the receiving watercourse. The construction sequence of each of the material deposition areas is such that the area allocated for material deposition is compartmentalised to allow a deposition area to be first established in one compartment, while the runoff water from this compartment flows into and is contained within an adjacent compartment. This will allow settlement of sediment to take place. Once settlement of the sediments has occurred, this settlement area is then itself filled with peat and the adjacent compartment acts as the settlement area for the runoff from this section. This process is repeated as the works advance. The construction sequencing and design of the material deposition areas will ensure that there will be negligible impact on adjacent watercourses. As part of the CEMP a plan for erosion and sediment control has been developed which deals specifically with the potential impacts of the material deposition areas and this is attached in Appendix A.7.5	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
N83 Tuam Road Flood Risk	Provision of a storage area on the eastern side of the N83 Tuam Road to mitigate loss of flood storage from a pluvial flood risk area. The flood relief mitigation measures to eliminate this flood risk and reduce the existing flood risk in this area are as follows (refer also to Figure 11.6 of Chapter 11, Hydrology): • Prevent the upgraded portion of the N83 Tuam Road from spilling laterally northwards into the driveways of existing flood risk houses by: – Upgrade and provide effective road drainage network along the existing N83 Tuam Road. The proposed upgraded road drainage for the N83 portion extends for a length of 780m – Provide interceptor drain to capture rapid hill slope runoff from the southeast reaching the N83 Tuam Road – Provide for infiltration of this interceptor drain for the less severe rain storm events – Connect this interceptor drain to the proposed flood compensation storage • Compensate flood storage lost by providing compensation storage of 8,030m^3 in the form of an excavated rectangular engineered storage pond with the base elevation of 16m OD and a top design water level elevation of 17.5m OD • Connect this compensation storage to the remaining low-lying natural flood storage area located to the northwest of the Project so that both storage areas are hydraulically linked via culverts • Provide for a permanent pumping station and rising mains from the proposed compensation flood storage facility to discharge to the existing storm sewer with a pumping capacity of 250l/s Refer also to Table 11.51 in Chapter 11, Hydrology which outlines the required storage volumes required for the catchment for a range of return periods and durations events. • The required flood storage, with an available pumping rate of 0.25cumec (i.e. 250l/s) from the engineered storage pond, is 20,700m^3 for the 100year event which is further increased to 24,800m^3 to include for 20% climate change The available storage provided in the engineered storage pond at a top water level of 17.5m OD is compensation storage of 8,030m^3 and the remaining (with Project) natural storage provided of 18,470m^3 gives a total available flood storage of 26,500m^3, which is sufficient to achieve to meet and exceed the required storage.	There will be a moderate to significant positive residual impact on flooding and flood risk at N83 Tuam Road Twomileditch area, as the proposed mitigation measure will reduce the flood risk to the existing road and to the six remaining houses. However negative slight residual flood impacts associated with the N83 flood relief measures will remain: • Discharge of flood water into the Terryland Basin at 250 l/s resulting in slight increase in flood levels within the Terryland River channel. The impact of this discharge on flood levels in the Terryland Basin is minor representing a slight permanent residual impact on flood levels • Reduction of available capacity within the existing storm sewer located to immediately south in the City North Business Park (the full bore capacity in the pipe is estimated to be 900l/s and therefore the proposed maximum discharge of 250l/s will reduce the available capacity by 27% This is considered a slight impact • Residual flood risk at the N83 Tuam Road associated with potential breakdown of the storm water pumping station, and blockage of storage area and associated drains and outfalls. This is considered slight in light of regular monthly inspections proposed
Flood Risk	Design measures employed in the Lackagh Tunnel and the material deposition areas are intended to minimise the risk of flooding of the proposed N6 GCRR at Lackagh Tunnel associated with the potential for elevated groundwater table compounded by pluvial ponding within the quarry under more extreme 1000-year flood events and climate change conditions. The potential flood risk for the Lackagh Tunnel pre-mitigation is rated as representing a moderate flood risk. The Incident Response Plan which forms part of the CEMP included in Appendix A.7.5 of this updated EIAR and which will be finalised by the Contractor following appointment and prior to the commencement of the construction works, so as to include any additional measures required pursuant to any decision to grant approval, will include flood and environmental risk management in adherence with the commitments presented in the schedule of commitment in Chapter 23 of this updated EIAR.	There is a moderate potential flood risk for the Lackagh Tunnel associated with the potential for elevated groundwater table compounded by pluvial ponding within the quarry under more extreme 1000-year flood events and climate change conditions. Compliance with the Incident Response Plan, which forms part of the CEMP included in Appendix A.7.5 of this updated EIAR, will reduce the residual risk to slight.
Landscape and Visual		
Site clearance and construction activities	Mitigation of landscape and visual impacts for the Project shall have regard to the approach as set out in the following NRA/TII guidance documents: • A Guide to Landscape Treatments for National Road Schemes in Ireland (2006) • Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland (2012) • Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (2006) • Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (Revision 1, 2010) • Design and Delivery of Soft Landscape Treatments in Urban Transport Environments (2024) Landscape mitigation proposals shall take account of the approaches and principles as set out in A Guide to Landscape Treatments for National Road Schemes in Ireland, in particular to Chapter 4: Components of the Roadside Landscape; Chapter 5: Soil Geographic Factors; and Chapter 6: Landscape Treatments. Unless otherwise qualified in the following or in Chapter 8, Biodiversity, seeding and planting proposals, including species and planting type and species shall be in accordance with Chapter 6 of the Landscape Guidelines, adapted as required for local environmental and landscape conditions. The updated Natura Impact Statement (NIS) includes the following specific measure of relevance to the landscape treatment of the Project in the vicinity of Special Areas of Conservation (SAC): *"The seed/planting mix should not include either non-native invasive species at any location, nor within 250m of the SAC, negative indicator species for limestone pavement or calcareous grassland, including perennial rye grass, white clover, sycamore, beech and conifers. Within 100m of the SAC there will be control of other negative indicator species as listed by Wilson and Fernandez (2013), such as creeping thistle and ragwort, while the vegetation is establishing on the soft estate for two years post-seeding."*	There will be significant residual impacts during construction until such time as the proposed landscape mitigation proposals establish and become increasingly effective.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	During the construction stage, the CEMP in Appendix A.7.5 will be finalised and adopted by the Contractor'. Adherence to the CEMP will be a contract requirement and this will ensure good working practices are followed so as to minimise and manage any significant, negative environmental impacts arising from construction. As well as other items, the CEMP includes the mitigation set out within this chapter and incorporates these measures as part of their implementation. Mitigation will ensure that the works will have continuous monitoring under the CEMP so as to ensure adequate protection of areas outside of the construction works. Specific measures shall ensure that: • Site machinery shall operate within the footprint of the proposed N6 GCRR construction area • Storage areas shall be located so as to avoid impacting further on existing residential and other property, woodlands, trees, hedgerows, drainage patterns, etc. • Solid site hoarding of minimum 2.0m in height shall be provided alongside construction works adjoining residential property or recreational amenities • Solid hoarding or similar, of minimum 2.0m in height shall be provided along any side of a proposed construction compound, where they are located within 100m of residential properties • Construction compounds shall be fully decommissioned and reinstated to their pre-construction condition at the end of the construction contract unless these areas have been identified as habitat compensation or material deposition areas • Side slopes and other landscape areas along the proposed N6 CRR shall be prepared for soiling, and either seeded and/or planted at the earliest possible opportunity. As such, some scope may exist for undertaking significant areas of seeding and planting prior to the end of the construction works. However, due to construction programming and seasonal restrictions, it is also likely that significant planting works will not be undertaken until the end of the major construction phase in Phase 2 of the Project	
Cultural Heritage		
Construction activities including site clearance and demolition works	The proposed mitigation measures for the cultural heritage are outlined below and detailed in Appendix A.13.11: A summary of all sites, structures, potential impacts and Chapter 13 of this updated EIAR. The mitigation strategy has been updated from the 2018 EIAR chapter to reflect any changes in the impact assessment that have arisen from the application of the methodology required within the 2024 TII *Guidelines for Cultural Heritage Impact Assessment of TII National Road and Greenway Projects.* The proposed mitigation measures for the construction phase are as follows: • All work will be undertaken as part of a Stage (i)-(iv) Archaeological Services Contract and will be managed and overseen by the Project Archaeologist appointed by TII in consultation with the Project Engineer. All archaeological surveys, testing and excavation will be carried out in advance of the commencement of construction • A programme of geophysical survey (where practicable) will be carried out within the footprint of the Project prior to construction going ahead. This will target greenfield and previously undisturbed areas within the Assessment Boundary • Geophysical survey will be followed by archaeological test trenching, which will be carried out under Ministerial Directions in consultation with the DoHLGH and the Project Archaeologist. Dependant on the results of the investigations, further mitigation may be required such as preservation by record or in-situ. Any further mitigation will require the agreement of the National Monuments Service of the DoHLGH. Full provision will be made available for the excavation of any archaeological features and/or deposits that may be identified, if that is deemed the most appropriate manner in which to proceed • The excavation (preservation by record) of all previously recorded archaeological sites – where these fall, in whole or in part, within the footprint of the Project – will be carried out under Ministerial Direction in consultation with the DoHLGH and the Project Archaeologist • Prior to demolition, the thatched cottage BH 12 will be subject to a full measured, written and photographic survey. This will be carried out by a suitably qualified person or team in consultation with the DoHLGH and the Project Archaeologist • The demesne landscape associated with Menlo Castle (DL 8), at Dangan Lower (DL7) and at Bushypark House (DL4) will be subject to a detailed photographic and written record prior to the construction of the Project. This will be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the DoHLGH and the Project Archaeologist • All Cultural Heritage (CH) sites listed in Table 13.17 of Chapter 13 of this updated EIAR that include built heritage remains will be subject to a detailed written and photographic survey (to include test trenching where appropriate). This shall be carried out under Ministerial Directions in consultation with the DoHLGH and the Project Archaeologist. Full provision will be made available for the excavation of any archaeological features and/or deposits that may be identified, if that is deemed the most appropriate manner in which to proceed • Archaeological wade or underwater assessments will be carried out at any natural water courses (AAPs) to be impacted upon by the Project by disturbance to their banks or beds. This shall be carried out under Ministerial Directions in consultation with the DoHLGH and the Project Archaeologist. Full provision will be made available for the excavation of any archaeological features and/or deposits that may be identified, if that is deemed the most appropriate manner in which to proceed • Any section of Townland Boundary to be impacted upon will be subject to a detailed written and photographic survey (to include test trenching where appropriate). This shall be carried out in consultation with the DoHLGH and the TII Project Archaeologist. Full provision will be made available for the excavation of any archaeological features and/or deposits that may be identified, if that is deemed the most appropriate manner in which to proceed • In the area of Coolough Village, the above mitigation measures will be carried out in consultation with the representatives of the Menlo-Coolough-Ballinfoile-Ballindooley residents.	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Agriculture		
Construction activities	• The landowner will be provided with access to all separated land parcels during the construction of the Project. Where temporary disruptions to this access occur landowners will be notified in advance • Where existing water and electricity supplies are disrupted during the construction phase an alternative water source or electricity supply will be made available e.g. water tanker or electric cable ducting. If access to surface drinking water sources are permanently restricted alternative groundwater supplies will be provided (or compensation to allow farmer drill his own well) • Suitable boundary fencing will be erected to delineate the line for the proposed N6 GCRR and prevent disturbance to adjacent land • A key contact person will be appointed during the construction phase to facilitate communications between affected landowners and to facilitate the re-organisation of farm enterprises by farmers during critical times • Landowners with lands adjoining sites where either rock breaking, blasting or piling takes place will be notified in advance of these activities • The impacts on water quality will be minimised by way of a programme of mitigation measures for surface and ground water sources as described in the sections above on Hydrogeology and Hydrology • The spread of dust onto adjoining lands will be minimised by way of mitigation measures set out in the section below on Air Quality. Typically, the impact of dust on agricultural grazing livestock is not significant • Where drainage outfalls are temporarily altered or land drains blocked or damaged an adequate drainage outfall will be maintained and land drains will be repaired • Galway County Council will employ an equine expert or veterinary practitioner for the duration of the construction contract • The design and construction of the temporary stables and permanent stables proposed for Galway Racecourse will be carried out in consultation with the Irish Horseracing Regulatory Board (Horse Racing Ireland HRI) • Galway County Council will continue to liaise with Galway Race Committee in relation to the implementation of any approval granted in so far as it relates to Galway Racecourse • Provide cattle pen to replace existing cattle pen at plot 571	The 41 moderate, 39 Significant, 7 very significant and 4 profound construction impacts will remain and will be dealt with as part of the land acquisition process and will be agreed at a later date with a valuer. Compensation does not form part of the EIA process and is therefore not considered further.
Material Assets Non Agriculture		
Properties	• In the event of an approval of the Protected Road Scheme and Motorway Scheme and approval under Section 51 of the Roads Act 1993 (as amended), by An Bord Pleanála and subject to the availability of funding, Notice to Treat will be served firstly on owners, lessees and occupiers of the dwelling houses and commercial properties to be acquired, within six months of the scheme becoming operative, unless an application has been made for Judicial Review, in which case the Notice to Treat will be served in accordance with the provisions of Section 217 (6A) of the Planning and Development Act 2000 as inserted by the Compulsory Purchase Orders (Extension of Time Limits) Act 2010. Compensation will be agreed or determined by the property arbitrator as soon as possible after service of Notice to Treat. After compensation has been agreed or determined and satisfactory title has been produced, part payment can be made while the claimant remains for an agreed period in the property to be acquired. This will facilitate the claimant in removing uncertainty and will facilitate arrangements being made, as early as possible, to secure a replacement property • Where existing access to property is affected, this will be reinstated or an alternative access provided • Where part of a property or land surrounding a property is to be acquired, appropriate accesses have been designed and appropriate boundary treatment will be constructed • The proposed N6 GCRR severs the University of Galway Sporting Campus facilities. During construction, restricted access across the construction area at the University of Galway Sporting Campus facilities will be maintained at all times • The proposed N6 GCRR also intercepts the existing sports pavilion resulting in direct impacts to its western end. The building modifications will be sequenced such that access and use of the pavilion will be maintained during the construction phase of the proposed N6 GCRR • During the construction of the River Corrib Bridge, alternative access along the bank of the River Corrib will be provided • The works to Galway Racecourse, which are being considered in a separate planning application but forms part of the Project, are designed to mitigate against any disruption to the normal operation of Galway Racecourse during the construction of the road component of the Project. As previously stated, temporary stables will be provided for Galway Racecourse during the construction of the proposed N6 GCRR until such time as the Galway Racecourse Tunnel is complete and the N6 GCRR is operational. Permanent stables will then be provided upon completion of construction of the proposed N6 GCRR • Mitigation measures as detailed in individual accommodation works agreements, such as boundary treatment, domestic entrances, property condition surveys (as outlined below for Noise and Vibration), provision of ducting to facilitate services, maintenance of access during construction amongst other items will remove impacts related to the properties with partial landtake. Compensatory measures for the loss of land, buildings and other injurious affection will form part of the land acquisition process and will be agreed at a later date with a valuer. Compensation does not form part of the EIA process and is therefore not considered further • Plot 607 – Construction of a new stone faced boundary wall at the front of the property along the existing N84 to a height of 1.8m, piers to the entrance, the inclusion of noise reflective gates and regrading of driveway • Plot 666 – Construction of a new domestic entrance at the front of the property along the existing N83 on a like for like basis set back 5m from the edge of the carriageway • An additional field entrance gate will be provided from AR4/05 to service the farm yard in plot 216 • The new stone boundary wall for plot 125 will be 1.5m in height • The new stone boundary wall for plot 493 will match the height of the existing front boundary wall • The new stone boundary wall for plot 523 will match existing wall along Circular Road and will be 2.0m high along access road AR08/02 • The existing boundary and accessway for plot 131 on the Foraí Maola Road will be removed and a new stonework wall 1.5m high above ground level in accordance with standard detail GCRR-SK-C0-001 will be constructed • To the northern boundary of the property the stonework wall will extend to 2.0m high above ground level. A new 4.0m wide access will be constructed to the north of the property from the Na Foraí Maola to Troscaigh Link Road South. This access will be constructed in accordance with standard details CC-SCD-02753. The new access road will include a new field access to CC-SCD-02754 and single field gate to CC-SCD-00309 • A stone faced retaining wall will be constructed with a timber post and rail fence located on top as detailed in GCRR-SK-C-004 along the boundary of the display area of plot 668 adjacent to the N83 Tuam Road. A 1.2m high stonework wall will be provided along the remaining extent of the N83 Tuam Road, i.e. from the southern edge of the display area. The remaining proposed boundary treatment for the lands comprise of timber post and rail fencing, constructed in accordance with TII Standard Detail CC-SCD-00301, to the south of the plot and Paladin security fencing surrounding the proposed treatment ponds	The residual impacts from all of the very significant/significant impacts, 54 residential properties, eight commercial properties and one residential site, which will be acquired and/or demolished to accommodate the proposed N6 GCRR, remain as very significant/significant impacts as no mitigation is possible to reduce the impact. The residual impact post compensation cannot be assessed as the compensation to be agreed as part of the land acquisition is outside the scope of the EIA process. Mitigation measures as detailed in individual accommodation works agreements will remove the residual impacts related to the properties with partial landtake. There are no residual impacts on dwellings from which part of the roadbed will be acquired or on services or services infrastructure. The residual impacts on UoG Sporting Campus from a material assets perspective can be reduced from Very Significant as assessed in 2018 to Moderate with the additional mitigation secured by UoG and within their control as follows:: • UoG have prepared a new sporting campus plan and strategy for the sporting campus at Dangan in line with the University's overall strategic sport's vision • The removal of the existing sports fields will be replaced by new pitches for which planning permission has been secured • Utilities, roads and access and egress routes around the campus can accommodate and are integrated with the alignment of the proposed N6 GCRR The landscape setting of the existing campus will need to be developed to screen the visual effects of the proposed River Corrib Bridge from the surrounding pitches and ancillary supporting facilities such as car parking and changing facilities will require

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Access to the residual lands on plot 729, adjacent to the City East Business Park Junction, will be provided via access road AR 15/05. A single field access as per TII Standard Detail CC-SCD-02754 with a Paladin security gate will be provided • Signage will be erected at property 668 during construction to ensure that the entrance location is prominent and easily identifiable • New signage for the business at property 668 will be erected post construction, replacing the existing signage • A single field access gate will be provided for access road AR4/05 • The stonewall along the boundary of plot 521 adjacent to access road AR 08/01 will be 2.0m high • Access road AR 07/07 to be gated and locked with a key provided for property owners 486 and 272_462 • Boundary treatments and access as per Figures 5.5.1 to 5.5.30	remodelling post completion of the proposed N6 GCRR. The residual impact on University of Galway Sporting Campus post compensation cannot be assessed as the compensation to be agreed as part of the land acquisition is outside the scope of the EIA process. There will be a positive residual impact on Galway Racecourse with the provision of enhanced access to the premises and a new stable yard.
Services/Utilities	Each of the utility diversions associated with the Project have been planned with ongoing and detailed engagement with relevant utility providers during the preparation of this updated EIAR. This engagement will continue prior to and during the construction phases. Each diversion has been assessed from both a construction point of view, but also from an operational point of view. Where the infrastructure for service providers is impacted, this will be diverted or reinstated in accordance with service providers' requirements prior to construction. Service users will be notified in advance of any temporary disruption or outages necessitated by the construction works. The disruption to services or outages will be carefully planned so the duration is minimised. Public water supply and foul water systems affected will be reconnected. All necessary diversions will be carried out in accordance with the local authority and Irish Water's requirements. Where private potable water supplies are impacted, a new well or alternative water supply or financial compensation for the loss of the well will be provided. Mitigation for interference with septic tanks will be agreed by the valuer at a later stage.	No likely significant residual impacts.
Air Quality		
Air Quality	The following mitigation measures will be implemented for the construction phase of the Project, in order to reduce the dust risk associated with demolition, construction, earthworks and track-out, in accordance with IAQM guidance. Refer to the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 for further details on construction phase mitigation. All measures will be fully implemented by the appointed contractor. Measures Specific to all Sites: Communications • Development and implement a stakeholder communications plan that includes community engagement before work commences on site • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site management • Display the head or regional office contact information Site Management • Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken • Make the complaints log available to the local authority when asked • Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book • Hold regular liaison meetings with other high risk construction sites within 250 m of the Project Extents Boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes Monitoring • Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This will include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of Project Extents Boundary, with cleaning to be provided if necessary • It is proposed to carry out particulate monitoring (PM10 and PM2.5) at the nearest sensitive receptors upwind and downwind of the construction works where sensitive receptors have been identified within 25m of the works. This monitoring programme will take place when works likely to generate dust are being carried out. The monitoring will allow direct comparison with the PM10 and PM2.5 air quality standards on a daily basis • Dust deposition monitoring will be conducted at a number of locations in the vicinity of the Project. At a minimum, monitoring will be carried out at the two nearest ecological receptors at locations where works are occurring within 250m. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft guidelines. At least one month of dust deposition monitoring will be carried out in advance of the commencement of works to determine a baseline • Carry out regular site inspections, record inspection results, and make an inspection log available to the local authority when asked • Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions Preparing and Maintaining the Site • Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible • Solid dust screens will be implemented at locations where sensitive receptors are located within 100m of the works. In addition, a 2m dust screen will be provided at the locations at the locations in the areas of the overlap of the proposed N6 GCRR and the Lough Corrib SAC • Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	No likely significant residual effects

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Cover, seed or fence stockpiles to prevent wind whipping Operating Vehicle/Machinery and Sustainable Travel • Ensure all vehicles switch off engines when stationary - no idling vehicles • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable • Impose and signpost a maximum-speed-limit of 20km/hr on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate) Operations • Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate • Use enclosed chutes and conveyors and covered skips • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate • Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods Measure specific to demolition • Ensure effective water suppression is used during demolition operations • Bag and remove any biological debris or damp down such material before demolition Measure specific to earthworks • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable • Only remove the cover in small areas during work and not all at once Measure specific to construction • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery Measure specific to trackout • Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable • Record all inspections of haul routes and any subsequent action in a site log book • Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable) • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits • Access gates to be located at least 10 m from receptors where possible	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Climate		
Climate	A series of mitigation measures have been incorporated into the construction design with the goal of reducing the embodied carbon associated with the construction phase of the. These measures include: • The substitution of concrete containing Portland cement with concrete containing ground granulated blast furnace slag (GGBS). This measure has led to an estimated saving of c.1,034 tonnes of CO_2eq in the current design (50% of cement as GGBS) of the Project • The use of steel which comprises of a minimum of 70% recycled steel • The Project will minimise wastage of materials due to poor timing or over ordering on site thus helping to minimise the embodied carbon footprint of the Project, refer to Chapter 20 Waste and Resource Management • Where practicable, opportunities for materials reuse will be incorporated within the extent of the Project including the use of reclaimed asphalt and recycled aggregate • Where practicable, materials will be sourced locally to reduce the embodied emissions associated with transport The Contractor will be required to implement an Energy Management System for the duration of the works. This will include the following at a minimum: • Use of thermostatic controls on all heating systems in site buildings • The use of insulated temporary building structures • The use of low energy equipment and power saving functions on all computer systems • The use of low flow tap fittings and showers • The use of solar/thermal power to heat water for the on-site welfare facilities including sinks and showers In addition, in June 2024, the Government of Ireland produced procurement guidance to public bodies to promote the reduction of embodied carbon in publicly supported construction projects and construction materials. These measures include the following which must be adhered to during the procurement process of the Project: • Concrete products including poured or pre-cast products, should in general specify a minimum of 30% clinker replacement, consistent with IS EN 206, except where a technical justification is made by a suitably qualified professional to the satisfaction of the procurer • High-carbon CEM I cement products should not be procured by public bodies, or used in publicly produced construction projects, except where a technical justification is made by a suitably qualified professional to the satisfaction of the procurer • Public bodies should seek an Environmental Product Declaration, to an EN 15804 standard, or equivalent when directly procuring cement or concrete products. Confirmation of a similar disclosure should be sought by public bodies, where a contracted party is managing materials procurement. When available, public bodies should require a Declaration of Performance and Compliance under the Construction Product Regulation • Public bodies procuring infrastructure projects (construction other than buildings) in receipt of exchequer funding in excess of €60 million, should produce or procure a Whole Life-Cycle Greenhouse Gas Emissions assessment for their project. Public bodies should identify the most appropriate, available methodology to ensure that the project's embodied carbon is suitably interrogated, and applicable to the infrastructure or project-type A Construction Traffic Management Plan (CTMP) is included in Appendix A.7.5. The measures outlined in this plan will have the effect of further reducing carbon emissions. • No monitoring is required during the construction phase.	In accordance with the TII Climate Standard the impact of the Project should be considered based on its whole lifecycle. Based on the criteria outlined in Chapter 17 of this updated EIAR, the Project is expected to have a permanent moderate adverse effect on climate during over its lifecycle.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Noise and Vibration		
Noise	Mitigation measures for the construction phase are set out below in order to reduce potential impacts as far as practicable to within the adopted design goals for noise and vibration. The contract documents will clearly specify the construction noise criteria included in Chapter 18, Noise and Vibration 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 5228-1 (2009+A1:2014) 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 • Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use • Any plant, such as generators or pumps that is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen • During the course of the construction programme, the Contractor will be required to manage the works to comply with the limits detailed in Table 18.2 of Chapter 18, Noise and Vibration using methods outlined in BS 5228-1 (2009+A1 2014) BS 5228 -1 (2009+A1 2014) includes guidance on several aspects of construction site practices, which include, but are not limited to: • Selection of quiet plant • Control of noise sources • Screening • Hours of work • Liaison with the public • Monitoring Further comment is offered on these items in the following paragraphs and in Appendix A.18.3, however specific control measures relating to construction activities undertaken by the Contractor will be set out within the construction noise and vibration management plan. Noise control measures that will be considered in the plan will include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring. Further information on these measures is provided below. The Contractor will be required to conduct construction noise predictions prior to works taking place and put in place the most appropriate noise control measures depending on the level of noise reduction required at any one location. **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 piling, 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. The decision regarding the type of pile, excavation technique, rock breaking, crushing etc. to be used on a site will normally be governed by other engineering, environmental constraints. In these instances, it may not be possible for technical reasons to replace a noisy process by a quieter alternative (e.g. rotary bored piling over driven piles). Even if it is possible, the adoption of a quieter method may prolong the overall process (e.g. manual rock breaking versus blasting); the net result being that the overall disturbance to the community will not necessarily be reduced. **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. In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. It is therefore proposed to adopt the concept of *"Best Available Techniques"* as defined in EC Directive 96/61. In this context "best" *means "the most effective in achieving a high general level of protection of the environment as a whole"*. The expression *"available techniques"* means *"those techniques developed on a scale which allows implementation…., under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the operator carrying on the activity"*. The term *"techniques"* includes *"both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned"*. Thus, the concept of Best Available Techniques requires a degree of balance between the attainment of environmental benefits and the likely cost implications. In the identification of Best Available Techniques, regard will be had to a wide range of factors, however, emphasis will be given to *"practical suitability"* and the need *"to reduce an emission and its impact on the environment as a whole"*. 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, which have been reviewed and updated since the 2018 EIAR: • For static plant such as compressors, generators, motors, pumps, the units will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation, as required, to ensure CNTs are not exceeded • Where practicable, equipment powered by mains electricity shall be used in preference to equipment powered by internal combustion engines or locally generated electricity	Once the various mitigation measures are put in place, noise impacts associated with the construction phase will be of negative, not significant and temporary to short term, to negative, significant and temporary to short term impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• 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 10dB. Mobile plant will be switched off when not in use and not left idling • For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover • For percussive tools such as pneumatic concrete breakers, rock drills and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed. 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 • Reverse alarms from mobile plant within large construction compounds (e.g. areas of extensive cutting), will be broadband to reduce tonal elements from this source • Mobile and stationary plant will be switched off or throttled back to a minimum when not in use (engines, motors and generators). Lorries, trucks and concrete vehicles will not be permitted to queue outside site compounds with engines left idling. Construction vehicles in lorry holding areas will be required to switch engines off when stationary • For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum • 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 and drop chutes/dump trucks are lined with resilient materials. This is an important consideration for site compounds where materials are loaded and unloaded. Site compounds in close proximity to noise sensitive areas (refer to Table 18.15 of Chapter 18, Noise and Vibration) will incorporate a strict noise control policy relating to materials handling • 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 • 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/m^2 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. Annex B of BS 5228-1 (2009+A1:2014) (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials. In addition, careful planning of the site layout will also be considered. Within site compounds, the placement of site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening. Similarly, in some instances materials such as topsoil or aggregate along the route of the proposed N6 GCRR can provide a degree of noise screening if placed between the source and the receiver. **Hours of Work** Construction activity will mostly take place during daytime hours Monday to Friday and Saturdays (refer to Section 18.4.1.5 of Chapter 18, Noise and Vibration). Depending on the noise emission levels experienced and associated noise impact, the Contractor will be flexible and able to conduct certain works at hours which reflect periods when the neighbouring properties have lower sensitivities to noise. It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the project. Over the expected construction phase there will be up to 10 weeks of night time working along different sections of the proposed N6 GCRR primarily to facilitate bridge works over existing roads. Consideration will be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity will be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control. In situations where a particularly noisy activity is scheduled e.g. activities identified in Table 18.14, Chapter 18, Noise and Vibration (rock breaking/crushing/impact piling etc.) or other activities of similar noise level, the use of other on-site activities will be scheduled to control cumulative noise levels. **Liaison with the Public** On typical road construction sites, the major sources of noise are essentially mobile and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling, excavation, breaking and other high noise or vibration activities works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period. It is important, therefore, that clear forms of communication are established between the contractor and noise sensitive areas in proximity so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration. Special areas of noise sensitivity where communication of scheduled works will be required include the adjacent schools and nursing homes where daytime concentration and resting is important. Key areas of communication will be required during blasting, breaking, and other elements of high noise activity with potential for durations likely to exceed ten or more days in any 15 consecutive days. A designated noise liaison officer will be appointed to site during construction works. All noise complaints will be logged and followed up in a prompt fashion by the liaison officer. **Monitoring** During the construction phase noise monitoring will be undertaken at the nearest sensitive locations to ensure construction noise limits outlined in Table 18.2 of Chapter 17, Noise and Vibration are not exceeded. Noise monitoring will be conducted in accordance with the International Standard ISO 1996: *Acoustics – Description, measurement and assessment of environmental noise* Part 1 (2016) and Part 2 (2017). The selection of monitoring locations will be based on the nearest sensitive buildings to the working area which will progress along the length of the road construction. It is recommended that noise control audits are conducted at regular intervals throughout the construction programme in conjunction with noise monitoring. The purpose of the audits will be to ensure that all appropriate steps are being taken to control construction noise emissions and to identify opportunities for improvement, where required.	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Blasting and Air Overpressure	Air overpressure from a blast is difficult to control because of its variability, however, much can be done to reduce the effect and the control of the blast design at source. In terms of blast design control, specific guidance will be obtained from the recommendations contained within BS 5228-2 (2009+A1:2014) in relation to blasting operations in addition to experienced blast control techniques used by the contractor. As per the 2018 EIAR, these will include some or all of the following: • All blasting will be undertaken by professionally trained blast contractors • Restriction of hours within which blasting can be conducted (09:00 –18:00hrs) • Trial blasts will be tested in less sensitive areas to assist in blast designs and identify potential zones of influence • Explosive charges will be properly confined by a sufficient amount of stemming • Blasting contractors will ensure that the minimum amount of primer cord is used, and that no primer cord is located above ground • Profiling will be carried out after each blast in order to ensure the geometry of the rock face can be established, enabling the optimum burden and spacing to be applied for subsequent blasts; • The design, execution and completion of any blasting within 150 metres of any existing structure shall require special considerations. This will include the use of pre and post condition structural surveys by a competent structural engineer • Ground vibration and air over pressure (AOP) will be recorded simultaneously for each blast at the most sensitive locations, depending on the works area being blasted • When blasting moves into a new area, an initial low level blast will be carried out (i.e. a low Maximum Instantaneous Charge (MIC)) and monitoring will be carried out simultaneously at a number of sensitive properties in different directions in order to generate specific scaled distance graphs • The scaled distance graphs will be used to determine the optimum MIC for subsequent blasts area in order control vibration and AOP limits below the relevant limit values (as set out in Section 18.2.1 of Chapter 18, Noise and Vibration) at the nearest sensitive buildings In line with best practice mitigation measures from vibration sources, good communication and public relations are a key factor in reducing any startle effects to residents. In this instance, a Public Communications Strategy will be implemented by the Contractor prior to the commencement of any blast works. In such cases, as per the 2018 EIAR, the following recommended mitigation measures are proposed: • Relevant nearby residents will be notified before any work and blasting starts (e.g. a minimum of 24-hour written notification) • The firing of blasts will be undertaken, where possible, at similar times to reduce the 'startle' effect • Ongoing circulars will be issued informing people of the progress of the blasting works • The implementation of an onsite documented complaints procedure will be maintained by the contractor • The use of independent monitoring will be undertaken by external bodies for verification of result	Once the various mitigation measures are put in place, noise impacts associated with the construction phase will be of negative, not significant and temporary to short term, to negative, significant and temporary to short term impact. Whilst high noise levels are associated with an individual blast, the effects are momentary and the blast designs will be strictly controlled to ensure the AOP and PPV levels are within the specified limit values. The use of this form of rock breaking will expedite the level of rock extraction in any one location and hence reducing overall exposure times and overall impacts. Where the construction noise level and duration of works is considered in line with the DMRB Noise and Vibration (UKHA 2020) the Construction Phase residual noise levels are not significant.
Vibration	The TII Guidelines recommend that in order to ensure that there is no potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in Table 18.4, Chapter 18, Noise and Vibration. On review of the likely vibration levels associated with construction activities, it may be concluded that the construction of the Project is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or cosmetic damage to buildings. In the case of vibration levels giving rise to human discomfort, in order to minimise such impacts, the following measures shall be implemented during the construction period: • A clear communication programme will be established to inform adjacent building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to exceed perceptible levels. The nature and duration of the works will be clearly set out in all communication circulars • Alternative less intensive working methods and/or plant items shall be employed, where feasible • Appropriate vibration isolation shall be applied to plant, where feasible • Cut off trenches to isolate the vibration transmission path shall be installed where required • In the case of impact piling or demolition works for instance, a reduction in the input energy per blow shall be considered where required • Monitoring will be undertaken at identified sensitive buildings, where proposed works have the potential to be at or exceed the vibration limit values **Property Condition Surveys** Property condition surveys will be offered for all buildings within 50m of the Assessment Boundary and those within 150m of proposed blasting works along the proposed N6 GCRR. Property condition surveys will also be carried out at buildings and structures considered appropriate relative to their proximity to the works. Such property condition surveys shall be carried out by a Chartered Surveyor or Chartered Structural Engineer. Such property condition surveys, subject to the written agreement of relevant property owners, shall be carried out in two stages as the follows: • the first stage shall consist of pre-construction condition surveys including photographic records which shall be carried out prior to the commencement of construction • the second stage shall consist of post-construction condition surveys which shall include photographic records A property condition survey will be carried out at the thatched cottage in Coolough Village, Menlough and at M&M Qualtech, Parkmore Business Park. **Disturbance of Particularly Vibration-Sensitive Equipment and Processes** The location of potentially vibration sensitive activities have been identified for manufacturing facilities within the Parkmore and Racecourse Business Parks. This location is in proximity to an area where blasting will take place as part of the proposed tunnel at Ballybrit. The most effective form of mitigation for this type of sensitive process is through on-going consultation with the property owners as the design and construction of the Project progresses. This will involve baseline vibration monitoring and the use of trial blasts using an initial low level charge with simultaneously vibration measurements undertaken at the building. This information will be used to determine acceptable vibration levels for the facility relating to the sensitivity of the operating equipment. The results of this trial assessment will then set appropriate agreed limits values at the facility in question which will be monitored during subsequent blasts or other excavation methodologies. Where no safe limit is determined, the timing and scheduling of blasts will be	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	undertaken in consultation with the facility when no sensitive operations are taking place. Given the short time period over which an individual blast takes place (i.e. a number of seconds), this approach is deemed to be feasible. M&M Qualtech will be included in the list of property owners to be consulted with as the design and construction of the Project progresses, in particular in respect of the dates of rock breaking and blasting and the detailed traffic management plan for their area. Vibration monitoring will be undertaken at their property in Parkmore. The residents in the Menlo-Coolough-Ballinfoile-Ballindooley area will be informed of any proposed blasting in advance of blasting been undertaken, as set out in Section 13.1 of the CEMP in Appendix A.7.5 of this updated EIAR and Appendix C of the updated NIS. The Contractor shall liaise with the operator for Twomileditch Quarry in relation to the blasting schedule for the proposed N6 GCRR and the blasting schedule for the quarry. The Contractor shall ensure that blasting between the School Road and N84 does not take place at the same time (concurrently) as blasting in Twomileditch Quarry.	
Population and Health		
Population	This section should be read in conjunction with Tables 19.13 and 19.14 in Chapter 19 of this updated EIAR, which detail specific measures proposed for potential socio-economic impacts. Many of these measures have been included in the design of the Project. These include the provision of crossing facilities at the Foraí Maola Road, Troscaigh Road, Bearna to Moycullen Road L1321, Cappagh Road and Ballymoneen Road junctions to facilitate pedestrian and/or cyclist crossings of the proposed N6 GCRR. Pedestrian crossing facilities are also proposed at the terminus of the N59 Link Road North Junction at the N59 Moycullen Road (Bushypark Junction) and at the slip road connections with the N84 Headford Road Junction. Cycle lanes are proposed to facilitate access to the Miller's Lane pitches and Gort na Bró and at the N84 Headford Road Junction. Some commitments were given during the 2020 oral hearing and there are included below and identified with an **asterix**. The following specific mitigation measures are proposed to improve journey amenity and minimise severance: • Provide pedestrian crossing facilities at junctions between the proposed N6 GCRR and with minor roads serving local rural communities • Provide temporary visual and noise screening from construction works at St. James' Church cemetery in Bushypark and at St. James' School, Bushypark • Galway County Council will pay for similar alternative accommodation for the Kerin's family (Ard na Locha) to be rehoused during the duration of the 9 months earthworks period at the N59.* • The existing historic gates at the entrance to the Aughnacurra Estate will be removed, stored and erected at the front entrance upon completion, noting that these are decorative gates that currently do not close and that they will not close and span the new entrance width • Provide pedestrian crossing facility at Bushypark Junction with N59 Link Road North during construction • A 2m cycle track will be provided from Gort na Bró Roundabout to Gael Scoil Mhic Amhlaigh on both sides • A two-way cycle track will be provided from Gael Scoil Mhic Amhlaigh to Rahoon Road on the eastern verge of Gort Na Bró Road • Avoid any prolonged severance and minimise duration of use by construction traffic of An Seanbóthar • Provide for alternative access along the bank of the River Corrib, along with prior advice for walkers, if access restrictions apply due to construction of the overhead bridge crossing. Safe access across the construction site within University of Galway Sporting Campus will be maintained for the duration of the construction contract • The modifications to the Sports Pavilion at UoG Sporting Campus will be undertaken as enabling works during the summer period prior to commencement of the construction of the proposed N6 GCRR* • Welfare facilities at the Sports Pavilion at UoG Sporting Campus will be maintained throughout the construction works • To ensure interconnection for UoG post completion of the construction, GCC will be providing a right of way for UoG to use the lands under the proposed viaduct for sporting/athletic purposes by way of a long lease* • Phase construction works to minimise impacts on racing events at Galway Racecourse • Signage will be erected at property 668 during construction to ensure that the entrance location is prominent and easily identifiable. • The existing signage at property 668 on the N83 Tuam Road will be removed, stored and erected at the property upon completion • Provide pedestrian crossing facilities at N84 Headford Road Junction during construction • Provide a footpath within the proposed development boundary along School Road, Castlegar • Provide directional signage for a Briarhill Business Park, including a car dealership located here during construction • Provide directional signage for access to the car dealership and An Post Sorting Centre on the N83 during construction • Take measures to ensure that cul-de-sacs or adjacent lands are not used for illegal parking during construction • A pedestrian crossing will be installed at the entrance to Lackagh Quarry prior to the commencement of construction works to maintain the greenway. This pedestrian crossing will be maintained by the contractor for the duration of the works. There will be a speed restriction of 15km/h on the access road into the site compound at Lackagh Quarry for the duration of the works Material Assets Non-Agriculture above outlines the proposed mitigation measures for the University of Galway Sporting Campus facilities and Galway Racecourse.	There will be a significant residual impact as a result of the demolition of 44 dwellings and further acquisition of 10 dwellings on those involved in the compulsory purchase process but also the integrity of the communities left behind in terms of their identity. There will also be a signification residual impact on the two builders' providers which are to be acquired. Material Assets Non-Agriculture above outlines the residual impacts on University of Galway Sporting Campus and Galway Racecourse.
Irish Language	Mitigation measures proposed to protect the Irish Language are as follows: • During construction, all public notifications and all public project updates are provided in both Irish and English languages. • While it is expected that day-to-day communications involved in the construction of the Project will be through the English language, the Main Contractor shall have the capacity to communicate and correspond through the use of the Irish language and to devote adequate and proportionate staff resources to dealing with any individual wishing to correspond and communicate through the Irish language. • Placenames shall be cited in accordance with the relevant Placename Order issued under the Official Languages Act 2003 (as amended).	No likely significant residual impact.
Human Health	In the event of an approval of the Protected Road Scheme and Motorway Scheme and approval under Section 51 of the Roads Act 1993 (as amended), by An Bord Pleanála and subject to the availability of funding, Notice to Treat will be served firstly on owners, lessees and occupiers of the dwelling houses and commercial properties to be acquired, within six months of the scheme becoming operative, unless an application has been made for Judicial Review, in which case the Notice to Treat will be served in accordance with the provisions of Section 217 (6A) of the Planning and Development Act 2000 as inserted by the Compulsory Purchase Orders (Extension of Time Limits) Act 2010. Compensation will be agreed or determined by the property arbitrator as soon as possible after service of Notice to Treat. After compensation has been agreed	Likely significant residual impacts on those whose properties are to be acquired or demolished are as above for population.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	or determined and satisfactory title has been produced, part payment can be made while the claimant remains for an agreed period in the property to be acquired. This will facilitate the claimant in removing uncertainty and will facilitate arrangements being made, as early as possible, to secure a replacement property. Mitigation measures proposed for the potential air quality, noise, water, soils and landscape and visual are specified above in the respective sections. The implementation of these mitigation measures, emissions including air and noise will be adequately controlled to ensure no adverse effect on human health.	
Resource and Waste Management		
Resource and Waste Management	A suite of mitigation measures is outlined below which the Contractor will implement for the Project, and in any event, the Contractor will ensure that waste arisings will be managed in accordance with the waste hierarchy and in compliance with the provisions of the Waste Management Acts, 1996, as amended. A Construction and Demolition Resource and Waste Management Plan (CDRWMP) has been prepared and is included in the CEMP (Appendix A.7.5 of Chapter 7, Construction Activities). This has been prepared and will be implemented by the appointed Contractor in line with the Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects. The CDRWMP outlines how waste arising during the construction phase of the Project will be managed in a way that ensures compliance with the provisions of the Waste Management Acts as amended and all of the mitigation measures however contained in the CDRWMP will be retained and will be implemented. The appointed Contractor will update the CDRWMP in advance of construction commencing. The following mitigation measures will be implemented during construction by the appointed Contractor to ensure compliance with the Waste Management Acts and contribute to achieving the objectives set out in the Waste Action Plan for a Circular Economy: • Where waste generation cannot be avoided, waste disposal will be minimised • Opportunities for reuse of materials, by-products and wastes will be sought throughout the various phases of the Project • Non-hazardous excavation material will be sent for recycling or recovery • Excavations of made ground (comprising a mixture of tarmac, concrete, plastics, ballast materials and silica sand) will be monitored by an appropriately qualified person to ensure that any hotspots of possible contamination are properly identified, with the contaminated material segregated and disposed of appropriately • Any identified contaminated material will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross contaminate clean soils elsewhere throughout the site • If encountered, any potential asbestos during the construction phase will be managed using standard health and safety measures as outlined in 'Asbestos-containing Materials (ACMs) in Workplaces: Practical Guidelines on ACM Management and Abatement'. This document states that *"removal of asbestos from contaminated soil will require a specialist asbestos contractor for any friable asbestos to be removed"* and *"a risk assessment by an independent competent person should determine the most appropriate control measures and remediation strategies"* • The site will be maintained to prevent litter and regular litter picking will take place throughout the site • Just-in-time' delivery will be used to minimise material wastage • Paints, sealants and hazardous chemicals will be stored in secure, bunded locations • All staff on-site will be trained on how to minimise waste (i.e., training, induction, inspections and meetings) • Materials on-site will be correctly and securely stored • Where possible, metal, timber, glass and other recyclable material will be segregated and removed off-site to a permitted / licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation • On-site office and food waste arising will be source separated at least into dry mixed recyclables, biodegradable and residual wastes • Waste bins, containers, skip containers and storage areas will be clearly labelled with waste types which they should contain, including photographs as appropriate • Segregated skips will be used within a designated waste segregation area to be located in the on-site Construction Compounds (particularly for hazardous, gypsum, metal, timber, inert waste and general waste) • The appointed Contractor will record the quantity in tonnes and types of waste and materials leaving the site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered, which is recycled and which is disposed of • Waste generated on-site will be removed as soon as practicable following generation for delivery to an authorised waste facility • The appointed Contractor will ensure that any off-site interim storage facilities for excavation material have the appropriate certificate of registration, waste facility permit and / or EPA waste licence in place • Where Regulation 27 notifications are required in relation to the Project, the appointed Contractor will complete and submit these Regulation 27 notifications to the EPA for by-product reuse • The relevant appropriate waste authorisation will be in place for all facilities that wastes are delivered to (i.e., certificate of registration, waste facility permit and / or EPA waste licence)	No likely significant residual impact.

22.3 Operational Phase

Table 22.2 below sets out the mitigation measures proposed for each environmental factor along with the significant residual impacts and their environmental consequence for the operational phase of the Project.

Table 22.2 Assessment of Potential Impacts and Mitigation Measures – Operational Phase

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Traffic		
Traffic	The traffic modelling indicates that for the Opening (2031) and Design (2046) Years there are no traffic impacts of major significance and therefore no mitigation measures are required.	The Project will provide benefits to existing and new public transport services and walking and cycling routes on the adjoining local and regional road network and other measures proposed by the Galway Transport Strategy. No likely significant negative residual impact.
Waste Management		
Maintenance	There will be small quantities of operational waste likely to be generated from the Project which will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996 to 2016.	No likely significant residual impact.
Biodiversity		
General	GCoC will ensure that the results of monitoring will be used to inform the long-term ecological mitigation programme and any necessary timely corrective action. During operation, GCoC will engage the services of a suitable contractor to monitor the ecological mitigation measures for the lifetime of the project. All the relevant requirements in relation to monitoring and maintenance of the ecological mitigation measures over the lifetime of the Project, will be included as conditions in the contract(s) entered into with the appointed contractor. GCoC shall ensure that provision is made, in the contract(s) entered into with the appointed contractor, for corrective action to be undertaken if any aspects of the implementation of the ecological mitigation measures and monitoring commitments proposals are not effective. These provisions shall include a requirement for a suitably qualified ecologist/biodiversity expert to review the efficacy of any corrective actions required.	
Designated Areas for Nature Conservation	**European Sites and Natural Heritage Areas and proposed Natural Heritage Areas** In addition to the construction measures proposed to minimise significant residual impacts on European Sites and Natural Heritage Areas and proposed Natural Heritage Area, the following measures for the operational phase are also proposed. Refer also the NIS in relation to European Sites: • Habitat loss/fragmentation: mitigation measures to minimise habitat loss in Lough Corrib SAC and to avoid loss of QI habitats within Lough Corrib SAC during operation (refer to section below on habitats River Corrib Bridge Constructability Report Appendix A.7.1, Menlough Viaduct Constructability Report Appendix A.7.2, Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3) • Habitat degradation – hydrogeology: mitigation measures to avoid habitat degradation in Lough Corrib SAC as a result of potential hydrogeological impacts during operation • Habitat degradation – hydrology: mitigation measures to protect water quality in receiving watercourses during operation (refer to Hydrology section below) • Habitat degradation – tunnelling/excavation: mitigation measures to maintain the structural integrity of rock mass supporting QI habitats in Lough Corrib SAC during the construction of the proposed Lackagh Tunnel (and its western approach) during construction and operation • Habitat degradation – non-native invasive species: mitigation measures to avoid the introduction or spread of non-native invasive species to European sites and Moycullen Boys NHA during operation. These are detailed in the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5 • Barrier effect: mitigation measures to avoid the Project restricting Otter movement within the Bearna Stream catchment • Mortality risk: mitigation measures to remove the risk of Otter being killed/injured due to collisions with road traffic The mitigation measures that are required to ensure that the Project will not significantly affect Moycullen Bogs NHA during operation are as follows: • Measures to avoid the introduction or spread of non-native invasive species to Moycullen Bogs NHA during operation.	No likely significant residual impacts.
Habitats	Areas of Annex I habitat within the Assessment Boundary which are identified to be retained and fenced off during the construction of the Project will also be avoided during the operational phase. There will be no fencing within Annex I habitats that are located within Lough Corrib SAC. Areas of compensatory habitat, including the habitat planting as part of the species mitigation measures for the construction phase will be maintained and monitored during the operational phase and remediation works undertaken if deemed necessary. Refer also to the section below in relation to Compensatory Measures.	No likely significant residual impact.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Measures to Protect Groundwater Quantity and Groundwater Quality and potential impacts on biodiversity receptors	The mitigation measures to protect groundwater quantity and quality during operation are detailed below for Hydrogeology and in turn protect many of the biodiversity receptors.	No likely significant residual impact.
Measures to Control and Prevent the Spread of Non-native Invasive Species	The mitigation strategy in relation to non-native invasive plant species which will protect many biodiversity receptors is as per that outlined above for the construction phase. These are detailed in the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5.	No likely significant residual impact.
Rare and Protected Plants and Species	Where Plagiomnium cuspidatum and Plasteurhynchium striatulum plants are directly impacted and are growing on moveable substrates (rocks or logs) then the substrates will be relocated to areas of retained vegetation, with precisely the same environmental conditions as the donor site, with follow-up monitoring to confirm success or failure.	No likely significant residual impact.
Otters	**Habitat Severance/Barrier Effect and Collision Risk** Otters use many of the watercourses crossed by the Project. To avoid Otter road casualties, Otter passage facilities will be provided at all watercourses used by Otter (e.g. raised ledges within structures, or separate dry 600mm pipes installed adjacent to culverts). Mammal underpasses will be constructed in accordance with the Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (National Roads Authority, 2008). The locations where Otter passage facilities will be provided are listed in Table 8.43 of Chapter 8, Biodiversity and are shown on Figures 8.38.1 to 8.38.15. Mammal-resistant fencing will be required to prevent Otter accessing the Project and to guide Otters to the mammal underpasses. Mammal-resistant fencing will be installed in accordance with the specification outlined in Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (National Roads Authority, 2008) and TIIs mammal resistant fencing specification (currently CC-SCD-00320/00319). The locations where mammal-resistant fencing is to be installed are shown on Figures 8.38.1 to 8.38.15. In accordance with the recommendations described in the Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (National Roads Authority, 2008), quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first year after the completion of construction works (for example, fencing inspections to check for gaps and underpass inspection to check for blockages). Also, given the scale of the project, monitoring will continue for at least three years and the maintenance of the ledges will be incorporated into the general road maintenance programme.	No likely significant residual impact.
Bats	**Measures to reducing mortality risk and barrier effects within the design and operation of the Project** The mitigation to address significant barrier effects has been designed to reflect current best practice. The two main approaches employed for the Project include underpasses of a suitable size where the design of the Project is on embankment and a wildlife overpass where it is in cut. These two measures are the only options that have been demonstrated to be effective at a population level (CEDR, 2016, (Elmeros and Dekker, 2016, Abbot et al 2012, 2012). Underpasses are proposed in important crossing point areas and are aligned with existing landscape features that are known to be used by bats as a result of the surveys. Underpasses in the Menlough - Bóthar Nua area and N84 Headford Road areas are regarded to be of critical importance for Lesser horseshoe bat and other bat movements across this landscape. Table 8.47 of Chapter 8, Biodiversity sets out the schedule of structures which provide bat passage and states the function that they serve in terms of mitigating the potential barrier effect. The size and location of the underpasses and culverts took into account the research carried out by Abbott (2012a, b) and the advice provided in the CEDR, COST341 and WC1060 reports. Refer also to Figures 8.39.1 to 8.39.15. In addition to the structures specifically designed for bat passage, there are other structures such as where minor roads pass underneath the Project which will be used by bats as safe crossing points. The structures provided for the passage of bats will be checked prior to the operation of the Project to ensure they are constructed in accordance with the design requirements as set out in this section as well as Section 8.9.2 of Chapter 8, Biodiversity. The section of the proposed N6 GCRR from the N84 Headford Road to N83 Tuam Road is almost entirely in cut and installing underpasses is not possible, therefore the only effective option is a wildlife overpass (referred to throughout as the Castlegar Wildlife Overpass). The Castlegar Wildlife Overpass is a critical component of the strategy. It will allow bats to fly across the Project between the roosts and foraging habitats on the north side and Coopers Cave and foraging areas to the south at this location. A width below 20m is not recommended as although evidence shows that species will still use these bridges, the frequency of use is reduced. The proposed overpass at Castlegar is therefore 30m wide. The overpass will be landscaped to provide a connective habitat across the Project. The proposed planting design comprises of a central narrow grass pathway bounded on either side by a double hedgerow in the middle section of the overpass (to mimic a 4m wide bóithrín); that is, 2m wide tree-lined hedgerows of native tree and shrub species. Each of the hedgerows will then diverge out to create a “mouth” at the entrance to the overpass on both sides of the Project to funnel bats into the centre of the overpass. Soil depths will vary from a minimum of 45cm at the edges to 1.5m along the centreline. Tree species will be planted at 3m centres in double rows in each hedgerow and will include alder, birch, rowan, planted as standards (i.e. 8-10cm girth, c.2.4m high) and whips (1.25m high). Sixty percent of shrub planting will comprise blackthorn, hawthorn and hazel, augmented with elder, holly, spindle, willow etc. Hawthorn plants will be 90cm high. Other shrubs will be planted at 60cm high. The planting design comprises of a double hedgerow in the middle section of the overpass (to mimic a 4m wide bóithrín). Each of the hedgerows will then diverge out to create a “mouth" at the entrance to the overpass on both sides of the Project to funnel bats into the centre of the overpass. No lighting will be provided at or on any of the structures which have been designed to provide bat passage, with the exception of S06/01 where lighting will be provided to allow for safe use by pedestrians. All of the bat underpasses (as well as artificial roosts) that are designed for Lesser horseshoe bats will have connecting woody vegetation features. Other bats species are not as reliant on hedgerows and woodland edges. Whilst there are many existing landscape features outside of the Assessment Boundary, the bat mitigation strategy cannot rely on these in the long term as they may be subject to interventions by third parties. In effect, what will be created is a hedgerow corridor leading up to underpasses in the section of the Project between Aughnacurra and Castlegar. This planting provides a guaranteed green	Significant residual impacts will still remain following the implementation of the mitigation measures as some of the activities are unavoidable and can only be mitigated to a certain level of certainty. These are the same as those outlined above for the construction stage. These residual impacts have been addressed further by the proposal for specific compensatory measures noted in Section 22.4.2 below.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	corridor connecting up the underpasses/overpasses and will allow bats to adapt more easily to any future landscape scale losses of connecting habitat features that may occur. The hedgerow planting leading up to underpasses will be maintained and the growth of the hedgerow monitored for 5 years following completion and remediation works undertaken if deemed necessary **Proposed monitoring programme** As the baseline level of bat activity and roost occupancy can change over time, pre-construction monitoring will be carried out in advance of construction works commencing to ensure that the data against which the post-construction monitoring will be compared to is as up-to-date as possible (refer to Bat Derogation Licence included in Appendix A.8.25). Monitoring of the effectiveness of the bat mitigation and compensation measures will also be undertaken during and post-construction. Where the monitoring identifies issues with either the mitigation or compensation measures (e.g. light spill affecting usage), these will be remediated to ensure that those measures will achieve their aims with respect to mitigating or compensating for impacts on the local bat populations (refer to Bat Derogation Licence included in Appendix A.8.25). Refer to the Construction section above in relation to Pre-construction monitoring. ***During and Post Construction Monitoring*** *Roost Monitoring* Monitoring of occupancy of the artificial roost buildings (including retrofitted retained buildings) and bat boxes will commence immediately after their installation to determine how soon they are used. They will be installed prior to the main site clearance phase; therefore, all monitoring can be by visual inspection according to the following schedule: • Emergence counts at Menlo Castle roost: emergence counts will be undertaken during the construction works and in 10 years following construction in May, July and August. These counts will be made using infra-red video camera recording at the same time as visual inspections of bats using the proposed new roost site adjacent to Menlo Castle in order to get an overall count of bats at this location • Artificial roost buildings: Occupancy of the proposed artificial roost buildings (including retrofitted structures) during the works and post-construction will be undertaken in the 10 years following completion of construction. Surveys will be undertaken in mid-winter for hibernation use and in May and July for use during breeding season. Surveys will include checks for individuals and also for droppings (where necessary using DNA analysis). Droppings will be removed after each check to ensure that the subsequent survey only records usage in the interim period. The roosts will be monitored annually for Lesser horseshoe bats and counts sent to the NPWS as part of the national Lesser horseshoe bat monitoring programme. This monitoring may be undertaken by NPWS staff, Galway bat group or others to be decided by the local authority. Remote modes of monitoring using new technology may mean that visits to the roosts are not always required and that infra-red images inside the roost can be sent wirelessly. Should the monitoring of the roosts suggest that bats are not using them, additional focused surveys will be undertaken to try to understand bat movements in the locality and aim to address any issues. Any changes that may be deemed necessary will be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in the Environmental Impact Assessment or Appropriate Assessment documentation. Temperature and humidity probes coupled with data loggers will be installed in the roosts for two years post construction of the roost and measures taken (e.g. fitting vents, increasing period of water tanks in the hibernation roost area) to address any issues arising • Bat boxes: The authors are not aware of any minimum or recommended standard for bat box monitoring. After installation, boxes will be visually inspected quarterly per year for the first two years. Research into the effectiveness of mitigation measures has indicated that occupancy of bat boxes averages 50% since bats may prefer existing alternative roost sites in the locality. Any boxes not showing signs of occupancy after that time may be relocated to alternative locations within the Assessment Boundary nearby where they may be of benefit to the local bat population. In years 3-5 after installation the boxes will be checked in late March and September to record usage in winter and summer and to avoid disturbance during the sensitive hibernation times • Bat boxes will be checked for a minimum of 10 years after erection Monitoring crossing points Monitoring will comprise acoustic detector and infra-red camera recording at the culverts at the five locations previously surveyed pre-construction, namely: • Area 1: North of Bearna Woods • Area 2: Aughnacurra • Area 3: River Corrib to Bothár Nua • Area 4: West of N84 Headford Road • Area 5: Ballindooley to Castlegar, including the Castlegar Wildlife Overpass This will quantify the usage by bats compared to non-usage (e.g. using other flight paths). This will allow a determination as to whether the bat passage structures are being effective at a population level (where it is assumed that 90% of the bats are able to pass underneath the Project). Monitoring will be repeated at all locations to provide a robust dataset. In the event that the proposed bat passage structures including the Castlegar Wildlife Overpass are not deemed to be effective, then further focused surveys will be required to determine the causes and address them in a reasonable manner where possible (for example, controlling lighting, addressing local landscape changes). Any changes that may be deemed necessary will need to be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in the Environmental Impact Assessment or Appropriate Assessment documentation. In accordance with CEDR (2016) guidance it is proposed that this post-construction monitoring involves a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for ten bat activity seasons (May-August) following completion of the construction of the Project. The monitoring programme described above also relates to the compensation measures for bats described in Section 8.9.2 of Chapter 8, Biodiversity and repeated below in Section 22.4.2. Diversity and abundance adjacent to the Project corridor Transects of bat activity will be taken across the same locations as the pre-construction transects in order to identify any displacement effects caused by disturbance impacts during construction and operation. Whilst the application of the Berthinussen & Altringham (2015) methodology is not without its limitations as it has only been applied to open agricultural landscapes, it is nevertheless a foundation for a reproducible survey method that is appropriate to the Project. If a displacement effect is detected (decreased abundance and diversity close to the Project) then further focused surveys will be required to determine the causes and address them where possible (for example, controlling lighting, addressing local landscape changes through additional planting). Any changes that may be deemed necessary will need to be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in the Environmental Impact Assessment or Appropriate Assessment documentation. It is proposed that monitoring takes place during construction and 10 bat activity seasons following completion of the construction of the Project.	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Badgers	***Habitat Severance/Barrier Effect and Mortality Risk*** Badger passage facilities provided at locations listed in Table 8.43 of Chapter 8, Biodiversity and shown on Figures 8.38.1 to 8.38.15 will protect badgers during the operational phase. Mammal underpasses will be constructed in accordance with the Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (National Roads Authority, 2006). Mammal underpasses which are at least 600mm in width, have adequate drainage, have good vegetation cover around the entrances and good habitat connectivity have been proven to be used by badgers (Eldridge & Wynn, 2011). Mammal underpasses will extend as far as, and integrate with, the mammal resistant fencing. Where engineering constraints conflict with the recommended locations at construction, mammal underpasses may be moved to the nearest most suitable location, but not more than c.250 m away. A number of the mammal passage structures lie within the modelled light spill zone and artificial lighting may affect their usage by Badger: structures C07/04, C07/01(b) and C12/01. Screening will be provided to ensure that the approaches and entrances to these structures are unaffected by light spill. Mammal-resistant fencing will be required to guide badgers to the underpasses and will be installed in accordance with the specification outlined *in Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes* (National Roads Authority, 2006a), and TIIs mammal resistant fencing specification (currently CC-SCD-00320/00319), and will include badger proofing of emergency access roads and other similar access points, where located in areas where mammal-resistant fencing is to be installed. The locations where mammal-resistant fencing is to be installed are shown on Figures 8.38.1 to 8.38.15. This includes mammal proofing the paladin security fencing proposed around all attenuation ponds/water ponds. In accordance with the recommendations described in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006), quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first three years after the completion of construction works (for example, fencing inspections to check for gaps and underpass inspection to check for blockages, checking effectiveness of the ledges installed in culverts). Also, given the scale of the project, monitoring will continue for at least three years and the maintenance of the ledges will be incorporated into the general road maintenance programme.	No likely significant residual effect on Badger, at any geographic scale.
Other mammal species (excluding bats)	The schedule of structures to provide for mammal passage, as per Table 8.43 of Chater 8, Biodiversity and as shown on Figures 8.38.1 to 8.38.15, are required to ensure permeability for all other mammal species across the Project during operation. ***Habitat Severance/Barrier Effect*** The combination of the network of dedicated mammal passage facilities, along with the bridge and viaduct structures (the proposed River Corrib Bridge and the Menlough Viaduct), and the retained lands above the proposed Lackagh Tunnel and the Galway Racecourse Tunnel provide a high degree of landscape permeability along the Project for all of the other mammal species recorded, or likely to be present, with the study area. The locations are described in Table 8.43 of Chapter 8, Biodiversity and shown on Figures 8.38.1 to 8.38.15. Wildlife passage facilities have been shown to be used by small mammal species such as Hedgehog, Pygmy shrew and Wood mouse (Dolan 2006; Eldridge & Wynn 2011); although their effectiveness has not been tested. However, it is likely that the high permeability of the Project will reduce the effects of any severance, barrier effect or collision risk that may be associated with the Project (Haigh, 2012) such that the species' conservation status would not be affected. ***Collision Risk*** There are no practical or effective means of preventing small mammals or arboreal mammal species (such as the Pine marten and Red squirrel, which are highly skilled climbers) from accessing the Project. As discussed above in relation to severance and barrier effect, the design of the Project provides for a high degree of permeability across the Project and this offers the most practical solution to minimise the potential interaction of small mammals with the Project. Collision risk is therefore, not likely to affect the species' conservation status and not likely to result in a significant negative residual effect, at any geographic scale.	No likely significant residual effect on any other mammal species (excluding bats), at any geographic scale.
Invertebrates	**Marsh whorl snail** *Habitat Degradation – Groundwater* The mitigation measures relating to the protection of the groundwater resource during operation are described below for Hydrogeology. **Marsh fritillary** No likely significant negative effects on Marsh fritillary are predicted during operation and no mitigation measures are required.	**Marsh whorl snail** No likely significant negative residual impact on the Marsh whorl snail, at any geographic scale. **Marsh fritillary** No likely significant negative residual impact on the Marsh fritillary butterfly, at any geographic scale.
Birds	**Breeding Birds** ***Habitat loss, Habitat Severance/Barrier Effect and Mortality Risk*** Planting of woodland, hedgerow and grassland habitats along the Project as detailed in the landscape drawings (Figures 12.1.01 to 12.1.15) will provide compensatory habitat for some bird species. In some instances, such as in large areas of improved agricultural grassland with no vegetated field boundaries, this will improve the diversity of bird habitat. Many species may not nest near a road development due to disturbance (e.g. drowning out of bird song by traffic noise). Whilst the planting is not likely to fully offset the loss of breeding habitat (due to the proximity of road traffic disturbance on the operational road) it is likely to provide additional foraging habitat for some species. To further minimise the effects of breeding habitat loss, a total of 20 nest boxes will be erected by a qualified ecologist in suitable locations away from the busy junctions/roadways. The siting and type of nest boxes will be decided on by an ecologist at locations where trees will be planted or retained along the Project; as shown on Figures 12.1.01 to 12.1.15. Nest boxes will be monitored annually by an ecologist, and the results reported to Galway County Council, to record their usage by breeding birds for a period of three years post-construction. ***Barn owl*** Barn owl mitigation measures will be integrated into the landscape design in proximity to, and within a 5km zone surrounding, the breeding site at Menlo Castle, where these measures do not conflict with other landscape and safety requirements and other environmental considerations of the road design.	**Breeding birds** No likely significant residual effect on breeding bird species, at any geographic scale, with the exception of the Barn owl and the Peregrine falcon. Due to the likely permanent loss of Lackagh Quarry as a nesting site, the Project is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale. In the absence of an evidence regarding the efficacy of the mitigation measures to reduce mortality risk, there remains the potential for permanent impacts on the Menlo Castle Barn owl nest site due to its proximity to the Project and local Barn owl population as a result of the mortality risk which may result a significant negative residual effect on Barn owl, at the local geographic scale

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	The immediate roadside verge will be created or maintained as unsuitable foraging conditions to discourage Barn owls from hunting in this area to reduce risk of direct vehicle collision and/or birds becoming caught in the wake of a Heavy Goods Vehicle (HGV). Within 3m of the road edge immediately adjacent to the hard shoulder / carriageway (in the absence of a hard shoulder), the grass will be maintained to a height not exceeding 10cm or replaced with gravel if appropriate (noting that gravel would generally be considered inappropriate unless there are issues for access for maintenance, or aesthetic considerations at feature areas, such as roundabouts or entrances to towns). If possible and suitable to the existing surrounding landscape, a natural barrier of dense shrub and/or tree line will be provided in the wider verge adjacent to the immediate roadside verge to serve as buffer to: (i) Focus the foraging activities of birds further from the road, (ii) Reduce the wake effect of HGVs, and (iii) Deflect the flight path of Barn owls which are crossing the road above the height of vehicles. Where the width of the verge and other landscape treatment requirements allow, suitable foraging habitat for Barn owl in the form of semi-natural grassland can be provided which is segregated from the traffic by shrub and tree lines. Sections along the Project will be planted with dense low growing scrub cover (e.g. blackthorn) to discourage Barn owls from foraging near the Project. The planting will be of a density to minimise the lag time between planting and obtaining sufficient ground cover to deter foraging Barn owl. In areas where there is a high probability that Barn owls may regularly attempt to cross the Project (the section of embankment between Ch. 9+600 and Ch. 10+100), lines of closely spaced (approximately 2m centres) trees, greater than 4m in height, will be planted along the top of the embankments of the Project; outside of the safety barrier and clear zone. The understorey will also be densely planted. This is to present a solid vegetated barrier to deflect Barn owl from these high-risk areas and/or force birds to fly over the Project above the road traffic. In other locations along the Project, where there are areas of suitable barn owl habitat being created or retained, a 2m wide belt of shrubs and trees that will reach a minimum of 4m in height will also be planted to discourage Barn owl from accessing the road carriageway. This mitigation planting should be varied in composition appropriate to the landscape adjacent and may consist of a mix of fast growing species such as Alder (*Alnus glutinosa*), Silver Birch (*Betula pendula*), Whitebeam (*Sorbus aria*), Mountain Ash (*Sorbus aucuparia*), Hazel (*Corylus avellana*) and Willow species (*Salix aurita, Salix caprea, Salix cinerea*) and understorey species such as Bramble (*Rubus* spp. - 60% of understorey mix), Hawthorn (*Crataegus monogyna*), Holly (*Ilex aquifolium*) and Blackthorn (*Prunus spinosa*). It should be noted that this belt of shrub and trees proposed is within the 'Clear Zone' defined by TII technical guidance (*GE-ENV-01102 A Guide to Landscape Treatments for National Road Schemes in Ireland*). For new plantings or existing trees within the Clear Zone, the maximum allowable diameter shall not exceed 100mm or a girth of 314mm (when measured at 0.3m above the ground). For new plantings, the design shall consider the mature size of the tree. The grouping of trees with trunk diameters ⩽ 100mm and/or girths ⩽ 314mm together may constitute a hazard due to the cumulative impact of the trees on an errant vehicle for a spacing of less than 1500mm. Thus, to achieve the desired mitigation for Barn owls, the trees should be planted as multi-stem or bush forms in these locations, as they will reach the required height, but will not breach the 314mm girth limit (when measured at 0.3m above the ground). Such trees should be planted at 3.5-4m height from the outset, in order to ensure that the required protection is in place at the earliest possible stage. In areas of cut, the belt of shrubs and trees will be extended up the sides of the cut slopes so that the Barn owl's flight path is diverted to the required extent. All mitigation planting will be in place at the earliest feasible stage during construction to ensure that the mitigation is functioning as soon as possible, following the opening of the Project. The locations where planting will be used to reduce the risk of Barn owl mortality from road traffic are shown on Figures 8.38.1 to 8.38.15 and on the landscape drawings (Figures 12.1.01 to 12.1.15). To establish and maintain rough grassland habitat for barn owl, lands covering an area of c.8.9 ha to the northwest of the Project at Menlo Castle (see Figure 8.38.1 to 8.38.15) will be grazed annually by cattle for a three-month period between July and October at a stocking rate of 0.35 livestock units/ha. The strategy, and prescribed stocking density, follows that used by the Barn Owl Conservation Trust at their Nature Reserve in the UK, as detailed in the *Barn Owl Conservation Handbook* (Barn Owl Trust, 2012). Annual monitoring of the grassland habitat will be undertaken for a period of 5 years post-implementation with the objective of recording the establishment of suitable rough grassland habitat and adjustment of the stocking density, if required. The following monitoring measures are proposed: • Surveys will be undertaken of roadside planting at the end of years one and two with the objective of identifying and replacing failed plantings. • A road casualty survey to record barn owl mortalities along the route of the Project will be conducted following that approach set out in REENV-07004 *The interactions between Barn owls and major roads: informing management and mitigation* (Lusby *et al.*, 2021) for a period of two years post-opening • Monitoring to determine activity and breeding status of all active sites within 5km of the Project over two breeding seasons (February to July). This will be carried out concurrently with the road casualty survey, and will involve visits to known and potential nesting sites to determine brood size and breeding success. Where accessible, nests will be visited in order to ring owlets (subject to an appropriate licence from the NPWS)). A report summarising the findings of the above monitoring will be submitted at the end of year two to the NPWS. The report may include further recommendations pending survey outcomes. **Peregrine** Monitoring of Peregrine falcon breeding activity at both Lackagh Quarry and the proposed alternative nest site will be undertaken throughout each breeding season over the entire construction period to ascertain any nest success/failure of the local breeding pair and if blasting is affecting numbers of common Peregrine falcon prey species. Use of the artificial nest sites will also be monitored during operation of the Project for a period of three years. **Wintering Birds** **Measures to Protect Wintering Birds during Operation** ***Disturbance/Displacement*** Despite the assessment conclusion that disturbance during operation of the Project is not likely to result in any population level effects on wintering birds, hedgerow planting along the Assessment Boundary (at the locations shown on the landscape drawings (Figures 12.1.01 to 12.1.15) will further minimise the potential disturbance to wintering birds from road traffic.	**Wintering birds** No likely significant residual effect on wintering bird species, at any geographic scale.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Amphibians	**Measures to Protect Amphibians during Operation** ***Habitat Severance & Barrier Effect*** The combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) provide a high degree of landscape permeability along the Project. This will serve to maintain connectivity at a local scale between sites used by amphibian species and is predicted to reduce any long-term severance or barrier effects associated with the Project such that the conservation status of amphibian species is not likely to be negatively affected. Where tunnels or culverts for mammal passage occur in close proximity to ponds or wetlands, structures, such as earth banks, will be included to guide amphibians to those crossing structures. The locations of the wildlife passage facilities are described in Table 8.43 of Chapter 8, Biodiversity and shown on Figures 8.38.1 to 8.38.15. These are required to ensure permeability for amphibian species across the Project during operation.	No likely significant residual effect on the Common frog or the Smooth newt, at any geographic scale.
Reptiles	**Measures to Protect Reptiles during Operation** ***Habitat Severance & Barrier Effect*** The combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) provide a high degree of landscape permeability along the Project. This will serve to maintain connectivity at a local scale between sites used by reptile species and is predicted to reduce any long-term severance or barrier effects associated with the Project such that the conservation status of amphibian species is not likely to be negatively affected. The locations of the wildlife passage facilities are described in Table 8.43 of Chapter 8, Biodiversity and shown on Figures 8.38.1 to 8.38.15. These are required to ensure permeability for the Common lizard across the Project during operation.	No likely significant residual effect on the Common lizard, at any geographic scale.
Soils		
Lackagh Tunnel	During the operational phase, monitoring of the rock mass stability will continue. The rock and overburden retaining systems in Lackagh Quarry and Western Approach will continue to be monitored as part of the Local Authority maintenance schedule to ensure that they continue to operate as intended for the design life of the Project. In the extremely unlikely event that instability within the rock mass is observed additional support measures outlined in Section 9.4.2.1 and Section 9.6.2.4 of Chapter 9 of this updated EIAR, for the construction phase will be installed to ensure that there is no impact to the structural integrity of the Limestone pavement. However, based on the conservative design approach (the installed composite support system and monitoring during construction), it is considered that the risk of instability will be avoided and additional support measures will not be required. Operation mitigations measures for Lackagh Tunnel are further discussed in Appendix A.7.3 of this updated EIAR. The implementation of the design, construction methodology control measures and mitigation measures result in no other operational phase mitigation measures for avoiding potential direct and indirect impact to the soils and geology environment for the Project.	No likely significant residual impact.
Hydrogeology		
Groundwater Quantity and Quality	During the operational phase of the Project inspection and maintenance will occur to ensure that the infiltration basins continue to operate as intended for the design life of Project. Several measures were incorporated into the design of the Project to minimise their impact. In the drainage design, the infiltration basin design uses over excavation below the design invert to place subsoil of an appropriate thickness and material that meets TII Guidelines (TII HD45/15). All the infiltration basins are more than 15m from surface karst mapped during the karst survey (refer to Figure 10.1.002) and will have sealed drainage up to the point of infiltration. All infiltration basins are designed to include the following features: • A containment area • A hydrocarbon interceptor • A wetland There is also a containment area in each drainage network that can manually be activated to contain spillage on the carriageway. Networks S19a, S19b and S41 are located on the Lough Corrib Fen 1 (Menlough) GWB, which supports groundwater dependant terrestrial ecosystems (GWDTE) at Coolagh lakes. Due to the sensitivity of the Lough Corrib Fen 1 (Menlough) GWB those drainage networks that drain the carriageway above the GWB, which include S19a and S19b, also have a liner installed to ensure that the treated run-off percolates through the full thickness of the subsoil. S41 is located on a side road with a lower risk of accidental spillage and as such does not include this mitigation measure. Infiltration basins will be inspected regularly to confirm that no observable subsidence in the infiltration has occurred due to karst. There are no guidelines on the inspection frequency for infiltration basins, however, based on the mitigation measures implemented the risk of subsidence occurring is considered to be low and inspection is recommended on 5-year frequency. If karst features and potential pathways are found to be present during inspection, then the Karst Protocol developed for the construction phase will be implemented to ensure that no preferential pathways have formed within the infiltration basin.	There are no residual hydrogeological impacts to European sites and no residual impacts associated with GWDTE on the Visean Undifferentiated Limestone. Residual hydrogeological impacts remain for groundwater level drawdown impacts below the location of five Annex I habitats and four non-Annex I habitats which are located on the Galway Granite Batholith noted above for the construction stage.
Hydrology		
Flood Risk	The proposed design flood level for the relief measures at the N83 Tuam Road include for the 100 year return period flood event with a 20% allowance for climate change is 17.5m OD Malin which will prevent flooding of the driveways to the dwellings and the N83 Tuam Road. The flood relief mitigation measures to eliminate the flood risk of the Project and reduce the existing flood risk in this area are described above in Table 22.1 for hydrology. To minimise the residual flood risk associated with the blockage of flood relief culverts and associated drainage assets, the following operational mitigation measure is recommended: • Regular (monthly) inspection of N83 Flood Relief facilities be carried out to ensure that the system is in proper working order and performing as designed.	There will be no likely significant residual negative hydrological impacts on drainage and general flood risk, water quality, channel morphology or key ecological receptors. As noted above in Table 22.1 under Hydrology, there will be a significant positive residual impact on the N83 Tuam Road flood risk.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
		However, negative slight residual flood impacts associated with the N83 flood relief measures noted in Table 22.1 will remain.
Landscape and Visual		
Project-wide Landscape Measures	Measures proposed to mitigate the landscape and visual impacts of the operation stage of the Project are considered under Project-wide Measures and Specific Measures. **Project-wide measures** are outlined below and shown on Figures 12.1.01 to 12.1.15 The project-wide measures will be applied over the entire Project, depending on the nature of the particular section. Where feasible landscape measures shall include for the re-connection of existing field boundaries and hedgerows along the Project. Where appropriate trees species as noted above and in Tables 12.7 and 12.8 of Chapter 12, Landscape and Visual, shall be randomly spaced in a visually naturalistic manner within such hedgerows. This approach will be locally modified to incorporate other landscape treatments, which may negate the requirement for the hedgerow, e.g. blocks of native woodland planting (see Landscape Guidelines, Section 6.2: Tree and Shrub Treatments) or semi-natural meadows (see Landscape Guidelines, Section 6.1: Grassland Treatments) where it is considered appropriate to have open sections along the proposed carriageway. Open sections shall allow for views to the wider landscape where they do not impinge on requirements for screening for residential properties or other amenities. Proposals will ensure that planting is distributed along the proposed N6 GCRR and the associated local road realignments and will vary from locally appropriate hedgerow reinstatement, with tree-planting, where appropriate; to wider plantings of landscape and screen planting; to the establishment of larger areas of scrub/shrub planting and new woodland for integration of the development within the wider landscape. The approach will provide a density and diversity of plantings and improve the biodiversity structure of the new landscape (see Landscape Guidelines, Section 6.2: Tree and Shrub Treatments). Treatments will take into consideration the assessment and recommendations of Chapter 8, Biodiversity and will ensure that, species which are locally indigenous and native are utilised in the proposed plantings. However, detailed proposals in terms of their nature and approach will consider the locally impacted environment and in terms of species may include non-invasive, non-native plants, e.g. within residential areas where existing garden plantings are disturbed. Where areas are in cut or fill, a grass or meadow sward will be established over the slope except in areas of cutting through stable rock (see Landscape Guidelines, Section 4.2: Cuttings and Embankments). Except where otherwise required, it is not proposed to plant either cut or fill slopes in their entirety, but to encourage a more naturalistic and locally sympathetic grouping of plantings within a semi-natural grass sward. Slopes may also be seeded to wildflower grassland and hydro-seeding may be utilised for seeding of steep slopes. It is expected that significant extent of rock cutting will arise on the proposed N6 GCRR. Stable rock slopes will be retained as an exposed face for natural colonisation and as a local landscape features. Along the length of the Project, landscape areas within junctions and small areas of severed fields, plots or other property acquired for the construction of the Project will be varyingly treated including being planted in a semi-natural copse like scrub plantings and native woodland species (see Landscape Guidelines, Section 4.6: Additional Plots and Other Areas). Such planted blocks dispersed along the proposed N6 GCRR will assist in the improvement of the longer-term visual character of the proposed N6 GCRR and local surrounds. Particular attention shall be given to an appropriate extent and scale of planting in and surrounding junctions (see Landscape Guidelines, Section 4.3: Junctions, Interchanges and Roundabouts) and embankments (see Landscape Guidelines, Section 4.2.2: Embankments). Certain areas along the length of the proposed N6 GCRR have been set aside for drainage requirements/pollution control/attenuation. Where proposed these will be securely fenced and planted with locally appropriate hedgerows, shrubs and/or screen planting located along the proposed development boundary to minimise any visual impact from off road areas. However, it is noted that these features also offer the potential to provide for improved landscape diversity and habitat. Proposed planting will generally be established using bare-root transplants, whips and feathered plants which adapt readily to disturbed ground conditions. A proportion, totalling not less than 5% of 'Half-standard' (6-8cm girth & 200cm-250cm tall) and a further 5% 'Standard' (8-10cm girth & 250cm-300cm tall) trees shall be used to supplement these plantings, especially in the vicinity of residential areas. All planting mixes will take cognisance of, and include native and local species as identified in the Chapter 8, Biodiversity. These requirements have been adapted and further detailed as appropriate to particular areas as set out in Table 12.8 of Chapter 12, Landscape and Visual. Where used, tree species will be selected from a list of primarily native, naturalised and indigenous species, which will include alder, common ash (subject to planting restrictions at time of works), common birches, common oaks, mountain ash, Scots pine and willow species. Planting sizes will be from 75cm to 400cm in height and tree species will be planted at average 2.0m centres within the wider planting mix. Shrub planting species utilised will be selected from a list of primarily native and indigenous species, which will include, blackthorn, elder, hawthorn, hazel, holly, guelder rose, spindle, willows and other plants found naturalised in the affected localities. Planting sizes will vary from 30 to 75cm in height and shrub species will be planted at between 1.0 and 1.5m centres depending of landscape type, see Table 12.8 of Chapter 12, Landscape and Visual. Hedge planting will be primarily of blackthorn and hawthorn interspersed with other species such as elder, hazel, holly and those found locally. Hawthorn within hedgerows shall be planted at between 75 to 90cm in height and at 500mm centres in each of 2 double staggered rows or wider plantings where a denser effect is required. The hedgerow will be interspersed with standard-sized randomly spaced tree species such as alder, common ash and oaks, as appropriate to particular locality. Areas to be seeded to meadow will be thinly topsoiled (5cm layer) and seeded with a locally appropriate seed mix. Mainline and side road verges will be cultivated, topsoiled minimum 200mm deep and stone buried to remove stones down to 25mm diameter prior to seeding to a low-maintenance grass seed mix. Where lighting is proposed, the lighting design shall meet the requirements of BS EN 13201-2:2003 and BS5489-1: 2003, Code of Practice for Design of Road Lighting. Lighting of Roads and Public Amenity Areas and shall comply with the requirements of the DMRB TD 34-91. The detailed lighting design shall be completed in a manner, which will minimise glare and will ensure that light-spill effect is minimised. In specific locations barriers and/or earth bunds may be provided to reduce the impact of noise. Such barriers will also have the effect of providing immediate visual screening of traffic from properties. Such features shall, wherever possible, be integrated within the proposed landscaping measures. The Noise and Vibration section below outlines the assessment of noise impact and the requirements for such mitigation. Project-wide Landscape and Visual Mitigation Elements and Treatments: • Cut slopes on mainline, link roads and local roads	During the initial operation stage landscape and visual impacts will continue to arise from the physical presence and operation of the Project. The proposed N6 GCRR will be a significant and prominent new element in the landscape – at least until such stage as landscape mitigation proposals establish and become increasingly effective. As such, initial operational-stage landscape and visual impacts will continue to be pronounced and negative in the short-term (i.e. pre-establishment stage). With the development of mitigation planting, the significance and severity of landscape and visual impacts will gradually abate over time. Negative visual impact will also continue to arise for residential and other properties located close to or adjoining the boundary of the Project for some time (i.e. post-establishment stage). Therefore, significant or notable residual landscape impacts will continue to arise: • Along the edge of Sruthán Na Libeirtí, Bearna • On the open elevated landscapes of Ballagh, Rahoon, Letteragh, Barnacranny and Dangan Upper • On the recreation sports and amenity landscape of University of Galway Sports Campus • On the lowland landscape valley of the River Corrib, and the setting of Menlo Castle • On the limestone landscape of Menlough and Coolough • On the rolling landscape through Castlegar, south of Ballindooley Lough Locations of these significant landscape impacts are provided on Figures 12.1.01 to 12.1.15 of Chapter 12, Landscape and Visual. Significant or notable residual visual impacts will continue to arise for properties: • At the crossing of local roads north and northeast of Bearna (Foraí Maola Road, Troscaigh Road, Ann Gibbons Road, Aille Road) • At the crossing of local roads northwest of Galway (Cappagh Road, Ballymoneen Road, Rahoon Road and Letteragh Road) • To either side of the crossing of the N59 Moycullen Road north of Galway (The Heath, Barnacranny, Ard na Locha, Aughnacurra and at Bushypark/Ballagh) • On the recreation sports and amenity landscape of University of Galway Sports Campus • On the lowland landscape valley of the River Corrib, and setting of Menlo Castle • At the crossing of Bóthar Nua and Seanbóthar north/northeast of Galway City • At the crossing of the N84 Headford Road, at Castlegar, (including crossing of School Road) and at the N83 Tuam Road, northeast of Galway

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	– Cut slopes shall be finished to even gradients, topsoiled unless otherwise stated in this table or elsewhere in this updated EIAR. Slopes shall be free of rubble and stones over 50mm diameter. All such rubble/stone shall be removed or buried. Unless otherwise stated slopes shall be seeded to a low maintenance non-agricultural grassland or to a diverse grass/wildflower sward, as appropriate. Steep slopes may be hydro-seeded. – Where exposed, stable rock cuttings/slopes will be retained as a landscape feature along the proposed road corridor. • Embankments on mainline, link roads, and local roads – Embankments shall be finished to even gradients, topsoiled unless otherwise stated in this table or elsewhere in this updated EIAR. Slopes shall be free of rubble and stones over 50mm diameter. All such rubble/stone shall be removed or buried. Unless otherwise stated slopes shall be seeded to a low maintenance non-agricultural grassland or to a diverse grass/wildflower sward, as appropriate. Steep slopes may be hydro-seeded. • Verges & Roundabouts on mainline, link roads, and local roads – Verges will be provided along both sides of mainline. Verges will also be provided around junctions and along local road re-alignments and tie-ins. Verges and roundabouts shall be finished to even or gently flowing gradients, with minimum 200mm topsoil. Areas shall be stone buried or raked will be free of rubble and stones over 25mm diameter. Verges and roundabouts will be seeded to low-maintenance seed mix. • Ponds, swales, 'V-drains' etc. – All slopes shall be evenly graded and free of rubble and stones over 50mm diameter. Slopes shall be seeded to low maintenance non-agricultural grassland or to a grass/wildflower sward, allowing for natural development over time. Steep slopes on pond edges and 'V-drains' may be hydro-seeded. – Areas around ponds shall be a diverse landscape of low maintenance grassland/species-rich grass wildflower sward and plantings of scrub planting and/or low-canopy woodland and shrub planting. Hedgerows of blackthorn and hawthorn, hazel and holly, without tree species, shall be established along non-roadside boundaries. – Non-palisade type fencing (e.g. paladin or timber and anti-climb netwire fencing) shall be installed to secure pond areas. – The overall objective of the landscape treatment around pond features is to provide a sustainable, low maintenance and ecologically diverse landscape of grassland and mixed planting with new hedgerows along secured boundaries. The ponds have the potential to add to local landscape, visual and ecological diversity. • Noise barriers/bunds – Where possible hedgerow scrub and shrub planting and/or low-canopy woodland of native species shall be established as either a narrow planting of 3.0m minimum width or double-staggered hedgerow along the full off-road face of barriers. – Low-canopy and/or shrub planting of native species shall be established on the off road face of bunds. The planting shall include ash*, birch, blackthorn, elder, hawthorn, hazel, holly, rowan and/or willow species as appropriate. Plants shall be 90 to 120cm in height at planting. * Note: Due to the risk of Ash Dieback (*Chalara fraxinea*) and until further notice, ash (*Fraxinus species*) is no longer approved by the TII for planting schemes. This does not impact on the use of Mountain ash – also known as rowan (*Sorbus aucuparia*). – Transparent noise barriers will be used on the River Corrib Bridge • Plants and planting areas – All tree species over 150cm in height together with all Pine shall be appropriately staked and tied. All failed, dead or defective plants shall be replaced before the end of each and every year of defect aftercare. – Full planting area will be free of stones over 50mm in diameter. • Grass areas – Grass areas shall provide full sward cover within 12 months of seeding. Any failed, bare or defective areas shall be re-seeded between March – May and/or August – September in each and every year of defect aftercare. • Unauthorised access, parking and/or encampment – Landscape proposals shall avoid creating areas considered as being suitable for unauthorised parking and shall use landscape proposals to deter and prevent such use. • Remnant areas – Any post-construction remnant lands shall be treated to a diverse range of grassland and/or planting proposals to include a minimum 30% planting, amended as locally appropriate. The remaining area shall be treated as locally appropriate low maintenance grass/species-rich sward. • Stone walls – Where stone walls are removed and not replaced as part of the Project, the stone will be retained and made available for re-use by the adjacent property owners for the construction of a new stone wall their side of the Project boundary if they wish. – The removal of sections of old stone walls is a significant impact along sections of the proposed N6 GCRR. Many of these are low, dilapidated and interwoven with vegetation. As such, it would not be possible to replace walls of the same character and such features would not provide for an adequate boundary to the proposed N6 GCRR. – Provision of new a stone boundary along the mainline would create its own visual issues, due to what would be a homogenous and incongruous landscape feature in contrast with the existing dry stone walls in the area. – Therefore, the provision of timber post-and-rail fences and substantial landscaping planting – with selective replacement of stone or render boundary walls to affected houses is considered preferable • Road lighting – As detailed at Section 5.5.4.4 of Chapter 5 of this updated EIAR, proposed road lighting has been designed to limit light trespass and measures include: o The use of modern LED fittings with well-defined, controlled light beam distribution o The use of horizontal, lighting cut-off fittings, which prevents light emission to the sky and minimises light direction off the proposed N6 GCRR. • Construction Compounds	• At Ballybrit/Parkmore, at Racecourse Avenue, Ballybrit Crescent, Monivea Road and Coolagh-Briarhill east of Galway

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	At the end of the construction contract construction compounds will be decommissioned, cleared and the lands reinstated or landscaped	
Specific Landscape Measures	Specific mitigation measures are set out on Figures 12.1.01 to 12.1.15 and in Table 12.8 of Chapter 12 of this updated EIAR which is summarised below. The measures include construction-related aspects such as avoidance/minimising impact on property boundaries and landscape features as well as provision of solid screen hoarding during the construction phase for those properties particularly impacted by the works. All of the following specific mitigation measures will be taken account of in the detailed design and implementation of landscape measures: • Location of cut-off drains at the top of cuttings and at the bottom of embankments • The location and requirements for maintenance access along the mainline of the proposed N6 GCRR • Locations where rock is encountered in cuttings. Such rock faces may be retained as geological features of the corridor of the proposed N6 GCRR • The location and integration of noise barriers within the landscape design • Clearance zones (TD19 - Safety Barrier Standards) • Sight-lines, including at junctions and to carriageway signage, etc. A series of significant retaining walls, and a bridge over the N59 Moycullen Road, are proposed in the Dangan area between Ch. 8+300 and Ch. 8+670. This is both an existing residential area and a gateway into the city. Where feasible reinforced earth retaining wall approaches will be incorporated so as allow for a green landscape finish to all or part of the retaining structures. A limestone finish will be used where structural walls are required and for the abutments of the proposed bridge over the N59 Moycullen Road. The stone will consist of natural limestone, matching the character of the local stone, with a strong horizontal axis of between 5 to 1 and 7 to 1 (i.e. horizontal to vertical dimension). Landscape Measures also take account of the specific protection and mitigation measures detailed in Chapter 8 of this updated EIAR. In particular, the measures include: • Retained habitats, trees and hedgerows on land-take boundaries, etc. will be fenced-off and protected during construction works • Specific measures are proposed at a number of locations for mitigation of potential impact on Bat species. This includes: – the provision of artificial bat roosts – with specific planting to encourage use – the provision of a planted wildlife overbridge (Ch. 12+700) with tie-in planting to local hedgerows and proposed planting on the boundary of the proposed N6 GCRR, which will maximise potential benefit and use – dense planting, with trees for improvement of connectivity along the boundary of the proposed N6 GCRR: o west of the crossing of the L1323 Letteragh (Ch. 7+200 – Ch. 7+280) o along embankments to either side of the proposed bridge over the River Corrib o between the crossing of the N84 Headford Road at Ballindooley and School Road at Castlegar – hedgerow planting for improvement of connectivity of habitats to the east of Menlo Castle – hedgerow and copse planting for enhancement of foraging habitat to the north of Menlo Castle • In order to deter Barn Owls from foraging close to the proposed N6 GCRR, embankments and cuttings, other than rock cuttings or cut slopes left to naturally regenerate, will be densely planted with low growing scrub (e.g. blackthorn, hawthorn) from Ch. 8+550 to Ch. 17+500 • In order to deter Barn Owls from over flying the proposed N6 GCRR, planting of closely-spaced trees (approx. 2m centres) greater than 4m in height will be established along the top of the embankments between Ch. 9+600 and Ch. 10+100 • All mitigation planting will take place at the earliest opportunity feasible during the construction stage so as to maximise establishment prior to road opening Specific Landscape and Visual Mitigation Elements and Treatments: • 6.0m wide Screen Planting: (Planting at 1.0m centres for visual screening shall be of a minimum of 6m in width. The planting shall extend for a minimum of 100m to either side of any adjoining residential property or amenity (refer to Figures 12.1.01 to 12.4.15). – Planting will include a dense planting at 1m centres of alder, birch, blackthorn, elder, geulder rose, holly, hawthorn, hazel, rowan, and willow species. Shrubs shall be planted at between 60 to 90cm in height. – Scots pine of minimum 60cm in height at planting shall comprise 20% of the overall plant numbers and holly at a minimum of 45cm in height shall comprise a further 15%. – Tree species, planted equally at half-standard (6-8cm girth) and standard size (8-10cm girth), shall comprise minimum 10% of the mix. • 3.0m wide Screen Planting: (Where space is limited planting at 1.0m centres for visual screening shall be of a minimum of 3m in width. The planting shall extend for a minimum of 100m to either side of any adjoining residential property or amenity (refer to Figures 12.1.01 to 12.4.15). – Planting will include a dense planting at 1m centres of alder, birch, blackthorn, elder, geulder rose, holly, hawthorn, hazel, rowan, and willow species. Shrubs shall be planted at between 60 to 90cm in height. – Scots pine of minimum 60cm in height at planting shall comprise 20% of the overall plant numbers and holly at a minimum of 45cm in height shall comprise a further 15%. – Tree species, planted equally at half-standard (6-8cm girth) and standard size (8-10cm girth), shall comprise minimum 20% of the mix. • 3.0m wide Screen Planting: (West from Ch. 1+760 back to Ch. 1+580 (refer to Figures 12.1.01 to 12.4.15)). – It is proposed to extend the proposed 3m wide mixed screen planting belt along the property side of the proposed N6 GCRR. • Stone Wall Boundaries (Stone walls as indicated on Figures 12.1.01 to 12.4.15). – Where indicated stone walls will be replaced along impacted sections of property and road boundaries on local roads. The stone from the disturbed sections of existing walls will be retained and re-used (generally granite to west; limestone to east) where possible to reinstate these new boundaries. The boundary walls may be backed by hedgerows of locally appropriate species, i.e. blackthorn, hawthorn	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	and holly to west and hazel, hawthorn and holly to east. Elsewhere, where stone walls are removed the stone will be retained and made available for re-use by the adjacent property owners for the construction of a new stone wall on their side of the proposed development boundary if they wish. • Boundary Hedgerow (Typical double staggered hedgerow with tree planting, where locally appropriate) – West: Primarily blackthorn (30%), hawthorn (40%) and holly (10%) hedgerow in west interspersed with other species (20%) such as elder, willow, and those found locally. – East: Primarily hazel (30%), hawthorn (40%) and holly (10%) hedgerow to east interspersed with other species (20%) such as blackthorn elder, willow, and those found locally. – Hawthorn plants shall be of c.90cm in height and planted at 50cm centres in each of two double staggered rows, 25cm apart. Other plants of c.50cm in height shall be interspersed. – The hedgerow may be interspersed with 'half-standard-sized' (6-8cm girth) alder, birch and/or oak trees planted at random spacings but averaging a min. of 1 tree per 25 linear metre. Limited tree species, such as birch and mountain ash may also be included as 'whips' at 150cm in height. • Retaining Walls and structure over the N59 Moycullen Road: (Use of reinforced earth retaining systems and limestone finishes for structural elements. Retaining Wall Structures R08/01; R08/02; R08/07 & R08/04; and Bridge Structure S08/02 (Ch. 8+300 to Ch. 8+670)) – Where feasible reinforced earth retaining wall approaches will be incorporated so as allow for a green landscape finish to all or part of the retaining structures. – Planting of trees shall also be provided along the base of the structure. These shall include smaller growing species such as alder, birch and rowan planted as Selected Standards (i.e. 14cm girth or greater) – A limestone finish will be used for the external finish of the abutments of the proposed bridge over the N59 Moycullen Road and where structural walls are required. The stone will consist of natural limestone, matching the character of local stone, with a strong horizontal axis of between 5 to 1 and 7 to 1 (i.e. horizontal to vertical dimension). • Bat habitat enhancement (New 2m wide tree and shrub hedgerow, with occasional planted copses located north and east of Menlo Castle.) – New hedgerow of native species will be established with plants at 0.5m staggered centres in each of 5 rows located 0.5m apart to sub-divide existing open fields. – Standard-sized trees species (min 8-10cm girth, 2.4m high) will be planted at 15m staggered centres in each of the 3 central rows. Diverse range of shrub species will be planted between trees in the central rows and throughout the outer 2 rows. – Circa 15m diameter woodland copses will be established within open fields using similar approach, densities and species. – Planting will be protected by stock-proof fence, c.1.25m high located at 1.0m offset to either side of the outer row of the new hedgerow. – Tree species to include alder, birch, oak, rowan, planted as standards (as above) and whips (1.25m high). Shrubs to comprise mainly blackthorn, hawthorn and hazel (combined 60%), with elder, holly, spindle, willow etc. – Hawthorn plants shall be of between c.90cm in height and all other shrubs shall be c.60cm in height. • Wildlife Overpass: (Ballindooley/Castlegar, Structure S12/02 (Ch. 12+700)) – Wildlife overpass (c.30m wide) will be landscaped to provide for connective habitat across the proposed N6 GCRR. Planting to consist of a central narrow grass path bounded on either side by tree-lined hedgerows of native species. – Soil depths to vary from minimum c.45cm depth at edges to c.1.5m depth along centre-line of both hedgerows. Planted element of both hedgerow lines will be c.2m wide with standard-sized trees (min 8-10cm girth, 2.4m high) planted at 3m staggered centres in each of 2 rows in each hedgerow. Diverse range of shrub species will be planted between trees and along the line of each hedgerow. – Planting to tie-in to proposed planting leading east and west on upper slopes of cuttings on both sides of the proposed N6 GCRR. This will form a continuous hedgerow/planted network. – Tree species to include alder, birch, oak, rowan, planted as standards (as above) and whips (1.25m high). Shrubs to comprise mainly blackthorn, hawthorn and hazel (combined 60%), with elder, holly, spindle, willow etc. – Hawthorn plants shall be of between c.90cm in height and all other shrubs shall be c.60cm in height. • Barn Owl Tree Planting: (Typical double staggered treeline with dense underplanting, between Ch. 9+600 and Ch. 10+100. – Deterrent tree planting to comprise alder, birch and/or rowan planted at 3m in height (min 12-14cm girth) and at 2.0m centres in each of 2 rows 1.5m apart. – Dense low scrub planting to comprise blackthorn (50%), hawthorn (20%), hazel (10%) and holly (10%) hedgerow in west interspersed with other species (10%) such as elder, willow, and those found locally. – Hawthorn plants shall be of c.90cm in height and planted at 50cm centres. Blackthorn and other plants shall be of c.50cm in height and planted at 50cm centres in staggered rows, 50cm apart. • Barn Owl Scrub Planting (Dense low scrub planting on all embankments and cut slopes (other than rock cuttings or cut slopes left to naturally regenerate) from Ch. 8+550 to Ch. 17+540): – Dense low scrub planting to comprise blackthorn (50%), hawthorn (20%) hazel (10%) and holly (10%) interspersed with other species (10%) such as elder, willow, and those found locally. – Hawthorn plants shall be of c.90cm in height and planted at 50cm centres. Blackthorn and other plants shall be of c.50cm in height and planted at 50cm centres in staggered rows, 50cm apart. • Compensatory Habitat Areas: (CHA) Along Project: Refer to 'CHA' locations on Figures 12.1.01 to 12.4.15): – Areas identified for compensatory habitat for mitigation of potential ecological impacts will be as outlined above for biodiversity. • Aughnacurra Estate (Ch. 8+530 to 8+680 Aughnacurra Estate (Refer to location on Figure 12.1.06)): – A grass verge with birch tree planting will be established to either side of the new entrance avenue into Aughnacurra Estate to match the character of the existing entrance. • Properties 539 & 540 Aughnacurra Estate (Ch. 8+670 to 8+800 Aughnacurra Estate (Refer to Property No.'s. P008-066 & P008-067 on Figure 12.1.06)): – Except where the existing wall is retained, a new stone wall will be constructed to the front of Properties 539 and 540 (west of proposed N6 GCRR) along the side of the existing / realigned avenue within Aughnacurra Estate to match the character of existing stone walls within the estate. • Properties 539 & 540 Aughnacurra Estate (Ch .8+670 to 8+800 Aughnacurra Estate (Refer to Property No.'s. P008-066 & P008-067 on Figure 12.1.06)): – Ground levels within the residual lands at Properties 539 and 540 shall be raised back towards the proposed N6 GCRR and planted with 1000 no. trees of between 1.0 and 2.0m in height in accordance with the details set out on Figure 12.4.01. The soil grading and planting shall not interfere with the proposed Bat Roost Structure in Property 540.	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Plot 195 (Ch. 2+850 Bearna to Moycullen Road L1321 (Refer to Property No. P002-013A on Figure 12.1.01)): – It is agreed to consult with the landowner of Plot 195 in relation to the planting proposals to be established along their property boundary. • Plot 229 (Ch. 5+800 (Refer to location on Figures 12.1.04 & 12.1.05)): – In accordance with measures provided for under Project-wide Landscape Measures and above, any post-construction remnant areas within acquired portions of Plot 229 will be planted to locally appropriate native woodland species. In summary, the total planting in this updated EIAR is: • Boundary hedgerow planting will result in the planting of over 68km of new hedgerow with c.275,000 hedgerow trees and shrubs, which includes over 2,700 half-standard sized trees • Screen planting will result in the planting of over 300,000 sqm of screen planting with c.300,000 trees and shrubs, which includes c.40,000 standard / half-standard-sized trees • In overall terms, landscape proposals will result in the establishment of over 500,000sqm. i.e. 50 hectares, of new planting using approximately one million trees and shrubs	
Cultural Heritage		
General	The proposed mitigation measures for the operational phase are listed below. These measures are proposed to mitigate the indirect impacts of the operational phase of the Project on these features. It is noted that these measures will be carried out during or prior to the construction phase: • Archaeological sites, AH 15, 16, 29 and 24 will be subject to a detailed photographic and written landscape record to preserve their current setting prior to the construction and operation of the Project. This shall be carried out by a suitably qualified person or team in consultation with the DoHLGH and the TII Project Archaeologist. • Protected structures, BH 1, 7, 9, 10 and 17 will be subject to a detailed photographic and written landscape record to preserve their current setting prior to the construction and operation of the Project. This shall be carried out by a suitably qualified person or team in consultation with the DoHLGH and the TII Project Archaeologist. • Designed Landscapes, DL 4, 7 and 8 will be subject to a detailed photographic and written landscape record to preserve their current setting prior to the construction and operation of the Project. This shall be carried out by a suitably qualified person or team in consultation with the DoHLGH and the TII Project Archaeologist. • Cultural heritage sites, CH 8, 20, 23, 25, 30, 32, 33, 36, 37, 57, 68, 70, 71, 72 and 78 will be subject to a detailed photographic record, along with a written and photographic landscape record, (if required) to preserve their current setting prior to the construction of the proposed N6 GCRR. This shall be carried out by a suitably qualified person or team in consultation with the DoHLGH and the Project Archaeologist.	Whilst the proposed mitigation measures will record the current context of those sites which will be indirectly impacted, they will not fully remove the residual impact of the Project on the setting of the following sites: • AH 15/BH 19 Menlo Castle – post mitigation the operation of the Project will have an indirect negative impact on the castle, of moderate significance of effect. • AH 16/BH 10 Summer House – post mitigation the operation of the Project will have an indirect negative impact on the summer house, of moderate significance of effect.
Agriculture		
Operational Road	• The loss of agricultural land due to the construction of the Project is a permanent loss which cannot be mitigated except through compensation. • Landowners who lose buildings to the Project will be compensated. Compensation payments will enable farmers to replace buildings. • All separated land parcels will be accessible either via the local road network, via accommodation access roads and access tracks. • Where existing water and electricity supplies to fields or farm yards are severed, the supply will be reinstated by provision of ducting where possible. Alternatively, where ducting is not feasible a permanent alternative water source or electricity supply will be made available. Compensation payments will enable farmers to replace power and water supplies. • Landowners may have to build additional farm facilities (e.g. cattle holding and testing pens) on their separated land. Field boundaries and paddock systems may have to be re-organised to take into account the altered shape of fields. These matters are addressed in the compensation payments. • Water from the Project will be diverted to attenuation ponds before discharging to watercourses or to ground. The drainage design of the Project will intersect existing field drains and carry the drainage water to suitable outfalls. Drains and drainage outfalls within the proposed fenceline for the proposed N6 GCRR will be maintained by the local authority during the operation phase. • Boundary fencing along the mainline will be maintained by the local authority. • Other injury impacts such as loss of shelter, removal of field boundaries, disruption of farm roads and field paddock systems and the increased potential for trespass on to private land due to the Project are taken into account in this assessment. Statutory compensation will be used to compensate landowners for residual effects and to allow the landowners to execute mitigation measures and re-instatement works on their own land. • Landscaping along the Project will minimise the visual impact on farms along the route of the Project and will over time improve shelter in affected farms.	The 41 Moderate, 39 Significant, 7 very significant and 4 profound impacts will remain and will be dealt with as part of the land acquisition process and will be agreed at a later date with a valuer. Compensation does not form part of the EIA process and is therefore not considered further Whilst the residual impact on individual plots is significant and profound on some plots, the overall impact on agriculture in the study area is not significant.
Material Assets Non Agriculture		
Operational Road	The Project will result in a 20 per cent reduction of the UoG Sporting Campus at Dangan, due to the encumbrance caused by the viaduct support structures. This will result in the permanent removal of one grass-based GAA sized playing pitch and a sports training pitch in front of the pavilion building. As noted above, UoG have planning permission for replacement pitches at an alternative location on UoG lands in line with their strategy and for UoG to mitigate the impacts of the proposed N6 GCRR on their sports campus and to ensure its continued operation to its requirements and in accordance with its masterplan and strategy. To ensure interconnection for UoG Sporting Campus post completion of the construction of the proposed N6 GCRR, Galway County Council will provide UoG with a right for UoG to use the lands under the proposed viaduct for sporting/athletic purposes by way of a long lease. The stable yard and associated facilities for Galway Racecourse, as per separate planning application, will be relocated as shown on Figure 15.4.01 and detailed in Appendix A.15.2, mitigating the operational impacts on the racecourse. Noise barriers will be provided across the length of the Project to mitigate potential increase in noise as detailed in noise and vibration and shown on Figures 18.1.1 to 18.1.15.	The residual impacts from all of the very significant/significant impacts, 54 residential properties, eight commercial properties and one residential planning permission, which will be acquired and/or demolished to accommodate the proposed N6 GCRR, remain as very significant/significant impacts as no mitigation is possible to reduce the impact. The residual impact post compensation cannot be assessed as the compensation to be agreed as part of the land acquisition are outside the scope of the EIA process. The residual impacts on UoG Sporting Campus from a material assets perspective can be reduced from Very Significant as assessed in 2018 to Moderate with the additional mitigation secured by UoG and within their control.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
		The residual impact on University of Galway Sporting Campus post compensation cannot be assessed as the compensation to be agreed as part of the land acquisition is outside the scope of the EIA process.
Air Quality		
Air Quality	As no significant adverse effects on air quality are predicted to arise at human receptors, no project specific measures are proposed. As outlined in Section 16.2.7 of Chapter 16, Air Quality, an intermediate case has been applied to the TII REM Tool emissions calculations. Should the CAP scenario arise, based on achieving increases in EVs including 151,000 passenger car EV and PHEVs by 2025 and 840,000 passenger car EV and PHEVs by 2030, a lower level of pollutant concentrations would be predicted. In addition, on 10 November 2022, the EU Commission proposed more stringent air pollutant emissions standards for combustion-engine vehicles, regardless of the fuel used. The current emission limits apply to cars and vans (Euro 6) and to buses, trucks and other heavy-duty vehicles (Euro VI). For buses and trucks, stricter limits for exhaust emissions measured in laboratories (e.g. NOx limit of 200mg/kWh) and in real driving conditions (NOx limit of 260 mg/kWh). The Euro 7 proposal tackles non-exhaust emissions (microplastics from tyres and particles from brakes) and includes requirements concerning battery durability. This regulation will have the effect of further reducing vehicle emissions, particularly affecting the design year.	No likely significant residual impact. All predicted pollutant concentrations for the protection of human health comply with the air quality standards in 2031 and 2046. A worst-case effect of moderate adverse is predicted at one modelled receptor with the vast majority of receptors predicted to experience a neutral effect. Predicted concentrations of NOx are predicted to comply with air quality standards with a worst-case impact rating of moderate adverse expected in 2031 and 2046. Concentrations of ammonia are predicted to exceed the maximum critical level up to 30m (2031) and 40m (2046) from the proposed Project in the vicinity of Lough Corrib SAC. A substantial adverse impact rating is assigned at these locations. Levels of nitrogen deposition are predicted to comply with the critical load in 2031 with exceedances projected within 20m of the proposed Project at the Lough Corrib SAC. As outlined in the TII standard and as outlined **Section** 16.2.7 of Chapter 16, Air Quality, to determine if the air quality impacts at a sensitive designated habitat are significant, the project biodiversity practitioner shall consider a number of aspects, including the degree of sensitivity of fauna to relatively subtle changes in botanical composition and the extent of the sensitive designated site that is negatively affected. Refer to the Biodiversity section above for an analysis of the potential implications for the affected ecological sites.
Climate		
Climate	As no significant adverse impacts are likely due to the vulnerability of the Project to climate change, no mitigation measures are required. Carbon emissions are reduced through the implementation of a speed limit of 100km/hr which is less than the 120km/hr that usually applies to motorway schemes. Emissions are lowest between 55 and 95km/hr, increasing at higher and lower speeds. This measure is assumed to be in place in the assessment outlined in Chapter 17, Climate, so is deemed to be mitigation through design. Measures included in the Climate Action Plan and EU legislation have the potential to reduce emissions into the future. Although not considered to be mitigation measures for the purposes of the proposed Project, these measures are included here to demonstrate that emissions will continue to decrease due to regulation. EU Regulation 2023/1623 sets the following emission standards: • Cars: 93.6g CO2eq/km (2025-2029) and 49.5g CO2eq/km (2030-2034) • Vans: 153.9g CO2eq/km (2025-2029) and 90.6g CO2eq/km (2030-2034) From 2035 onwards, the EU fleet-wide CO2 emission target for both cars and vans is 0g CO2eq/km, corresponding to a 100% reduction. In May 2024, the EU formally adopted the regulation on CO2 emission standards for heavy-duty vehicles, amending and strengthening the existing EU rules. The updated rules will further reduce CO2eq emissions from road transport and will introduce new targets for 2030, 2035 and 2040. The regulation establishes the following new targets for heavy lorries weighing over 16t: • a 45% emissions reduction from 2030 • a 65% emissions reduction from 2035 • a 90% emissions reduction from 2040 These targets will apply to medium lorries, heavy trucks weighing over 7.5t and coaches, as well as to corresponding vocational vehicles from 2035 onwards. The new rules introduce a 100% zero-emission target for new urban buses by 2035, with an intermediate target of 90% for this category by 2030. Under CAP24, the following is proposed for the private car fleet by 2030:	In accordance with the TII Standard the impact of the Project should be considered based on its whole lifecycle. The Project is expected to have a permanent moderate adverse effect on climate during over its lifecycle. This is on the basis of the following: • The project's GHG impacts are partially mitigated; Measures are proposed during the construction phase which will have the effect of reducing the generation of embodied carbon as described in Chapter 17, Climate. This has the effect of reducing the level of impact of construction phase effects from major to moderate. No specific operational phase mitigation measures are proposed; the Project relies upon measures that are specified in CAP24 and EU Regulation to reduce carbon emissions in the future • Although the Project is expected to result in an increase in GHG emissions during its operational phase and therefore falls short of full contribution to Ireland's trajectory to net zero, these increases will decrease over time through the implementation of measures outlined in CAP24 and EU regulation as demonstrated by the outcomes of the assessment of the 2046 scenario.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	• Battery electric vehicle (EV) share of total passenger car fleet (30%) • EV share of new registrations (100% • 845,000 private EVs The following is proposed for the commercial fleet in 2030: • 20% EV share of total LGV fleet: 95,000 commercial EVs • 30% zero-emission share of new heavy duty vehicle registrations: 3,500 HGVs It is noted that these measures should be implemented prior to the opening year of the Project in 2031. No monitoring is required during the operational phase.	
Noise and Vibration		
Operational Road	The mitigation measures required to reduce traffic noise levels are specified based on the predicted noise levels for the Design Year of 2046. As discussed in Section 18.5.4.1 of Chapter 18, Noise and Vibration, a total of 79 locations have been identified to trigger the three TII conditions for noise mitigation. Since the 2018 EIAR, there are an additional 7 additional NSLs identified for mitigation which relate to newly constructed or planned properties. A Low Noise Road Surface (LNRS) will be used to reduce noise generated at source. Noise barriers as detailed in Table 18.24 in Chapter 18, Noise and Vibration will be implemented to reduce noise levels along the propagation path between the source (proposed N6 GCRR) and the specific receivers (houses, schools, churches etc.). These screens may be constructed as earth bunds, proprietary noise barriers or a combination of both. In addition to the physical barriers proposed, it is recommended that the following sections of road, outside of the Assessment Boundary are surfaced with a LNRS to reduce potential significant impacts in the opening and design years: • Ballymoneen Road: South of the proposed N6 GCRR to Western Distributor Road Junction • Ballymoneen Road: North of the proposed N6 GCRR to Rahoon Road Junction • Letteragh Road / Circular Road: South of the proposed N6 GCRR to Seamus Quirke Road This proposed approach aligns with the Draft Galway City and Galway County NAPs which identifies the use of resurfacing roads with a LNRS (10mm SMA) areas with identified significant effects. The proposed noise mitigation set out above have been designed to reduce traffic noise levels at or below the traffic noise design goal of 60dB L_{den}, where relevant. • The mitigation measures associated with the physical noise screening has been assessed to provide the most suitable available noise mitigation at the nearest sensitive locations. Discussion on the residual impacts taking account of the proposed mitigation measures are outlined in Chapter 18 of this updated EIAR	overall balance of residual effects are determined to be moderate or less across the Project with a small number of localised residual moderate to significant effects in the short and long-term assessment periods.
Population and Health		
Population	The provision of crossing facilities at the Foraí Maola Road, Troscaigh Road, Bearna to Moycullen Road L1321, Cappagh Road and Ballymoneen Road junctions to facilitate occasional pedestrian and/or cyclist crossings of the proposed N6 GCRR. Pedestrian crossing facilities are also proposed at the terminus of the N59 Link Road North Junction at the N59 Moycullen Road (Bushypark Junction) and at the slip road connections with the N84 Headford Road Junction. Cycle lanes are proposed to facilitate access to the Miller's Lane pitches and Gort na Bró and at the N84 Headford Road Junction. The following specific mitigation measures are proposed to improve journey amenity and minimise severance: • Provide pedestrian crossing facilities at junctions between the proposed N6 GCRR and minor roads serving local rural communities • Provide pedestrian crossing facility at Bushypark Junction with N59 Link Road North during operation • The existing historic gates at the entrance to the Aughnacurra Estate will be re erected at the front entrance upon completion of the construction phase, noting that they are decorative and currently do not close and that they will not close and span the new entrance width • Provide pedestrian crossing facilities at N84 Headford Road Junction during operation • A 2m cycle track will be provided from Gort na Bró Roundabout to Gael Scoil Mhic Amhlaigh on both sides • A two-way cycle track will be provided from Gael Scoil Mhic Amhlaigh to Rahoon Road on the eastern verge of Gort Na Bró Road • Signage will be erected at property 668 during construction to ensure that the entrance location is prominent and easily identifiable • The existing signage at property 668 on the N83 Tuam Road will be removed, stored and erected at the property upon completion • Provide pedestrian crossing facilities at N84 Headford Road Junction • Provide a footpath within the proposed development boundary along School Road, Castlegar • Provide directional signage for a Briarhill Business Park, including a car dealership located here • Take measures to ensure that cul-de-sacs or adjacent lands are not used for illegal parking The Project will facilitate the full implementation of all of the walking, cycling and public transport measures set out in the GTS, all of which align with our climate action targets. The transference of traffic from the existing N6 through Galway City to the Project will provide an opportunity for improved pedestrian and cycle paths and crossing facilities, including continuity at major junctions and a modal shift to alternatives to the private car. Improved walking and cycling journey amenity is contingent on these appropriate facilities being provided. When implemented, such facilities will provide a significant improvement to pedestrian and cyclist journey amenity combined with reduced severance. Material Assets Non-Agriculture above outlines the proposed mitigation measures for the University of Galway Sporting Campus facilities and Galway Racecourse.	There will be significant positive residual impacts (and in some cases profound) due to improvements in journey times and connectivity between locations to the east and west of Galway City. There will be a significant residual amenity effect on visitors to Menlo Castle on the east bank of the river due to the presence of the River Corrib Bridge. Slight residual impacts on tourism during the construction phase will be replaced by a very significant net positive impact due to the improved connectivity provided by the Project and by improved access into Galway City. The transfer of traffic from existing highly congested routes on the existing N6 and other roads, for example, in Doughiska, represents a significant to profound positive impact on journey times and journey amenity of drivers, cyclists and pedestrians as well as on the general amenity of people living and working alongside these roads. A profound positive residual impact will apply to businesses operating from the Parkmore Business Park and other nearby commercial/industrial estates in terms of much improved access to the N83 Tuam Road and between this road and the N6. This positive impact applies also to the business Boston Scientific, although a degree of severance will be introduced between existing and proposed facilities

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
		which will be mitigated by vehicle and pedestrian crossing facilities.
Irish Language	Place names shall be cited in accordance with the relevant Place Name Order issued under the Official Languages Act 2003	There will be positive moderate residual impact on the Irish Language once the Project is operational.
Human Health	Mitigation measures proposed for the potential air quality, noise, water, soils and landscape and visual are specified above in the respective sections. The implementation of these mitigation measures, emissions, including air and noise will be adequately controlled to ensure no adverse effect on human health.	**Health Protection** From a community perspective, overall the implementation of the mitigation measures will result in a residual slightly positive impact. Similarly, from a psychological health point of view overall from community perspective the impacts of the Project are assessed as being positive. There are individuals who may be adversely affected and principal among these are likely to be those whose homes are to be compulsorily acquired. The residual impact will be positive. **Health Improvements** There is the potential for a very significant opportunity for health improvements associated with the Project. These include the potential for economic development as well as tourism which in itself is associated with an improvement in health status. There is the potential for improvements in social health with a reduction in unemployment and particularly long-term unemployment. Such a potential if realised will bring with it benefits including reduced inequality in society. There is also potential for increased opportunity to exercise. There is the potential for reduced traffic accidents with a corresponding reduction in mortality and morbidity. Ease of access and egress has the potential to improve social interaction. It also will allow quicker and more reliable access for emergency services such as ambulances. The residual impact will be positive. **Improvement of Access to Services** There is potential for significant improvement in access to services. The benefits of this apply to both the residents of Galway City and beyond. Easier access to national road network will allow greater availability of national services such as major hospitals and others. This may be of particular benefit to those living to the west of the city including as far as Connemara. Decreased traffic in built-up areas of Galway City will allow easier access to the services such as retail, cinema, restaurants and other services. It may also encourage people outside of Galway, who are currently deterred from entering the city by traffic concerns to visit and access the services. The residual impact will be very positive.
Resource and Waste Management		
Resource and Waste Management	The maintenance of the Project will be undertaken by the local authority. Maintenance works will be carried out by appropriate staff of Galway Racecourse for the stables development for the duration of its operation.	No likely significant residual impact.

22.4 Compensatory Measures

22.4.1 Human Beings

Compensation for the acquisition of property is to be agreed as part of the land acquisition and is outside the scope of the EIA process and therefore, not discussed any further in this chapter.

22.4.2 Biodiversity

Where there are significant residual biodiversity impacts as a result of the Project, despite the mitigation measures proposed, compensatory measures are proposed to offset or reduce the predicted impacts[4]. These are not compensatory measures in the context of the requirements of Article 6(4) of the Habitats Directive as they are not compensating for an impact that would adversely affect the integrity of any European site. As concluded in the updated NIS, the Project will not result in such an impact on any European site.

Since the 2018 EIAR, there have been minor changes to Compensation measures based on the modifications made to the proposed N6 GCRR detailed in Chapter 5 of this updated EAIR, changes in land usage, and natural ecological succession in the landscape. This has resulted in slight amendments to habitat loss calculations, and habitats that did not have a residual impact previously, including; Blanket bog (active) [*7130], Wet heath/Dry heath, Active blanket bog [4010/4030/*7130], Limestone pavement/Calcareous grassland mosaic [*8240/6210], and Dry heath/Wet heath mosaic [4030/4010].

The likely significant residual effects of the Project relate to habitat loss, the potential permanent loss of a Peregrine falcon nest site, mortality impacts on Barn owl, and impacts on the local bat populations. Each of these are discussed below with regard to whether compensatory measures are feasible and likely to succeed in compensating for the potential impacts of the Project.

It should be noted from the outset, that whilst additional measures were recommended within the ABP Inspector's Report, dated June 2021, the following was also recognised by Dr. Arnold:

"the mitigation and compensation measures do lessen the severity or likelihood of many of the identified impacts, and many of the measures such as the use of viaducts and tunnels, habitat creation and the provision of overpasses and underpasses are beneficial."

22.4.2.1 Habitat loss

Limestone pavement [*8240] has a clint and gryke, or shattered pavement, structure which supports the vegetation characteristic of this habitat type. This underlying rock structure is created over millennia by geological and weathering processes and cannot be artificially recreated and is effectively a non-renewable habitat resource. Therefore, the losses of Limestone pavement habitat associated with the Project cannot be compensated.

Petrifying springs [*7220] are a product of the interaction of groundwater and the underlying geology to create a tufa forming spring that supports the associated species assemblage to correspond to this priority Annex I habitat type. Such features cannot readily be artificially recreated with any degree of certainty and, as per Limestone pavement, are effectively a non-renewable habitat resource. Therefore, the loss of one Petrifying spring associated with the Project cannot be compensated.

Wet heath [4010] is a habitat type that forms on shallow peats with impeded drainage. In the western part of the study area, this is due to the underlying bedrock and undulating topography retaining a water table near to the surface. Wet heath cannot readily be artificially recreated with any degree of certainty. Therefore, the loss of Wet heath associated with the Project cannot be directly compensated.

The areas of Residual alluvial forest [*91E0], Dry heath [4030], Calcareous grassland [6210] and *Molinia* meadow [6410] that will be lost as a result of the Project will be compensated. In each case the area of each habitat type being provided is greater than that being lost. In relation to Dry heath, the area of habitat being

[4] "Compensation describes measures taken to make up for residual effects resulting in the loss of, or permanent damage to ecological features despite mitigation" (CIEEM, 2016)

provided (c.4.15ha) is greater than the combined losses associated with this habitat type and this habitat type when it occurs in a mosaic with Blanket Bog (active) [*7130], Wet heath [4010] and *Molinia* meadows [6410] (c 3.18ha).

The full details of the Habitat Compensation Management Plan for each of the Annex I habitat types being compensated for, including monitoring, are presented in Appendix A.8.27. The areas where compensatory habitats will be created are shown on Figures 8.38.1 to 8.38.15.

In compensating for the losses of these habitat types, the Project is not likely to result in a significant residual effect, at any geographic scale, on Residual alluvial forest [*91E0], Dry heath [4030], Calcareous grassland [6210] or Molinia meadow [6410].

This is summarised below in Table 22.3.

Table 22.3 Summary of Residual Priority Annex I/Annex I habitat loss outside any European site after compensation

Annex I habitat type	Permanent Area of Habitat Loss	Area of Compensatory Habitat Created	Residual Habitat Loss	Residual Impact Significance Post-compensation
Blanket bog (active) [*7130]	c.0.01ha	N/A	c.0.01ha	Likely significant residual effect at the international geographic scale
Wet heath/Dry heath/Active Blanket Bog [4010/4030/*7130]	c.0.01ha	N/A	c.0.01ha	Likely significant residual effect at the international geographic scale
Petrifying springs [*7220]	Four Petrifying spring feature	N/A	Four Petrifying spring feature	Likely significant residual effect at the county geographic scale
Residual alluvial forest [*91E0]	c.0.14ha	c.0.17ha	None	No likely significant residual effect
Limestone pavement [*8240]	c.1.54ha	N/A	c.1.54ha	Likely significant residual effect at the international geographic scale
Limestone pavement/Calcareous grassland mosaic [*8240/6210]	c. 0.03ha	N/A	c.0.03ha	Likely significant residual effect at the international geographic scale
Wet heath [4010]	c.2.54ha	N/A	c.2.54ha	Likely significant residual effect at the national geographic scale
Dry Heath	c.1.76ha	c.4.22ha	None	No likely significant residual effect
Dry heath / Wet Heath [4030 / 4010]	c.0.96ha	N/A	c.0.96ha[5]	Likely significant residual effect at the national geographic scale

[5] Considered as Wet heath habitat for the purposes of the impact assessment, the loss of which cannot be directly compensated for.

Annex I habitat type	Permanent Area of Habitat Loss	Area of Compensatory Habitat Created	Residual Habitat Loss	Residual Impact Significance Post-compensation
Wet heath/Dry heath/Molinia [4010/4030/6410]	c.0.45ha	N/A	c.0.45ha[6]	Likely significant residual effect at the national geographic scale
Calcareous grassland [6210]	c.0.25ha	c.8.50ha	None	No likely significant residual effect
Molinia meadow [6410]	c.0.29ha	c.0.49ha	None	No likely significant residual effect

There are a number of habitat types of a local biodiversity importance that will be permanently lost as a result of the Project, and where significant residual negative effects are likely:

- Calcareous springs (FP1)
- Dry-humid acid grassland (GS3)
- Poor fen and flush (PF2)
- (Mixed) broadleaved woodland (WD1)
- Hedgerows (WL1)
- Treelines (WL2)

Of these, the planting proposed in the landscape design will compensate for the loss of the areas of (mixed) broadleaved woodland (WD1), hedgerows (WL1) and treelines (WL2) by providing the equivalent, or greater, area to that being permanently lost to the Project, as follows:

- (Mixed) broadleaved woodland (WD1) - > 2.09ha
- Hedgerows (WL1) - > 7.88km
- Treelines (WL2) - > 4.05km

In compensating for the losses of these habitat types, the Project is not likely to result in a significant residual effect, at any geographic scale, on (mixed) broadleaved woodland (WD1), hedgerows (WL1) and treelines (WL2).

However, the Project is likely to have a significant residual negative effect, at the local geographic scale, as a result of the permanent loss of six Calcareous spring features (FP1), c.5.24 of Dry-humid acid grassland (GS3) and c.1.19 of Poor fen and flush habitat (PF2).

Compensatory Habitat Management Plans (CHMPs)

Compensatory Habitat Management Plans (hereafter referred to as “CHMPs”) have been prepared in order to compensate for loss of specific Annex I habitats.

Areas of compensatory habitat will be created, managed and monitored as set out in the CHMPs in Appendix A.8.27 with locations of donor and receptors sites shown on Figures 8.38.1 to 8.38.15.

In all cases the area of lands proposed for habitat creation are those necessary to ensure the aims and targets set out in Appendix A.8.27 are achieved in terms of habitat creation and mitigating the likely significant effects on Annex I habitats associated with the Project. Best practice is to have habitat replacement ratios

[6] Considered as Wet heath habitat for the purposes of the impact assessment, the loss of which cannot be directly compensated for.

greater than one-to-one to ensure delivery of the target habitat type in terms of extent, quality and diversity due to the uncertainties inherent in habitat creation (i.e. the habitat creation sites should be greater than the sites being translocated or removed). Appendix A.8.27 includes for the long-term management and maintenance of the created habitat areas so they achieve the desired habitat type and quality in each location for the life of the Project.

Given the changing baseline environment, the CHMPs set out in Appendix A.8.27 of this updated EIAR are live documents which will need to be updated by the appointed contractor by way of pre-construction surveys.

The Ecology Site Management Plans, to be updated and finalised by the appointed contractor based on the detailed principles set out in this chapter and Appendix A.8.27, will set out the longer-term management regime for each of the habitats being translocated/created as part of the Project, for the lifetime of the Project.

Ecology Site Management Plans for compensatory habitats will be prepared by the contractor prior to the commencement of works, in accordance with the principles set out in Appendix A.8.27 of this updated EIAR.

In addition, the specific measures below will be incorporated into the Ecology Site Management Plans:

- Soils and plant material (including turves) from all 4030 donor sites will be the primary method used for dry heath habitat translocation and creation. The locations of all 4030 donor and receptor sites are presented in Appendix A.8.27.
- Monitoring immediately after the turves are placed in the receptor sites will be undertaken every three weeks and after a heavy rainfall event until such time as the Dry heath is established, with an adaptive corrective plan put in place if evidence shows that it is not successful.
- A minimum 100m translocated soils/turve depth will be provided at each 4030 receptor site.
- The pH of the top 400mm layer of material in MDAs, where it directly underlies areas proposed for dry heath habitat creation, will be below 6.5.
- The preferred method of habitat translocation is for direct translocation of turves and soil/peat from donor to receptor sites. However, the construction phasing may not facilitate this in every instance. Where direct translocation of turves to receptor sites is not possible, they will be handled and stored based on documented best practice and proven case studies for peatland turve translocation which include:
  - Ensuring turves are as large in size and depth as possible
  - If necessary, use of specially designed digger buckets suitable for the purpose
  - Use of low ground pressure vehicles for turve removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary operating on bog mats
  - Storage of turves for the minimum time possible and placement at receptor sites at the earliest possible opportunity
  - Storage of turves in a single layer to avoid crushing and to maintain their integrity
  - Storage of turves on a flat surface placed on top of either a geotextile membrane, on bog mats or similar
  - Regular watering (with rainwater) and monitoring of the turves for the duration of the storage time
  - Storing turves end to end (i.e. with no gaps) to avoid edges drying out and if necessary using silt fencing or geotextile membranes along any vertical exposed edges of turves
- In the case of some of the dry heath receptor sites the nature of the ericaceous vegetation, shallow soils and outcropping granite, may make intact turve removal difficult. In these situations, trimming the

ericaceous vegetation (and retaining this cut material for use as brash and a source of seed to assist in vegetation regeneration at the receptor sites) may assist in extracting intact turves. Where turves cannot be extracted intact in these areas then the scraw (mixture of soils, root stock, seed bank etc) will still be valuable for use as soils to be translocated to the receptor sites

- Similarly, where direct translocation of soil/peat to receptor sites is not possible, it will be handled and stored in the following manner to ensure it is protected:
  - Use of low ground pressure vehicles for soil removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary operating on bog mats
  - All wet peaty soils (e.g. this will be likely from the 4010 and *7130 donor sites) will be transported in sealed trucks to avoid loss of wet peat in transit
  - Storage of soil/peat for the minimum time possible and placement at receptor sites at the earliest possible opportunity
  - Storage of soils/peat from donor sites in dedicated area(s) within construction compounds for the Project west of the River Corrib, on top of a geotextile layer, no higher than 1.5m to avoid compaction
  - Turves from donor sites will be 'thatched' on top of the stored soil/peat areas to seal and protect it for the duration of the storage period
- Turves will be placed end to end with no gaps. Where necessary receptor sites will be protected from erosion, and vegetation regeneration will be encouraged through the following means:
  - Use of geocoir (on flat surface) or geojute (on sloped areas) on areas of bare soil, pinned down with 0.5m steel pegs or similar
  - Spreading heather clippings which have been harvested from donor sites on bare soil
  - Re-seeding, preferably with seeds collected from donor sites prior to turves/soil being removed, or if necessary with additional dry heath native seed material from a reputable supplier such as http://www.wildflowers.ie/. Where seeds are collected from donor sites prior to turves/soil being removed, they will be collected a minimum of one summer/autumn season prior to construction works commencing, during warm, dry conditions. Until such time as they are required to be planted at the receptor sites, seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites.
- Minimising risks of erosion or escape of translocated soil/peat by:
  - Undertaking all translocation works and handling of turves and soils/peats during dry weather conditions
  - Undertaking these activities during dry conditions at the start of the vegetation growing season (i.e. spring) to encourage rapid establishment of plant growth prior to the winter season
  - Implement the measures set out in the Sediment, Erosion and Pollution Control Plan (SEPCP) which summarises the procedures and technical practices for implementing effective sediment, erosion and pollution control through a variety of delivery methods for the construction phase of the Project is presented in Section 8 of the CEMP (Appendix A.7.5)
  - All wet peaty soils (e.g. this will be likely from the 4010 and *7130 donor sites) will be transported in sealed trucks to avoid loss of wet peat in transit
- The following measures will be implemented as part of the habitat translocation and creation measures to ensure that *Daboecia cantabrica* becomes established at the dry heath receptor sites:
  - Seeds from mature plants of *Daboecia cantabrica* will be collected from the sites within the Assessment Boundary where it has been recorded, from August/September onwards (in a year prior

to construction works commencing), during warm, dry conditions. Seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites

- Where it is possible to translocate turves from dry heath donor sites containing *Daboecia cantabrica*, all specimens of *Daboecia cantabrica* will be located in the centre of turves to ensure their successful translocation
- All existing soils/peat at dry heath donor sites will be translocated for placement as the substrate at the dry heath receptor sites, thereby retaining the seedbank, including for *Daboecia cantabrica*, to allow natural regeneration of the species at the receptor site
- Heather clippings will be harvested at all dry heath donor sites and this material will include clippings from *Daboecia cantabrica* specimens.

The calcareous grassland ecological recreation areas at Lackagh Quarry will be managed in perpetuity by GCC, are not accessible to the public and will be fenced off. There will be a minimum of two maintenance visits each year as set out in Appendix A.8.27 (CHMPs) of this updated EIAR.

22.4.2.2 Bats

Loss of the more "significant" roosts (e.g. maternity roosts or roosts used by Lesser horseshoe bats) will be compensated by the erection of replacement structures (artificial roosts) in locations close to the original roost.

There is a dual purpose to the artificial roosts. Firstly, to ensure that there is no net loss of roosting opportunities for the bats confirmed to be roosting within the Assessment Boundary. Secondly, it has been recognised that there will be an inevitable increase in mortality rates due to road collisions as suggested by scientific evidence (see Section 8.5.6.2.2 of Chapter 8, Biodiversity). So the second function of the replacement roosts is to create improved conditions for bats to breed and to offset the likely increase in mortality.

Four artificial roost structures are proposed at the following locations:

- Aughnacurra
- Menlo Castle
- Menlo Woods
- Ballindooley

Four artificial roost structures are proposed as set out below. The detailed specifications of these artificial roosts will follow the recommendations of an experienced bat ecologist and further consultation with the Vincent Wildlife Trust will take place to ensure that their experiences in these techniques are taken into account.

There will be a need to screen structures from the effects of construction phase disturbance by means of solid hoarding or brushwood screens with an appropriate buffer zone around the roost. The dimensions of the planting will depend on the local topography and surrounding landscape and will be decided on a case-by-case basis by the bat ecologist.

It should be noted that the mitigation strategy, outlined above in Section 22.2, has included ensuring that passage underneath the Project in the vicinity of the roosts has been facilitated by including culverts underneath the Project in locations as close to the roosts as possible.

Proposed Aughnacurra maternity/hibernation roost for Lesser horseshoe bats and Brown long-eared bats

The proposed replacement roost will be located close to the existing Aughnacurra roost (PBR178) structure.

Whilst this roost was not confirmed during the 2023 surveys, this replacement roost has been retained in the mitigation strategy, taking a conservative approach. This is due to both to the high levels of localised Lesser horseshoe bat foraging and commuting activity recorded in area PBR178 (although 2023 surveys returned

low to negligible evidence of confirmed entry/exit of Lesser horseshoe bats at the property) connecting to a previously known Lesser horseshoe bat satellite roost at Menlo Castle (PBR06). While it cannot be wholly-ruled out that Lesser horseshoe bats would return to the property, the roost area is within a sub-optimal building (garage) in terms of the preferred building type for this species, and its occupation by bats may be a reflection of the lack of availability of better roost opportunities in the area.

The proposed roost within the Assessment Boundary will be temporarily screened with brushwood fencing or similar semi-solid screens c.2m high for the construction stage and will also be planted up around it as soon as the roost is constructed to provide long-term screening during the operation of the Project. Non-native ornamental species may be used to provide screening in this case as it is in keeping with the suburban setting.

The design of the roost will take account of the Vincent Wildlife Trust (VWT) guidance[7] and will follow the following design parameters (as shown in drawing GCOB-3000-D-001 in Annex K of Appendix A.8.25 of this updated EIAR):

- The template for the design will be taken from the roost at Garryland, Co. Galway constructed for the N18 Oranmore to Gort road scheme which has been shown to have worked successfully since its completion in 2011
- Single storey structure with southwest orientation for maximum solar gain on the pitched roof
- Location as set out in Plate 8.5, of Chapter 8 Biodiversity in corner of garden to be acquired
- Rendered block wall structure with natural slate roof. The exterior walls can be clad with rough stone or a material designed to have no adverse visual impact
- The building will have a footprint of *c.*10m x 8m with a steep pitched slate roof, partitions in the ground floor and roof space and an attic floor laid down with an open hatches for access for bats
- Plywood partitions will be installed within the roof voids to create bat "hotboxes" and separate roosting spaces for different species so that the brown long-eared bat roost can also be accommodated in the same building
- The interior of the roof will be lined with BS 747 bituminous felt. All ceilings on the ground floor will be fitted with rough wood
- The entry point for bats shall be on the western side away from the Project and close to the vegetation on the eastern perimeter which will be retained and enhanced. The entry point will be *c.*500mm x 300mm with bars set 125mm apart and lead flashing to be placed over the window sill under the hatch to prevent predator entry
- The northern corner will include a hibernation room at ground level which will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering will be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed
- No water or electricity services are required
- Access for surveyors will be via a door on the southern side. Bats will be allowed to fly around the ground floor via an open hatch in the attic floor near the entry point

The proposed location (within the Assessment Boundary) is close to vegetation which is important cover for bats entering and leaving. Additional planting is proposed to link the roost to the perimeter and to connecting features in the wider landscape.

Menlo Castle alternative roost - Lesser Horseshoe maternity/hibernation roost

[7] Vincent Wildlife Trust (2015) *Lesser Horseshoe Bat: Conservation Handbook.*

This roost is not replacing any specific loss of roost but is a critical part of the bat compensation measures. It will assist to increase the recruitment in the local Lesser horseshoe bat population so as to offset any increases in mortality as a result of the potential impacts of the Project. Prior to 2020, the current roost in the chimney of the castle (PBR06) was unstable, inadequate and vulnerable to being lost if the castle fell into further disrepair. A series of renovation works has been conducted at Menlo Castle since that time, including in 2023. The new Menlo Castle roost would be better in design and aim to increase natural birth rates and thereby neutralise or overturn any negative impacts of the Project. The preferred location is in a field to the east of the castle. The key design parameters will include the following.

The design of the roost has taken account of the Vincent Wildlife Trust (VWT) guidance and following consultation with Dr Kate McAney and Ruth Hanniffy (VWT) and will follow the following design parameters (and as shown in drawing GCOB-3000-D-001 in Annex K of Appendix A.8.25 of this updated EIAR):

- The template for the design will be taken from the roost at Garryland, Co. Galway constructed for the N18 Oranmore to Gort road scheme which has been shown to have worked successfully since its completion in 2011.
- Single storey structure with southern orientation for maximum solar gain on the pitched roof.
- Location as set out in Plate 8.6, of Chapter 8 Biodiversity in the northwest corner of the field close to Menlo Castle (PBR06).
- Rendered block wall structure with natural slate roof. The exterior walls can be clad with rough stone or a material designed to have no adverse visual impact. Additional planting around the perimeter of the building will also screen it from view.
- The building will have a footprint of c.10m x 8m with a steep pitched slate roof, partitions in the ground floor and roof space and an attic floor laid down with an open hatches for access for bats. All ceilings on the ground floor will be fitted with rough wood.
- Plywood partitions will be installed within the roof voids to create bat “hotboxes” and separate roosting spaces for different species so that other bat species roost can also be accommodated in the same building.
- 4 no. wooden Kent bat boxes will be erected on the gable end of the structure to provide roosting opportunities for Daubenton’s and Pipistrelle bat species. See: https://cdn.bats.org.uk/pdf/Bat-Box-Information-Pack.pdf?mtime=20181101151309.
- The interior of the roof will be lined with BS747 bituminous felt or equivalent bituminous felt
- The entry point for bats shall be on the west gable end sides away from the Project and close to the vegetation on the eastern perimeter which will be retained and enhanced. The entry point will be c.500mm x 300mm with bars set 125mm apart and lead flashing to be placed over the window sill under the hatch to prevent predator entry.
- The northern corner will include a hibernation room at ground level. This will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed.
- No water or electricity services are required.
- Access for surveyors will be via a door on the southern side. Bats will be allowed to fly around the ground floor via an open hatch in the attic floor near the entry point.
- The proposed location within the Assessment Boundary is close to vegetation which is important cover for bats entering and leaving. Additional planting is proposed to link the roost to the perimeter and to connecting features in the wider landscape.

Menlough Woods Replacement Night roost for Lesser horseshoe bats and Soprano pipistrelle and Brown long-eared bats roosts

This is to replace a night roost for Lesser horseshoe bats (PBR219) and Soprano Pipistrelle bats (PBR179). It will be located near the edge of the Assessment Boundary west of Bóthar Nua and will be a simple wooden shed type structure (1m wide, 2.5m high, 2m deep) modelled on the Vincent Wildlife Trust design[8] and is shown in drawing GCOB-3000-D-002 in Annex K of Appendix A.8.25 of this updated EIAR. The footprint will be much smaller than the area symbol indicated below on Plate 8.7, of Chapter 8, Biodiversity. The design parameters include:

- Steep pitched slate roof facing southeast
- Plywood "ceiling" with access open hatch 300mm x 300mm for bats
- Access for bats via gap over access door 500mm x 500mm
- Access for birds prevented by installing plywood baffle 1m behind access gap
- Roof lined with BS747 bituminous felt

Ballindooley Night/Day roost for Brown long-eared and Pipistrelle bat and night/day/hibernation roost for Lesser horseshoe bats

This roost is to replace a Soprano Pipistrelle day/night roost on the N84 Headford Road (PBR179), to replace roosts for Brown long-eared bats (PBR204) Leisler's bats (PBR196), and Lesser horseshoe bat roost at PBR219. The structure will be a small block building (e.g. 6m x 8m footprint) with natural slate roof and some external features e.g. Kent bat boxes for use by other bats species. Drawing ref GCOB-3000-D-002 in Annex K of Appendix A.8.25 of this updated EIAR shows the design of this roost.

The design parameters include:

- Single storey structure with southwest orientation for maximum solar gain
- Location as set out in Plate 8.8, of Chapter 8 Biodiversity, abutting the vegetation for good connections to foraging and shelter
- Rendered block wall structure with natural slate roof and can be clad and designed so as to have no adverse visual impact
- The building would have a footprint in the region of 6m x 8m with a steep pitched slate roof, partition wall in the ground floor and roof space and an attic floor laid down with an open hatch for access for bats[9]
- Plywood partitions may be installed within the roof voids to create bat "hotboxes" and separate roosting spaces for different species
- The interior of the roof should be lined with BS747 bituminous felt
- Entry points for bats shall be on the northeast facing sides away from the Project and close to vegetation which will be retained and enhanced
- The northern corner will include a hibernation room at ground level which will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering will be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed

[8] http://www.vwt.org.uk/wp-content/uploads/2015/04/lesser-horseshoe-night-roost-design.pdf

[9] Vincent Wildlife Trust (2015) *Lesser Horseshoe Bat: Conservation Handbook*.

- No water or electricity services are required
- Access for surveyors will be via a door on the southern side

Retrofitting of Existing Structures

At Ch. 12+960 the detached converted garage (next to PBR183) to the south of the Project to be retained and converted for use by several species including Brown long-eared bats and Lesser horseshoe bats. This building is in a strategically-important location as it will connect to the linear planting on the south side of the Project and is just c.250m from the proposed Castlegar Wildlife Overpass in and within a local ecological corridor leading to Cooper's Cave, a proven hibernation and mating site for Lesser horseshoe bats. This structure will undergo minor interior and exterior modifications to create warm areas in the roof space for summer roosting and breeding and also cold conditions for hibernation. Plate 8.9 in Chapter 8, Biodiversity shows this location.

Bat Boxes

Bat boxes will preferably be located near the roosts to be lost but not immediately adjacent to the Project where risk of collision with vehicles is highest.

Bat boxes will be erected by, or under the supervision of, a bat specialist.

These bat boxes will target Common and Soprano pipistrelle bats and Brown long-eared bats and will consist of Schwegler Type 1FF and 2FN bat boxes (or equivalent) mounted on wooden poles set into concrete bases adjacent to treelines and hedgerows as these have been demonstrated as being successful for these species in Ireland[10]. Mounting boxes on poles close to the edge of tree canopies will also allow the long-term retention of the boxes, as opposed to mounting boxes on small trees which have limited longevity.

A rocket box (as shown in Appendix A.8.25 - see Drawing GCOB-3000-D-002 in Annex K of the bat derogation licence application) will be installed at Ch. 3+320 near the roost at PBR241 (refer Figure 8.26.1) rather than a bat box fixed to the building itself so as not to detract from its cultural heritage value.

Box locations, as shown on Figure 8.39.1 to 8.39.15, will include the following:

- Ch. 3+320: Rocket box to be erected to west of the building PBR241
- Ch. 10+050: 5 boxes to be erected along the edge of the tree canopy near the underpass
- Ch. 11+400: 5 boxes to be erected on the entrance road into Lackagh Quarry
- Ch. 15+100: 5 bat boxes to be erected south of Galway Racecourse

In the case of bat boxes provided as replacements for bat tree roosts to be felled, boxes will be Schwegler Type 1F bat boxes (or equivalent) erected on suitable trees or structures retained within the Assessment Boundary in the vicinity of the tree to be lost where possible. The type and siting of any bat boxes required will be determined by the bat specialist at that time but preliminary areas for bat boxes have been identified in the areas of woodland around Menlough, Coolagh, on retained structures and the quarry walls at Lackagh Quarry and in areas near attenuation and infiltration ponds.

All new roosts, retrofitted structures and bat boxes will be erected in advance of the commencement of site clearance so that replacement roosts are available to bats and that there is reasonable chance that they will have discovered them prior to loss of the existing roost. Boxes can be erected at any time of year and preferably as soon as the necessary consents are in place for the Project.

[10] McAney K. and Hanniffy, R. (2015) *The Vincent Wildlife Trust's Irish Bat Box Schemes* http://www.mammals-in-ireland.ie/wp-content/uploads/2015/11/Ireland-Bat-Box-Project-Report-WEB.pdf

Protection of proposed artificial roosts during construction works

- Newly created roosts and bat boxes within the Assessment Boundary will be protected from the adverse effects of noise and lighting during the construction phase as it is an essential element of the mitigation strategy that they are accessible and usable by bats during this time
- All existing and proposed artificial roosts retained within the Assessment Boundary will be surrounded with wooden panels to a height that allows shading and shelter of key roost access features
- Planting around the existing and proposed artificial roosts retained within the Project will include fast growing shrub species, or fast-growing willow if the ground conditions permit. Planting will aim to guide bats away from the open construction zone toward linear features. Use of non-native species may be appropriate in some locations where it is important to get vegetation established
- All structures will be locked and not used for other purposes such as storage of materials or shelter without agreement from the Ecological Clerk of Works
- The maintenance of the existing and proposed artificial roosts retained within the Assessment Boundary, in a state that they are accessible and usable by bats, will be carried out by the Contractor until the completion of the Project whereby it will be taken in charge by the local authority. Maintenance will include standard building repairs over time and responding to the results of the roost monitoring (e.g. increasing or reducing humidity)

Compensation for loss of foraging habitat

Approximately 7ha of woodland-pasture-hedgerow-scrub habitat will be removed from the area between the River Corrib and An Bóthar Nua in Menlough. This habitat is used by the Lesser horseshoe bat population and therefore there is a risk that there may be reduced breeding success if replacement planting is not made available.

An area of land has been identified which is within the known core foraging area of the Menlo Castle roost (PBR06) but is not optimal feeding habitat. It is composed of open fields of varying size used for low density cattle grazing. It is proposed to enhance lands at Menlo to enhance feeding areas for bats as a result of impacts to Lesser horseshoe bats potentially caused by the construction and operation of the Project.

The project team analysed the usage of lands near the maternity roost at Menlo Castle to identify if they met the following requisite criteria to allow them to be considered as part of the lands for this purpose:

a. The lands must be capable of being accessed by the Lesser horseshoe bats roosting at Menlo Castle and from the proposed artificial roost nearby. Linear features such as hedgerows and woodland edges must connect the roost and the newly created habitat

b. The lands must show some evidence of use by Lesser horseshoe bats to demonstrate that they can access the area

c. The lands should not already contain areas of optimal Lesser horseshoe bat foraging habitat such as woodland, scrub and wetlands and should be capable of being enhanced using planting and landscaping to increase the suitability as a feeding resource

d. Any proposed changes to the lands must not depreciate its ecological value and there is a general assumption that lands within a Special Area of Conservation (SAC) should not be used for planting purposes

Specifically, hedgerows in this area will be augmented and thickets of hazel, hawthorn, holly and oak will be provided in several of the fields to create pockets of wood and grassland habitat. Grazing will continue on the lands as it has been shown that foraging over grazed land is preferred to ungrazed lands (Downes et al, 2016). Connectivity to foraging areas will also be secured through tying the proposed planting strips to hedgerows and woodland edges.

In addition, smaller fields to the east of Menlo Castle and the proposed artificial roost (Area A3 in Plate 1 in the Statement of Evidence Responses to EIA Biodiversity Objection/Submissions Document, shown in of Appendix A.8.25 Bat Derogation Licence) were identified as being capable of further subdivision to provide

enhanced foraging habitat and connectivity close to the roost (PBR06) and possibly reduce the need for bats to cross the Project.

Finally, another area within the former Lough Corrib SAC area (the boundary of the Lough Corrib SAC was revised by NPWS in April 2018) was investigated by means of automatic bat detectors and deemed to already have suitable foraging habitat for Lesser horseshoe bats. Sensitive wetland habitats and species were present in this area which could be adversely affected by interventions associated with the measures, such as planting or alteration to local drainage. As such, it was decided that it would not be appropriate to include this area within the proposed habitat planting area for bats.

Planting of new hedgerows in fields between the Project and Menlo Castle will improve the foraging resources of this core foraging area and provide connectivity underneath the proposed N6 GCRR. Such planting will include additional native hedgerows planted across the existing fields to increase the lengths of hedgerows close to the proposed new roost for Lesser horseshoe bats (refer to Section 8.6.57.2) near Menlo Castle. The fields will still be grazed and the hedgerows can be fitted with field gates as required provided gaps are kept to a minimum.

The area of habitat enhancement for the purposes of offsetting the loss of suitable bat habitat due to the Project amounts to approximately 8ha. (refer to Figure 8.39.7).

The monitoring programme for bats outlined in Table 22.1 and Table 22.2 above also relates to the compensation measures for bats described in this section.

22.4.2.3 Peregrine falcon

While artificial nest sites for Peregrine falcon can, and have been proven to, be successful, they require suitable cliff face or building of sufficient height at the proposed nest site. However, providing such nest sites does not guarantee that they will be taken up by either the Peregrine pair being displaced or occupied by another breeding pair in the future; particularly when they would likely be remote from the existing site, by at least a few kilometres, due to the topography of the surrounding land and the type and height of building structures nearby. Therefore, the potential loss of a Peregrine falcon nest site associated with the Project cannot be directly compensated for.

22.4.2.4 Summary

The Project, despite the implementation of the mitigation and compensation measures proposed, will have the following likely significant residual effects on biodiversity where changes have occurred since the 2018 EIAR, this has been detailed below:

- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the priority Annex I habitat Blanket bog (active) [*7130] (additional since the 2018 EIAR)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the mosaic containing the priority Annex I habitat Blanket bog (active) [*7130], Wet heath [4010] and Dry heath [4030] (additional since the 2018 EIAR)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.1.54ha of the priority Annex I habitat Limestone pavement [*8240] (increase in loss since 2018 EIAR by c.1ha)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.03ha of the habitat mosaic containing the priority Annex I habitat Limestone pavement [*8240] and Calcareous grassland [6210] (additional since 2018 EIAR)
- A likely significant residual effect, at the national geographic scale, for the permanent loss of c.3.95ha of the Annex I habitat Wet heath [4010][11] (increase in loss by c.1.02ha)

[11] As noted in Table 22.3, this comprises c.2.54ha of Wet heath dominated habitat and an additional c.1.41ha of habitat mosaic which contains Wet heath.

  - A likely significant residual effect, at the county geographic scale, for the permanent loss of four Petrifying spring [*7220] features at Lackagh Quarry
  - Likely significant residual effects on Habitat Clusters 1-12 ranging from the local to international scale, dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster (additional since 2018 EIAR)
  - A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Imbricate bog moss *Sphagnum affine* at the national geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feathermoss *Plasteurhynchium striatulum* and Red bog-moss *Sphagnum capillifolium* at the county geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect for the loss of local populations Eyebright *Euphrasia arctica* at a local geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect, at the local geographic scale, for the potential permanent loss of a Barn Owl nest site at Menlough (additional since 2018 EIAR)
  - A likely significant residual effect, at the county geographic scale, for the potential permanent loss of a Peregrine falcon nest site at Lackagh Quarry
  - A likely significant residual effect, at the local geographic scale, on all bat species (including lesser horseshoe bat) due to the presence of the Project within their foraging areas
  - A likely significant residual effect, at the local geographic scale, for the permanent loss of 18 calcareous springs (FP1) (Non-Annex I habitat type) at Lackagh Quarry (loss of 15 in 2018 EIAR), c.5.24ha of Dry-humid acid grassland (GS3) (Non-Annex I habitat type) (decrease in loss by c.2.57ha since 2018 EIAR) and c.1.30ha of Poor fen and flush habitat (PF2) (Non-Annex I habitat type) (increase in loss by c.1.17ha since 2018 EIAR)
- Coast Road (R336) to the N59 Moycullen Road local biodiversity area
  - Residual impact at the national geographic scale for the loss of Wet heath [4010] and Blanket bog (active) [*7130] habitat
  - Residual impact at the local geographic scale for the loss of Dry-humid acid grassland (GS3) and Poor fen and flush habitat (PF2) along with impacts on bat species present here
- River Corrib and the Coolagh Lakes local biodiversity area
  - Residual impact at the local geographic scale due to impacts on bat species present here
- Menlough to Coolough Hill local biodiversity area
  - Residual impact at the international geographic scale for the loss of Limestone pavement [*8240] habitat
  - Residual impact at the county geographic scale for the loss of Petrifying springs [*7220] and impact on the Peregrine falcon
  - Residual impact at the local geographic scale from the loss of Calcareous springs (FP1) and along with impacts on bat species present here
- Ballindooley – Castlegar local biodiversity area
  - Residual impact at the national geographic scale on Lesser horseshoe bat
  - Residual impact at the local geographic scale due to impacts on bat species present here

- Doughiska local biodiversity area
  - Residual impact at the international geographic scale for the loss of Limestone pavement [*8240] habitat
  - Residual impact at the local geographic scale due to impacts on bat species present here
- Cooper's Cave Terryland local biodiversity area
  - Residual impact at the national geographic scale on Lesser horseshoe bat
- Terryland Glenanail local biodiversity area
  - Residual impact at the national geographic scale on Lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat
- City Canal System local biodiversity area
  - Residual impact at the national geographic scale on lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat
- Waterbody local biodiversity area
  - Residual impact at the national geographic scale on lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat

Although the significant residual effects associated with the losses of Limestone pavement and Wet heath habitat cannot be directly compensated for, areas of related habitats will be created to provide an overall biodiversity gain for both peatland habitats containing dry heath and limestone associated habitats locally. The area of Dry heath habitat being provided is c.4.10ha which is greater than the combined losses of peatland habitats containing dry heath (i.e. [4030], and the mosaics [4030/4010], [4030/4010/*7130] and [4030/4010/6410]) combined (c.3.18ha). The area of Calcareous grassland habitat being provided is c.7.98ha which is greater than the combined losses of Limestone pavement and Calcareous grassland habitat combined (c.1.82ha).

22.5 Overview

Galway City and its environs have critical transport issues that require urgent resolution. There are however significant constraints for developing new transport infrastructure for Galway given (i) the physical form of the city, (ii) the limited space available, (iii) the built environment and residential areas on both sides of the River Corrib, and (iv) the presence of designated ecological sites.

Given these constraints the Project will result in significant residual impacts as outlined above in this chapter. However, this must be viewed and balanced in the context of the overall benefit that the Project will deliver, described above and in Chapter 3, Need for the Project.

Numerous alternatives have been considered which are more damaging in terms of property demolitions and other potential environmental impacts in comparison to the Project. However, there are very significant/significant residual impacts remaining including but not limited to the demolition of 44 residential properties and the further acquisition of 10 residential properties, demolition of four commercial properties and the further acquisition of one commercial property and acquisition of one residential planning permission and a significant residual impact to University of Galway Sporting Campus.

The proposed N6 GCRR is a key element of the Galway Transport Strategy and represents the best solution to the transport issues described in Chapter 3, Need for the Project and supports more sustainable travel for the following reasons:

- It will provide a **strategic route**, forming part of the TEN-T comprehensive network, across the River Corrib without the need to go through the city

- This strategic route will be of a **high standard** cross-section and will provide the **capacity required for the strategic traffic** serving the city and connecting the county to the national network
- Improves **connectivity to the Western Region** i.e. the county areas and hinterland beyond the city zone and provides the necessary connectivity to all the national roads and the Western Region and for those living within Galway and the rest of the country
- Moreover, access to this strategic route is limited to the junctions which will **protect the road asset in the future** and means that its **capacity is secure**
- This route is of European importance given that the **TEN-T comprehensive network designation** extends west of the city to the terminus of the proposed N6 GCRR and will provide a link to the Western Region of the standard of a comprehensive route in accordance with TEN-T
- Provides for strategic traffic accessing Galway City and connectivity with zones of traffic generators and attractors
- This route provides connections to **essential city links** to better distribute traffic
- It meets the functionality of the **road component of the overall intermodal transport solution** and enables the reallocation of existing road space within the city to public transport and smart mobility measures and is part of a sustainable holistic transport solution. Thus, facilitating a **more efficient public transport system** and the provision of a **multi-modal choice of travel**
- **Improves safety** levels for all public road users
- By **tackling the city's congestion issues**, it will provide a **better quality of life** for the city's inhabitants and provide a much **safer environment** in which to live
- By **reducing the number of cars** on the roads within the city centre and improving streetscapes, workers and students are facilitated to commute using **multi-modal transport means**. This includes travelling on foot, by bicycle and on the public transport system
- Provides connectivity to the national roads via junctions to maximise the transfer of cross-city movements to the new road infrastructure, thus **releasing and freeing the existing city centre zone from congestion** caused by traffic trying to access a city centre bridge to cross the River Corrib
- Attracts traffic from the city centre zone thus facilitating reallocation of road space to public transport leading to **improved journey time reliability for public transport**
- **Caters for the strong demand** between zones on either side of the city
- Provides additional river crossing with **connectivity back to the city** either side of the bridge crossing
- Facilitates **improved city centre environment** for all due to reduced congestion, thus **encouraging walking and cycling** as safe transport modes

The proposed N6 GCRR is the key component of the optimum transport solution and is consistent with proper planning and sustainable development and this view is supported/validated by the inclusion of policy support for both GTS and constituent measures, including the proposed N6 GCRR, in the relevant Galway Development Plans.