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20 Summary of Mitigation Measures and Residual Impacts

20.1 Introduction

An objective of the design of the proposed N6 Galway City Ring Road, hereafter referred to as the proposed road development, has been to reduce the adverse effects of the proposed road development on the environment to a practical minimum. Design measures and mitigation measures have been incorporated into the design of the proposed road development and will be applied during the construction and operation of the proposed road development.

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 the EIAR and are also presented in summary format in this chapter. These mitigation measures along with the design measures required for the proposed road development are presented in **Chapter 21, Schedule of Environmental Commitments** 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 impacts. All of the residual impacts are comprehensively detailed in the relevant chapters of the EIAR however, this chapter summarises the likely significant residual environmental impacts associated with the proposed road development. Throughout this document, where reference is made to 'residual impacts', it should also be understood to mean 'residual effects'.

20.2 Construction Phase

Table 20.1 below sets out the mitigation measures proposed in respect of each environmental factor along with a summary of the likely significant residual impacts predicted for the construction phase of the proposed road development.

Table 20.1: Assessment of Potential Impacts and Mitigation Measures – Construction Phase

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Traffic		
Construction Traffic	The construction of the proposed road development will cause temporary short term traffic impacts on the local road network. The Construction Environmental Management Plan (CEMP), included in Appendix A.7.5 , shall ensure that construction traffic impacts 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	<p>Mitigation measures for impacts to air quality (i.e. from dust), noise and vibration impacts, 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.</p> <p>Any impacts to the existing environment such as deterioration of public roads used as haul routes will be repaired.</p> <p>Any structural damage caused to buildings/structures/wells as a result of the construction will undergo a full stabilisation and rehabilitation works.</p> <p>A Construction Environmental Management Plan (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 EIAR.</p> <p>The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, <i>Environmental Good Practice on Site Guide, 4th Edition</i> (CIRIA 2015). The plan also has regard to the <i>TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan</i>.</p> <p>The CEMP summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed road development. 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 proposed road development. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.</p> <p>The CEMP has been prepared in conjunction with the Environmental Impact Assessment (EIA) Report and 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 EIAR and must be read in conjunction with the information already provided in this EIAR.</p> <p>In addition to the controls and mitigation presented below in Table 20.1 and in the CEMP (Appendix A.7.5), please also refer to the following documents for additional details on construction methodologies for the significant structures:</p> <ul style="list-style-type: none"> • River Corrib Bridge Constructability Examination Appendix A.7.1 • Menlough Viaduct Constructability Examination Appendix A.7.2 • Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3 • Galway Racecourse Tunnel Constructability Report Appendix A.7.4 <p>A construction management team shall be appointed for the duration of the construction phase. This team will supervise the construction of the proposed road development, including monitoring the performance of the Contractors to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts 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.</p> <p>In order to help ensure the successful development, implementation and maintenance of the CEMP, the Contractor will be obliged to appoint a Site Environmental Manager (SEM). The SEM will possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken. In particular, the SEM 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 SEM are provided throughout the CEMP document in Appendix A.7.5.</p> <p>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.</p>	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Debris	<p>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:</p> <ul style="list-style-type: none"> • 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.
Waste Management	<p>Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.</p> <p>This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced.</p> <p>Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated or waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed to landfill.</p> <p>All waste removed from the site will be collected only by Contractors with valid waste collection permits, under the Waste Management (Facility Permit and Registration) Regulations 2007 and (Amendment) Regulations 2008, 2014, 2015. All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there.</p> <p>Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.</p> <p>All wastes from the construction of the proposed road development will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996-2016. By only using facilities with the appropriate waste permits/licence, Galway County Council will be satisfied that the Contractor will comply with the objectives of the Waste Management Act and that any environmental emissions (noise, dust, water) are managed at the destination site and therefore are legally the responsibility of the owner/operator of the destination site. In this manner Galway County Council can be satisfied that the off-site spoil management aspect of the development is legally compliant with environmental and waste management legislation.</p> <p>In general, construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions. The practice of excessive purchase of materials and equipment to allow for anticipated wastage will be avoided.</p>	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 21, Schedule of Commitments) which 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).	
Designated Areas for Nature Conservation	<p>European Sites</p> <p>The mitigation measures that are specifically required to ensure that the proposed road development will not result in a likely significant effect (i.e. adversely affect the integrity of) on the European sites within its ZoI (Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA) are presented in Section 10 of the Natura Impact Statement (NIS).</p> <p>Following an assessment of the proposed road development on the identified relevant European sites, mitigation measures were developed to address the following potential impacts that were identified:</p> <ul style="list-style-type: none"> • Habitat loss/fragmentation: mitigation measures to minimise habitat loss in Lough Corrib cSAC and to avoid loss of QI habitats within Lough Corrib cSAC during construction (Refer to section below on habitats and the CEMP Appendix A.7.5, River Corrib Bridge Constructability Examination Appendix A.7.1, Menlough Viaduct Constructability Examination 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 cSAC 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 cSAC as a result of potential hydrogeological impacts during construction and operation (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) 	No likely significant residual effect on any European sites.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> Habitat degradation – air quality: mitigation measures to control dust emissions during construction to prevent impacts on vegetation in Lough Corrib cSAC (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 or operation (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 road development 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 cSAC. These include both measures to ensure that construction materials are not introduced into the River Corrib and to remove the risk of Otter being killed/injured due to collisions with road traffic (Refer to Otter section below). <p>Natural Heritage Areas and proposed Natural Heritage Areas</p> <p>The potential for the proposed road development to significantly affect Lough Corrib pNHA or Galway Bay Complex pNHA is as per the corresponding European sites (Lough Corrib cSAC and Lough Corrib SPA in relation to Lough Corrib pNHA, and Galway Bay Complex cSAC and Inner Galway Bay SPA in relation to Galway Bay Complex pNHA). Therefore, the mitigation measures outlined above for European sites and as detailed in Section 10 of the NIS, will prevent the proposed road development resulting in a significant negative effect on Lough Corrib pNHA or Galway Bay Complex pNHA at the national geographic scale.</p> <p>The mitigation measures that are required to ensure that the proposed road development will not significantly affect Moycullen Bogs NHA are as follows:</p> <ul style="list-style-type: none"> Measures to control dust emissions during construction to prevent impacts 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 or operation. These are detailed in the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5. 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 	<p>No likely significant residual effects on either Lough Corrib pNHA or Galway bay Complex pNHA or on any nationally designated areas for nature conservation.</p>
Habitats	<p>Mitigation Measures to Minimise Habitat Loss</p> <p>To minimise the loss of Annex I habitat, areas of these habitat types within the proposed development boundary but which are not required to construct the proposed road development will be retained and fenced off for the duration of construction. These are shown on Figures 8.23.1 to 8.23.14.</p> <p>To minimise the loss of habitat associated with the proposed road development, there are also areas within the proposed development boundary which are included for mitigation planting where general construction works will not be undertaken. These are shown on Figures 8.23.1 to 8.23.14.</p> <p>Where possible, woodland, scrub, treelines and hedgerows which lie within, or along the boundary of the proposed road development, 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 8.23.1 to 8.23.14 and on Figures 12.2.01 to 12.2.14 (landscape design).</p> <p>Where possible, areas of river channel and bankside vegetation which lie within, or along the boundary of the proposed road development, 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.</p> <p>The Petrifying spring feature present in Lackagh Quarry, which lies c.25m to the north of the mainline of the proposed road development at Ch. 11+400, will be retained and shotcrete¹ will not be used as part of the quarry face stabilisation measures at the spring site.</p> <p>Measures to Reduce the Potential for Impacts on Vegetation to be retained</p> <p>Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the proposed development 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:</p> <ul style="list-style-type: none"> All trees along the proposed development boundary that are to be retained, both within and adjacent to the proposed development boundary (where the root protection area of the tree extends into the proposed development 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 	<p>Despite these mitigation measures, the proposed road development will result in permanent area loss of the following Annex I habitat types, which are discussed further below:</p> <ul style="list-style-type: none"> Petrifying springs [*7220] Residual alluvial forest [*91EO] Limestone pavement [*8240] Wet heath [4010] Dry heath [4030] Wet heath/Dry heath/<i>Molinia</i> mosaic [4010/4030/6410] Calcareous grassland [6210] <i>Molinia</i> meadow [6410] <p>None of the areas of Annex I habitat that will be permanently lost are located within any European sites.</p> <p>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 a Petrifying spring feature which results in a likely</p>

¹ 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
	<p>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.</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> ○ 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 proposed development 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 	<p>significant negative residual effect at the county geographic scale.</p> <p>For non-priority Annex I habitat types lost outside European sites, the habitat loss is considered to constitute a likely significant residual effect at the national geographic scale.</p> <p>The habitat types, and areas lost, are summarised in Table 8.38 of Chapter 8, Biodiversity.</p> <p>Similarly, despite the mitigation measures the proposed road development will result in likely significant residual effects, at the local geographic scale, on the following habitat of a local biodiversity value:</p> <ul style="list-style-type: none"> • Calcareous springs (FP1) - fifteen features • Dry-humid acid grassland (GS3) - c.7.81ha • Poor fen and flush (PF2) - c.0.13ha • (Mixed) broadleaved woodland (WD1) - c.2.62ha • Hedgerows (WL1) - c.7.8km • Treelines (WL2) - c.4km
Measures to Reduce the Potential for Air Quality Impacts on biodiversity receptors during Construction	To control dust emissions during construction and protect many of the biodiversity receptors mitigation measures detailed below in the Air Quality and Climate section will be implemented.	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 Construction Environmental Management Plan (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 proposed road development.	No likely significant residual impact
Measures to Control and Prevent the Spread of Non-	The mitigation strategy in relation to non-native invasive plant species is outlined in the Non-native Invasive Species Management Plan 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 proposed road development, having regard to the specific timing/seasonal constraints that apply in relation to each individual species.	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
native Invasive Species	<p>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.</p> <p>As species may have spread, or their distribution may have changed, between the habitat surveys carried out for this 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 proposed development 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.</p> <p>In accordance with the National Roads Authority, 2010a guidelines, 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 licenced landfill in the case of non-native invasive plant species.</p> <p>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 1996-2011.</p> <p>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).</p>	
Rare and Protected Plants and Species	As there are no rare or legally protected plant species present within the ZoI of the proposed road development they will not be affected. Therefore, no mitigation measures are required.	No likely significant residual impact.
Otters	<p>Habitat degradation - water quality</p> <p>The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology.</p> <p>Loss of breeding/resting sites</p> <p>As Otter could potentially establish new holt or couch sites within the ZoI of the proposed road development in the future, a pre-construction check of all suitable Otter habitat will be required within 12 months of any constructions works commencing.</p>	No likely significant residual effect on Otter, at any geographic scale.
Bats	<p>Measures to Protect Bats during removal of Roosts</p> <p>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 an 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 proposed road development, a derogation licence under Section 54 of S.I. 477 of 2011 will be required. The Bat Derogation Licence application is included in Appendix A.8.25.</p> <p>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:</p> <ul style="list-style-type: none"> • Prior to demolition of the 14 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 be 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, if demolitions are proposed during the period May – August (note this time period will not be permitted in the case of the confirmed bat roosts to be demolished). 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. • 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. 	<p>Significant residual impacts will still remain as some of the activities are unavoidable and can only be mitigated to a certain level of certainty:</p> <ul style="list-style-type: none"> • Demolition of 14 buildings within the proposed development boundary which will affect local populations of Soprano pipistrelle bats, Common pipistrelle bats, Brown long-eared bats and Lesser horseshoe bats. • One maternity roost is being demolished, a Brown long-eared roost at Aughnacurra (PBR256) • One satellite roost for Lesser horseshoe bats will be demolished at Aughnacurra (PBR178) (believed to be a satellite roost for the Menlo Castle (PBR06) Lesser horseshoe maternity roost) • 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 proposed road development on individual bats. Whilst best practice has been

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>The following mitigation measures are proposed in relation to those trees identified as having high potential to support roosting bats. These include the two trees confirmed to have had bats present (PTR43, PTR48) or 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 8.16.1 to 8.16.15 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:</p> <ul style="list-style-type: none"> 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 <p>Prior to felling the two confirmed tree roosts (PTR43 and PTR48) replacement bat boxes will be in place to ensure that bats are able to access alternative resting places at the earliest opportunity. The location of the bat boxes in these instances will be within the proposed development boundary but the precise height and location will be decided by the bat specialist. If any additional bat tree roosts are confirmed, and will be removed by the proposed felling works, then appropriate alternative roosting sites will be provided in the form of replacement bat boxes.</p> <p>Measures to preserve flight paths across Construction areas</p> <p>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.</p> <p>The <i>Report WC1060 Development of a Cost-Effective Method for Monitoring the Effectiveness of Mitigation for Bats crossing linear infrastructure</i> 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 proposed road development:</p> <ul style="list-style-type: none"> “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” <p>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.</p>	<p>followed in the design of the proposed road development and the inclusion of underpasses/culverts and a wildlife overpass, a small proportion of the local bat population will inevitably fly over the proposed road development and be vulnerable to vehicle collisions. A small proportion of the population will also be adversely affected by the barrier effect posed by the proposed road development 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.</p> <p>These residual impacts have been addressed further by the proposal for specific compensatory measures, which are further discussed in Section 20.4.2 below.</p>

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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:</p> <ul style="list-style-type: none"> Area 1: North of Bearn Woods Area 2: Aughnacurra Area 3: River Corrib to Coolough Road Area 4: West of N84 Headford Road Area 5: Ballindooley to Castlegar <p>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.</p> <p>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.</p> <p>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.</p> <p>Proposed monitoring programme</p> <p>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. 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.</p> <p>Pre-construction monitoring</p> <p>Pre-construction monitoring is required to provide data against which the post-construction monitoring can be compared. Parameters will include:</p> <ul style="list-style-type: none"> • 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 proposed road development <p>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).</p> <p>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 proposed road development.</p> <p>The risk of adverse effects on bat diversity and abundance adjacent to the proposed road development 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 proposed road development will be monitored using standardised survey transects from the edge of the proposed road development outwards as described by Berthinussen & Altringham (2015). These transects will be used to record bat activity across the lands flanking the corridor of the proposed road development. It is proposed that six transects are surveyed pre-construction in locations of high bat activity where underpasses or an overpass are proposed.</p> <p>Refer to the Operational Biodiversity section below in relation to “During and Post Construction Monitoring”</p>	
Badger	<p>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).</p> <p>A comprehensive suite of mitigation measures has been incorporated into the proposed road development 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.</p> <p>The mitigation measures described below follow the recommendations set out in the <i>Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (National Roads Authority, 2006)</i>. These guidelines set out the best practice approach in considering and mitigating impacts on Badgers during construction works.</p>	No likely significant residual effect on Badger, at any geographic scale.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>A detailed summary of the mitigation measures as they relate to each of the Badger setts within the ZoI of the proposed road development is presented in Appendix A.8.24. The non-interference zones (30m, 50m and 150m), as they relate to each of the Bader setts within the ZoI of the proposed road development, are shown on Figures 8.23.1 to 8.23.14.</p> <p>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.</p> <p><i>Disturbance/displacement</i></p> <p>In order to prevent any disturbance to Badger setts not directly affected by the proposed road development, 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).</p> <p>Prior to works commencing, a non-interference zone of 30m will be established around each of the Badger setts within the ZoI of the proposed road development, as shown on Figures 8.23.1 to 8.23.14. 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.</p> <p>The mitigation measures, as they relate to each of the Badger setts within the ZoI of the proposed road development, are summarised in Table 8.36 of Chapter 8, Biodiversity and illustrated on Figures 8.23.1 to 8.23.14.</p> <p><i>Loss of breeding/resting sites</i></p> <p>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 <i>Guidelines for the Treatment of Badgers during the Construction of National Road Schemes</i> (National Roads Authority, 2006):</p> <ul style="list-style-type: none"> • 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.8.24. The location of the artificial sett is shown on Figures 8.23.1 to 8.23.14². • Inaccessible areas (see Figures 8.3.1 to 8.3.14) 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	<p><i>Habitat degradation - water quality</i></p> <p>The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology.</p>	No likely significant residual impact on any other mammal species, at any geographic scale.
Invertebrates	<p>White-clawed crayfish & Freshwater pearl mussel</p> <p>As there are no records of White-clawed crayfish or Freshwater pearl mussel from the area within the ZoI of the proposed road development they will not be affected. Therefore, no mitigation measures are required.</p> <p>Marsh whorl snail</p> <p><u>Habitat Degradation – Surface Water Quality</u></p> <p>The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology.</p> <p><u>Habitat Degradation – Groundwater.</u></p> <p>The mitigation measures relating to the protection of the groundwater resource during construction are outlined below for hydrogeology.</p> <p>Marsh fritillary butterfly</p> <p><u>Mortality Risk</u></p>	<p>White-clawed crayfish & Freshwater pearl mussel</p> <p>No likely significant residual impacts are predicted.</p> <p>Marsh whorl snail</p> <p>No likely significant residual impact on the Marsh whorl snail, at any geographic scale.</p> <p>Marsh fritillary</p>

² 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
	<p>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:</p> <ul style="list-style-type: none"> All areas within the proposed development 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 proposed development boundary or, if within, to an area of suitable habitat that will remain unaffected by construction works for the duration 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 	No likely significant residual impact on the Marsh fritillary butterfly, at any geographic scale.
Birds	<p>Breeding Birds Habitat Loss, Disturbance and Destruction of Breeding Habitat General 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.</p> <p>Barn owl To 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 8.23.1 to 8.23.14 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.</p> <p>Peregrine falcon 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. The installation of rock bolts on the cliff faces in the vicinity of the nest site will be undertaken in a sensitive manner (as advised by a suitably experienced ecologist) so as to minimise any potential disturbance to the nest site during the breeding season, particularly if the nest site is occupied.</p> <p>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: <i>Code of practice for noise and vibration control on construction and open sites – Noise</i> and the NRA (now TII) guidelines <i>Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes</i> (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.</p>	<p>Breeding birds No likely significant residual impact on breeding bird species, at any geographic scale, with the exception of the Peregrine falcon. Due to the likely permanent loss of Lackagh Quarry as a nesting site, the proposed road development is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale.</p> <p>Wintering birds No likely significant residual impact on wintering bird species, at any geographic scale.</p>
Amphibians	<p>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 proposed road development. 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 proposed road development. 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.</p>	No likely significant residual impact on the Common frog or the Smooth newt, at any geographic scale.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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.</p> <p>Any capture and translocation works shall be undertaken immediately in advance of site clearance/construction works commencing.</p> <p>Habitat Degradation – Surface Water Quality</p> <p>The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for Hydrology.</p>	
Reptiles	<p>Measures to Protect Reptiles during Construction</p> <p>Habitat Loss, Disturbance & Mortality Risk</p> <p>Given the broad range of habitat types favoured by the Common lizard, and that the majority of the proposed road development passes through mosaics of such habitats, site clearance works at any time of year in suitable habitat are highly likely to encounter the species, cause disturbance and have the potential to kill or injure individuals.</p> <p>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 8.10.1 to 8.10.8, where the presence of Common lizard has been confirmed:</p> <ul style="list-style-type: none"> • 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	<p>Measures to Protect Fish Species during Construction</p> <p>Habitat Loss</p> <p>The structures have been designed in consultation with IFI and in accordance with the design criteria set out in <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes</i> (National Roads Authority, 2005) and the <i>Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters</i> (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.</p> <p>To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the proposed development boundary, but not within the footprint of the proposed road development 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.</p> <p>Habitat Degradation – Surface Water Quality</p> <p>The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined below for hydrology</p> <p>Habitat Degradation – Groundwater</p> <p>The mitigation measures relating to the protection of the groundwater resource during construction are outlined below for Hydrogeology.</p> <p>Mortality Risk & Disturbance/Displacement</p> <p>To minimise the potential effects of construction works on fish species the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> • 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 <i>Channels & Challenges. Enhancing Salmonid Rivers.</i> (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 <p>Habitat Severance/Barrier Effect</p> <p>All temporary crossing structures used to cross watercourses during construction will be designed in accordance with the <i>Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters</i> (IFI, 2016) and <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes</i> (National Roads Authority, 2005) to maintain fish and macroinvertebrate passage, and to prevent sedimentation and erosion.</p>	No likely significant negative residual impact on fish species, at any geographic scale.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Soils		
Earthworks construction	<p>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.</p> <p>Loss of Agricultural Land and Solid Geology</p> <p>All excavated material, excluding a small potential volume of hazardous material, will be re-used as construction fill and material deposition areas minimising the loss of the feature. The Contractor will ensure acceptability of the material for re-use within the proposed road development with appropriate handling, processing and segregation of the material.</p> <p>Introduction of Material derived from a different Lithology</p> <p>A construction earthworks programme will be implemented as part of the CEMP included in Appendix A.7.5, which is finalised by the Contractor, for the proposed road development which categorises the source of material for each fill section. During the finalisation of this programme, the fill limitations outlined below will be incorporated.</p> <p>To prevent impact to the local peatland habitats, the following fill limitations will be incorporated at the locations identified Table 9.18 of Chapter 9, Soils and Geology.</p> <ul style="list-style-type: none"> • 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 <p>Flood Barrier</p> <p>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.</p> <p>Earthworks Haulage</p> <p>Earthworks haulage will be along predetermined routes within and outside the proposed development boundary as shown on Figures 7.101 to 7.123 of Chapter 7, Construction Activities. The identified haulage routes are along existing national, regional and local routes or within the proposed development boundary.</p> <p>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 proposed road development will be avoided.</p> <p>Washout of Fines/Sediment Runoff</p> <p>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, 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.</p> <p>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.</p> <p>Sediment control methods are outlined in the CEMP in Appendix A.7.5 and in the Hydrology and Hydrogeology sections below.</p> <p>Effect on Surrounding Ground</p> <p>Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.</p> <p>In situations where the site specific blast design has determined that blasting is not feasible in a particular location due to excessive ground vibrations, 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.</p> <p>A geotechnical expert will be appointed by the Contractor and will be present to monitor the surrounding ground vibrations near sensitive receptors during blasting works. 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. Allowable distances for the various construction methods are given in the section below on Noise and Vibration.</p>	The small loss of the attribute (Limestone pavement (all outside European designated sites)) will result in a significant/moderate residual impact.
Reuse and processing of site material	<p>A construction earthworks programme will be implemented for the proposed road development which categorises the source of material for each fill section. During the finalisation of this programme the fill limitations outlined above will be incorporated at the locations presented in Table 9.18 of Chapter 9, Soils and Geology.</p>	No likely significant residual impact.
Importation, exportation and disposal of materials	<p>Importation, exportation and disposal of materials</p> <p>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 proposed road development. This will significantly reduce the deposition of material off-site.</p> <p>Hazardous material will be transported off site for disposal or recovery at appropriately licenced or permitted sites as outlined above in the section on Construction Activities and in the CEMP (Appendix A.7.5).</p>	No likely significant residual impact.
Tunnelling	<p>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.</p>	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
<p>Construction of Structures</p> <p>Contaminated ground</p> <p>Karst features</p>	<p>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. 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.</p> <p>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 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. For further information on Lackagh Tunnel is presented in Section 9.3.2.5 of Chapter 9 Soils and Geology and Appendix A.7.3.</p> <p>Construction of structures will be completed in accordance with the CEMP in Appendix A.7.5. The construction of the River Corrib Bridge will meet the requirements of the: River Corrib Bridge Constructability Examination Appendix A.7.1; the Menlough Viaduct will meet the requirements of the Menlough Viaduct Constructability Examination Appendix A.7.2, the Lackagh Tunnel will meet the requirements of the Lackagh Tunnel Geotechnical and Hydrogeological Appraisal Appendix A.7.3 and the Galway Racecourse Tunnel will meet the requirements of the Galway Racecourse Tunnel Constructability Report Appendix A.7.4. Ground settlements will be controlled through selection of the foundation type and method of construction which are suitable for the particular ground conditions.</p> <p>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.</p> <p>During construction, the Limestone pavement at Menlough Viaduct will be protected and will not be impacted 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 for further details.</p> <p>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 licence or permitted sites in accordance with the current Irish Waste Management legislation.</p> <p>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.</p> <p>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.</p> <p>The Contractor is required to 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.</p> <p>As a minimum, the carriageway drainage network will be sealed in areas where the proposed road development 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 proposed road development 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, determined by the extent of karst and make-up of the proposed road development as outlined in the karst protocol which is part of the CEMP in Appendix A.7.5. 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.</p> <p>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.</p>	<p>No likely significant residual impact.</p>
Hydrogeology		
Groundwater Quantity and Quality	<p>Through the evolution of the design of the proposed road development measures were included in the design to reduce or avoid specific impacts where possible. The following measures were incorporated into the design of the proposed road development:</p> <ul style="list-style-type: none"> 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. 	<p>There are no residual hydrogeological impacts to European sites.</p> <p>Residual profound hydrogeological impacts remain for groundwater level drawdown impacts below the location of five Annex I habitats,</p>

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> • 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). <p>The design of the proposed road development includes dewatering of the bedrock aquifer in cuttings in the Galway Granite Batholith and in cuttings in the Visean Undifferentiated Limestone with the exception of the construction of Menlough Viaduct or Lackagh Tunnel (or its approaches). 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.</p> <p>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.</p> <p>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.</p> <p>Following the evaluation of potential impacts as a result of the design which includes the above measures, specific mitigation measures have been developed to avoid, prevent, reduce and, if possible, remedy any significant adverse impacts on hydrogeology as outlined below.</p> <p>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.</p> <p>The following measures included in the CEMP will be implemented to control the potential for pollution from accidental spillages on site:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ Containment measures ○ 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. 	<p>outside of any European sites, on the Galway Granite Batholith at:</p> <ul style="list-style-type: none"> • Na Foráí Maola Thiar Ch. 0+650 to Ch. 0:750 • Na Foráí Maola Thoir Ch. 1+1250 to Ch. 1+500 • Troiscaigh Thiar (Ch. 1+850 to Ch. 2+400) • Aille (Ch. 3+300 to Ch. 3+900) • Ballyburke (Ch. 4+800 to Ch. 5+900)

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Groundwater dependant receptors	<ul style="list-style-type: none"> ○ 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. <p>A number of mitigation measures have also been developed specifically for groundwater dependent receptors. These are detailed below for aquifer, supply wells and habitats.</p> <p>Aquifer</p> <p>Aquifer specific mitigation measures are implemented where karst or high permeability zones are encountered during the construction programme.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 proposed road development 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 proposed road development 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 measureable impact beyond that stated in this 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 rain water infiltrating through the material. The time frame between excavation and removal will be kept to an absolute minimum <p>Supply Wells</p> <p>The mitigation measures listed below will be adopted during the construction phase of the proposed road development:</p> <ul style="list-style-type: none"> • Five wells (W50-10, W50-12, W50-13, W50-14 and W50-15) will be lost during the construction of the proposed road development. These will each be mitigated by providing a replacement well, connecting to mains supply where available or by financial compensation. Where wells have to be abandoned as part of the proposed road development 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 • Wells outside of the proposed development 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 on a monthly basis for 12 months before construction, during construction and for 12 months after construction. If the monitoring indicates that the proposed road development 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 on a monthly basis. These wells will be monitored for standard drinking water quality parameters on a monthly basis for 12 months before construction, during construction and for 12 months after construction. If the monitoring indicates that the proposed road development has impacted on a supply, then mitigation will be applied <p>GWDTE</p> <p>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.</p>	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>Construction activities represent a potential source of impact on the water quality of the Coolagh Lakes, which form part of the Lough Corrib cSAC, 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.</p> <p>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.</p> <p>These above measures will ensure that the risk of pollution of groundwater bodies is controlled. These mitigation measures are employed during construction, the impacts on groundwater quality beneath the site will be of Negligible Magnitude and Imperceptible Significance.</p>	
Hydrology		
<p>Drainage, general flood risk water quality, channel morphology and key ecological receptors</p>	<p>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:</p> <ul style="list-style-type: none"> • 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 the 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) <p>Construction activities will be required to take cognisance of the following guidance documents for construction work on, over or near water:</p> <ul style="list-style-type: none"> • 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) <p>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:</p> <ul style="list-style-type: none"> • 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 as defined above 	<p>The will be no significant residual negative hydrological impacts on drainage and flood risk, water quality, channel morphology or key ecological receptors.</p>

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
N83 Tuam Road Flood Risk	<ul style="list-style-type: none"> • 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 cSAC) • 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) <p>To minimise the risk of contamination to the Galway Bay Complex cSAC 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 cSAC and Inner Galway Bay SPA will be avoided.</p> <p>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):</p> <ul style="list-style-type: none"> • Prevent the upgraded portion of the N83 Tuam Road from spilling laterally northwards into the driveways of existing flood risk houses by: <ul style="list-style-type: none"> ○ 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 8,030m³ 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 proposed road development 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 <p>Refer also to Table 11.41 in Chapter 11, Hydrology which outlines the required storage volumes required for the catchment for a range of return periods and durations events.</p> <ul style="list-style-type: none"> • The required flood storage, with an available pumping rate of 0.25cumec (i.e. 250l/s) from the engineered storage pond, is 20,700m³ for the 100year event which is further increased to 24,800m³ to include for 20% climate change 	<p>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.</p> <p>However negative slight residual flood impacts associated with the N83 flood relief measures will remain:</p> <ul style="list-style-type: none"> • 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

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> The available storage provided in the engineered storage pond at a top water level of 17.5m OD is compensation storage of 8,030m³ and the remaining (with proposed road development) natural storage provided of 18,470m³ gives a total available flood storage of 26,500m³, which is sufficient to achieve to meet and exceed the required storage. 	<ul style="list-style-type: none"> 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
Landscape and Visual		
Site clearance and construction activities	<p>Mitigation of landscape and visual impacts for the proposed road development shall have regard to the approach as set out in the following NRA/TII guidance documents:</p> <ul style="list-style-type: none"> Guidelines for the Creation and Maintenance of an Environmental Operating Plan (2007) A Guide to Landscape Treatments for National Road Schemes in Ireland (2006) 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) Standard Construction Details (2000-2017) Specification for Works (2000-2017) <p>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</p> <p>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.</p> <p>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.</p> <p>Specific measures shall ensure that:</p> <ul style="list-style-type: none"> Site machinery shall operate within the proposed road development 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 road development 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. 	There will be significant residual impacts during construction until such time as the proposed landscape mitigation proposals establish and become increasingly effective.
Archaeology, Architectural and Cultural Heritage		
Construction activities including site clearance and demolition works	<p>The proposed mitigation measures for the archaeological, architectural and cultural heritage are outlined below and detailed in Appendix A.13.11: A summary of all sites, structures, potential impacts and proposed mitigation is included in Tables 13.21 to 13.26 in Section 13.8 of Chapter 13, Archaeological, Architectural and Cultural Heritage.</p> <ul style="list-style-type: none"> A programme of archaeological test trenching will be carried out within the footprint of the proposed road development prior to construction going ahead. This will target the sites and areas of archaeological and cultural heritage potential as outlined in Section 13.5.3 of Chapter 13, Archaeological, Architectural and Cultural Heritage as well as previously undisturbed areas within the proposed development boundary 	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> • Test trenching will be carried out under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a 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 • 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 under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a TII 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 proposed road development. This will be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a TII Project Archaeologist • All Cultural Heritage (CH) sites listed in Table 13.17 of Chapter 13, Archaeological, Architectural and Cultural Heritage 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 Department of Culture, Heritage and the Gaeltacht and a 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 • Archaeological wade or underwater assessments will be carried out at any natural water courses (AAPs) to be impacted upon by the proposed road development by disturbance to their banks or beds. This shall be carried out under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a 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 • 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 under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a 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 • Excavation of all previously recorded archaeological sites – where these fall, in whole or in part, within the footprint of the development – will be carried out under Ministerial Direction consultation with the Department of Culture, Heritage and the Gaeltacht and a TII Project Archaeologist. 	
Agriculture		
Construction activities	<ul style="list-style-type: none"> • The landowner will be provided with access to all separated land parcels during the construction of the proposed road development. 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 of the proposed development boundary 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 and Climate. 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 	The 48 Significant, 8 very significant and 12 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	<ul style="list-style-type: none"> • 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 	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 road development, remain as very

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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.</p> <ul style="list-style-type: none"> • 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 road development severs the NUIG Sporting Campus facilities. During construction, restricted access across the construction area at the NUIG Sporting Campus facilities will be maintained. • Alternative pitch facilities will be provided to replace the existing pitches directly impacted by the proposed road development. The facilities include a floodlit 3G GAA pitch and a floodlit 3G training area and associated site infrastructure for the drainage of these pitches and furniture such as ball-stop netting. The proposed road development also intercepts the existing sports pavilion resulting in direct impacts to its western end and the building will be modified as follows: <ul style="list-style-type: none"> ○ the existing western plant room, 1 no. changing room, 1 no. storage area, 1 no. weights area and associated access hallways on both ground floor and upper levels will be demolished ○ the western plant room and its associated plant will be relocated ○ construction and reconfiguration of internal and external walls, roof, windows and door locations. • During the construction of the River Corrib Bridge, alternative access along the bank of the River Corrib will be provided • Temporary stables will be provided for Galway Racecourse during the construction of the proposed road development until such time as the Galway Racecourse Tunnel is complete and the permanent stables are constructed. • 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. 	<p>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.</p> <p>Mitigation measures as detailed in individual accommodation works agreements will remove the residual impacts related to the properties with partial landtake.</p> <p>There are no residual impacts on dwellings from which part of the road bed will be acquired or on services or services infrastructure.</p> <p>The residual impacts on NUIG Sporting Campus remain as very significant in the absence of a new university sports masterplan. The proposed road development will effectively divide the sports campus into two, removing the two centrally located grass based sand carpet full sized GAA pitches. In tandem with this the existing context of the existing sporting changing facilities setting and curtilage will be altered completely. With an appropriate level of masterplanning and implementation of the following in such, a masterplan would reduce the residual impact to moderate:</p> <ul style="list-style-type: none"> • The sporting campus at Dangan will require a new sporting campus plan and strategy to re-accommodate the removed pitches and ancillary sports pavilion. This must be in line with the university's overall strategic sport's vision • The removal of the existing sports fields will require replacement by similar or more likely improved facilities which allow for the more intensive use of the remaining reduced campus footprint • Utilities, roads and access and egress routes around the campus will require complete re-planning to re-integrate with the proposed road development • The remaining sports pitches will require remodelling to accommodate a more intensive use of the existing campus footprint • 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.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
		<ul style="list-style-type: none"> Ancillary supporting facilities such as car parking and changing facilities will require remodelling <p>The residual impact on NUIG 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.</p> <p>There will be a positive residual impact on Galway Racecourse once the mitigation measures have been constructed with the provision of enhanced access to the premises and a new stable yard.</p>
Services/Utilities	<p>Each of the utility diversions associated with the proposed road development have been planned with ongoing and detailed engagement with relevant utility providers during the preparation of this 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.</p> <p>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.</p> <p>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.</p> <p>Mitigation for interference with septic tanks will be agreed by the valuer at a later stage.</p>	No likely significant residual impacts.
Air and Climate Change		
Air quality	<p>Emissions to air during earthmoving and construction will occur, although the prevailing weather, the size of the site and its distance from sensitive receptors will assist in facilitating the management of any effects. The focus of the control procedures will therefore be to reduce the generation of airborne material.</p> <p>The assessment of potential construction impacts includes the implementation of 'standard mitigation', as stated in the TII Guidelines. This shall include the following measures:</p> <ul style="list-style-type: none"> Spraying of exposed earthwork activities and site haul roads during dry weather Provision of wheel washes at exit points Control of vehicle speeds and speed restrictions. It is proposed that site traffic is restricted to 20 km/hr. This will help to minimise the occurrence of dust re-suspension Sweeping of hard surface roads <p>In addition, the following measures will be implemented. These measures are based on best practice as outlined in the British Research Establishment (BRE) document 'Controlling particles, vapour and noise pollution from construction sites' and the Institute of Air Quality Management (IAQM) 'Guidance on the assessment of dust from demolition and construction', 2016.</p> <ul style="list-style-type: none"> A public communication strategy will be implemented by the Contractor which will outline procedures to inform members of the community on activities that may be disruptive, further details are contained in the CEMP in Appendix A.7.5. This appendix also includes details of a complaints register which will be implemented during the construction phase Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the Contractor through regular servicing of machinery During dry periods when dust generation is likely or during windy periods, construction areas and vehicles delivering material with dust forming potential will also be sprayed with water, as appropriate Areas where materials will be handled and stockpiled will be positioned away from main site access roads. These areas will also be designed to minimise their exposure to wind – all stockpiles shall be kept to the minimum practicable height with gentle slopes There shall be no long-term stockpiling on site and storage time will be minimised Material drop heights from plant to plant or from plant to stockpile will be minimised Water suppression will be used during the demolition of buildings Crushing and concrete batching plant will be located as far from sensitive receptors as is reasonably practicable. All storage bins and transfer points will be covered. Silos will be fitted with reverse jet air filters 	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Climate	<p>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 proposed road development and the Lough Corrib cSAC and where the proposed road development is adjacent to Moycullen Bogs NHA.</p> <p>Employee awareness is also a most important way that dust may be controlled on any site. Staff training and the vigilant management of operations ensure that all dust suppression methods are implemented and continuously inspected. Further details on employee training are provided in the CEMP in Appendix A.7.5.</p> <p>Dust deposition and PM₁₀/PM_{2.5} monitoring shall be carried out to confirm the effectiveness of the mitigation measures.</p> <p>Dust deposition monitoring will also be conducted at a number of locations in the vicinity of the proposed road development. At a minimum, monitoring will be carried out at the two nearest sensitive receptors at locations where works of a 'major' scale is proposed while works are taking place in proximity. 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. Should an exceedance of the TA Luft limit occur during the construction phase or a complaint be received in relation to dust levels, additional mitigation measures, for example more regular spraying of water, will be implemented. At least one month of dust deposition monitoring will be carried out in advance of the commencement of works to determine a baseline.</p> <p>In addition, it is proposed to carry out particulate monitoring (PM₁₀ and PM_{2.5}) 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 PM_{2.5} air quality standards on a daily basis.</p> <p>The particulate and dust deposition limits will be used to determine potential occurrences of dust nuisance associated with the proposed construction works. Should the limit values be approaching an exceedance during the construction works, the levels will be recorded by the Contractor. An investigation will subsequently be carried out to determine potential causes and the options available to reduce the level of dust.</p> <p>All potential causes for the high dust levels will be analysed. These will include the construction works taking place, potential off site sources and meteorological conditions. Should the construction works taking place be identified as the primary cause of the high level, the Contractor will ensure that the mitigation measures listed above are improved upon. Should high dust levels continue to occur following these improvements, the Contractor will provide alternative mitigation measures and/or will modify the construction works taking place.</p> <p>The following mitigation measures will be implemented during the construction phase of the development so as to minimise CO₂ emissions:</p> <ul style="list-style-type: none"> • Materials required for the construction works will be sourced locally where possible. There are operational quarries located in proximity to the proposed road development. Rock crushing will be undertaken on site where possible, to reduce the requirement to import crushed stone to site • The Construction Traffic Management Plan outlined in the CEMP in Appendix A.7.5 will be implemented in full. This will minimise congestion and encourage car sharing and the use of public transport • Materials will be handled efficiently on site to minimise the waiting time for loading and unloading, thereby reducing potential emissions. • Engines will be turned off when machinery is not in use • The regular maintenance of plant and equipment will be carried out • Materials with a reduced environmental impact will be used where available, such as: <ul style="list-style-type: none"> ○ Ground Granulated Blast Furnace Slag (GGBS) and Pulverished Fly Ash (PFA) will be used as replacements for Portland cements ○ Recycled steel <p>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:</p> <ul style="list-style-type: none"> • 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. 	No likely significant residual impact.
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.	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>The contract documents will clearly specify the construction noise criteria included in Chapter 17, 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 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that:</p> <ul style="list-style-type: none"> • 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 17.1 of Chapter 17, Noise and Vibration using methods outlined in BS 5228-1:2009+A1 2011. Part 1 - Noise <p>BS 5228 -1:2009+A1 2011 includes guidance on several aspects of construction site practices, which include, but are not limited to:</p> <ul style="list-style-type: none"> • Selection of quiet plant • Control of noise sources • Screening • Hours of work • Liaison with the public • Monitoring <p>Further comment is offered on these items in the following paragraphs and in Appendix A.17.2, 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.</p> <p>Selection of Quiet Plant</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>General Comments on Noise Control at Source</p> <p>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.</p> <p>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 "<i>Best Available Techniques</i>" as defined in EC Directive 96/61. In this context "best" means "<i>the most effective in achieving a high general level of protection of the environment as a whole</i>".</p> <p>The expression "<i>available techniques</i>" means "<i>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</i>".</p> <p>The term "<i>techniques</i>" includes "<i>both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned</i>".</p>	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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 “<i>practical suitability</i>” and the need “<i>to reduce an emission and its impact on the environment as a whole</i>”.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 • 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 17.10 of Chapter 17, Noise and Vibration) will incorporate a strict noise control policy relating to materials handling • Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/ areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation • Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact • Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary • 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 <p>Screening</p> <p>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.</p> <p>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.</p> <p><i>BS 5228 -1:2009+A1 2011</i> states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 10 kg/m² will give adequate sound insulation performance. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver. Annex B of <i>BS 5228-1:2009+A1:2014</i> (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.</p> <p>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 road development can provide a degree of noise screening if placed between the source and the receiver.</p> <p>Hours of Work</p> <p>Construction activity will mostly take place during daytime hours Monday to Friday and Saturdays (ref Section 17.2.2.1 of Chapter 17, 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.</p> <p>It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the project. Over the expected 36-month construction phase there will be up to 10 weeks of night time working along different sections of the proposed road development primarily to facilitate bridge works over existing roads.</p> <p>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 17.9, Chapter 17, 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.</p> <p>Liaison with the Public</p>	

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
Blasting and Air Overpressure	<p>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.</p> <p>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.</p> <p>Monitoring</p> <p>During the construction phase noise monitoring will be undertaken at the nearest sensitive locations to ensure construction noise limits outlined in Table 17.1 of Chapter 17, Noise and Vibration are not exceeded. Noise monitoring will be conducted in accordance with the International Standard ISO 1996: <i>Acoustics – Description, measurement and assessment of environmental noise</i> 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.</p> <p>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.</p> <p>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.</p> <p>In terms of blast design control, specific guidance will be obtained from the recommendations contained within BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration in relation to blasting operations in addition to experienced blast control techniques used by the Contractor. These will include some or all of the following:</p> <ul style="list-style-type: none"> • 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 17.2.1 of Chapter 17, Noise and Vibration) at the nearest sensitive buildings 	No likely significant residual impact.
Vibration	<p>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, the following recommended mitigation measures are proposed:</p> <ul style="list-style-type: none"> • 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 results <p>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 17.3, Chapter 17, Noise and Vibration.</p> <p>On review of the likely vibration levels associated with construction activities, it may be concluded that the construction of the proposed road development 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.</p> <p>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:</p>	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> 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 <p>Property Condition Surveys</p> <p>Property condition surveys will be offered for all buildings within 50m of the proposed development boundary and those within 150m of proposed blasting works along the proposed road development. 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:</p> <ul style="list-style-type: none"> 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 <p>Disturbance of Particularly Vibration-Sensitive Equipment and Processes</p> <p>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 proposed road development 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 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.</p>	
Human Beings, Population and Health		
Socio-economics	<p>This section should be read in conjunction with Tables 18.13 and 18.14 in Chapter 18, Human Beings, Population and Health, which detail specific measures proposed for potential socio-economic impacts. Many of these measures have been included in the design of the proposed road development. These include the provision of crossing facilities at the Forá Maola Road, Troscaigh Road, Bearnna to Moycullen Road L1321, Cappagh Road and Ballymoneen Road junctions to facilitate pedestrian and/or cyclist crossings of the proposed road development. 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.</p> <p>The following specific mitigation measures are proposed to improve journey amenity and minimise severance:</p> <ul style="list-style-type: none"> Provide pedestrian crossing facilities at junctions with minor roads serving local rural communities Provide temporary visual screening from construction works at St. James' Church cemetery in Bushypark and at St. James' School, Bushypark Provide pedestrian crossing facility at Bushypark Junction with N59 Link Road North during construction and operation 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 Phase construction works to minimise impacts on racing events at Galway Racecourse Provide directional signage for access to the car dealership and An Post Sorting Centre on N83 during construction Provide pedestrian crossing facilities at N84 Headford Road Junction during construction and operation 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 both the construction Take measures to ensure that cul-de-sacs or adjacent lands are not used for illegal parking in the operational phase <p>Material Assets Non-Agriculture above outlines the proposed mitigation measures for the NUIG Sporting Campus facilities and Galway Racecourse.</p>	<p>There will be a significant residual impact as a result of the demolition of 44 dwellings and further acquisition of dwellings on those involved in the compulsory purchase process but also the integrity of the communities left behind in terms of their identity.</p> <p>There will also be a signification residual impact on the two building providers which are to be acquired.</p> <p>Material Assets Non-Agriculture above outlines the residual impacts on NUIG Sporting Campus and Galway Racecourse.</p>
Irish Language	<p>Mitigation measures proposed to protect the Irish Language are as follows:</p> <ul style="list-style-type: none"> During construction, all public notifications and all public project updates are provided in both Irish and English languages. 	No likely significant residual impact.

Source / Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> While it is expected that day-to-day communications involved in the construction of the proposed road development 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. 	
Human health	<p>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.</p> <p>Mitigation measures proposed for the potential air quality, noise, water and soils 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.</p>	Likely significant residual impacts on those whose properties are to be acquired or demolished are as above for socio-economic.

20.3 Operational Phase

Table 20.2 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 proposed road development.

Table 20.2: Assessment of Potential Impacts and Mitigation Measures – Operational Phase

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Traffic		
	The traffic modelling indicates that for the Opening (2024) and Design (2039) Years there are no traffic impacts of major significance and therefore no mitigation measures are required.	The proposed road development 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 proposed road development which will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996 to 2016.	No likely significant residual impact.
Biodiversity		
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: <ul style="list-style-type: none"> Habitat degradation – hydrogeology: mitigation measures to avoid habitat degradation in Lough Corrib cSAC as a result of potential hydrogeological impacts during 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 proposed road development 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	No likely significant residual impacts.
Habitats	Areas of Annex I habitat within the proposed development boundary which are identified to be retained and fenced off during the construction of the proposed road development will also be avoided during the operational phase. There will be no fencing within Annex I habitats that are located within Lough Corrib cSAC. 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.
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.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Rare and Protected Plants and Species	As there are no rare or legally protected plant species present within the ZoI of the proposed road development they will not be affected. Therefore, no mitigation measures are required.	No likely significant residual impact.
Otters	<p>Habitat Severance/Barrier Effect and Collision Risk</p> <p>Otters use many of the watercourses crossed by the proposed road development. 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, 2008c). The locations where Otter passage facilities will be provided are listed in Table 8.36 of Chapter 8, Biodiversity and are shown on Figures 8.23.1 to 8.23.14.</p> <p>Mammal-resistant fencing will be required to prevent Otter accessing the proposed road development 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, 2008c) 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 8.23.1 to 8.23.14.</p> <p>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, 2008c), 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)</p>	No likely significant residual impact.
Bats	<p>Measures to reducing mortality risk and barrier effects within the design and operation of the proposed road development</p> <p>The mitigation to address significant barrier effects has been designed to reflect current best practice. The two main approaches employed for the proposed road development include underpasses of a suitable size where the design of the proposed road development 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 2012a, 2012b).</p> <p>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 8.35 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 8.23.1 to 8.23.14. In addition to the structures specifically designed for bat passage, there are other structures such as where minor roads pass underneath the proposed road development which will be used by bats as safe crossing points.</p> <p>The section 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 this report as the Castlegar Wildlife Overpass). The Castlegar Wildlife Overpass is a critical component of the strategy. It will allow bats to fly across the proposed road development 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.</p> <p>The proposed 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 proposed road development to funnel bats in to the centre of the overpass.</p> <p>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 proposed development 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 proposed road development between Aughnacurra and Castlegar. This planting provides a guaranteed green corridor connecting up the underpasses/overpasses and will allow bats to adapt more easily to any future landscape scale losses of connecting habitat features. 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</p> <p>Proposed monitoring programme</p> <p>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.</p> <p>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 the Construction section above in relation to Pre-construction monitoring.</p> <p><i>During and Post Construction Monitoring</i></p> <p><i>Roost Monitoring</i></p>	<p>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.</p> <p>These residual impacts have been addressed further by the proposal for specific compensatory measures noted in Section 20.4.2 below.</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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:</p> <ul style="list-style-type: none"> • Emergence counts at Menlo Castle roost: emergence counts will be undertaken during the construction works and in 5 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 5 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 this report. 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 proposed development 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 5 years after erection <p><u>Monitoring crossing points</u></p> <p>Monitoring will comprise acoustic detector and infra-red camera recording at the culverts at the five locations previously surveyed pre-construction, namely:</p> <ul style="list-style-type: none"> • Area 1: North of Bearn 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 <p>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 proposed road development). 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 this report.</p> <p>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 two bat activity seasons (May-August) following completion of the construction of the proposed road development.</p> <p>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 20.4.2.</p> <p><u>Diversity and abundance adjacent to the proposed road development corridor</u></p> <p>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 proposed road development. If a displacement effect is detected (decreased abundance and diversity close to the proposed road development) 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 this report. It is proposed that monitoring takes place during construction and two bat activity seasons following completion of the construction of the proposed road development</p>	
Badgers	<p><i>Habitat Severance/Barrier Effect and Mortality Risk</i></p> <p>Badger passage facilities provided at locations listed in Table 8.36 of Chapter 8, Biodiversity and shown on Figures 8.23.1 to 8.23.14 will protect badgers during the operational phase.</p>	No likely significant residual effect on Badger, at any geographic scale.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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.</p> <p>Mammal-resistant fencing will be required to guide badgers to the underpasses and will be installed in accordance with the specification outlined in <i>Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes</i>, 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 8.23.1 to 8.23.14.</p> <p>In accordance with the recommendations described in the <i>Guidelines for the Treatment of Badgers during the Construction of National Road Schemes</i> (National Roads Authority, 2006), 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)</p>	
Other mammal species (excluding bats)	<p>Habitat Severance/Barrier Effect</p> <p>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 proposed road development for all of the other mammal species recorded, or likely to be present, with the study area. The locations are described in Table 8.36 of Chapter 8, Biodiversity and shown on Figures 8.23.1 to 8.23.14.</p> <p>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 proposed road development will reduce the effects of any severance, barrier effect or collision risk that may be associated with the proposed road development (Haigh, 2012) such that the species' conservation status would not be affected.</p>	No likely significant residual effect on any other mammal species (excluding bats), at any geographic scale.
Invertebrates	<p>White-clawed crayfish & Freshwater pearl mussel As there are no impacts, no mitigation measures are required.</p> <p>Marsh whorl snail Habitat Degradation – Groundwater The mitigation measures relating to the protection of the groundwater resource during operation are described below for Hydrogeology.</p> <p>Marsh fritillary No likely significant negative effects on Marsh fritillary are predicted during operation and no mitigation measures are required.</p>	<p>White-clawed crayfish & Freshwater pearl mussel No likely significant residual impact.</p> <p>Marsh whorl snail No likely significant negative residual impact on the Marsh whorl snail, at any geographic scale.</p> <p>Marsh fritillary No likely significant negative residual impact on the Marsh fritillary butterfly, at any geographic scale.</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Birds	<p>Breeding Birds <i>Habitat loss, Habitat Severance/Barrier Effect and Mortality Risk</i></p> <p>Planting of woodland, hedgerow and grassland habitats along the proposed road development as detailed in the landscape drawings (Figures 12.2.01 to 12.2.14) 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.</p> <p>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.</p> <p>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 proposed road development; as shown on Figures 12.2.01 to 12.2.15.</p> <p>Barn owl</p> <p>Sections along the proposed road development will be planted with dense low growing scrub cover (e.g. blackthorn) to discourage Barn owls from foraging near the proposed road development. The planting will be of a density to minimise the lag time between planting and obtaining sufficient ground cover to deter foraging Barn owl.</p> <p>In areas where there is a high probability that Barn owls may regularly attempt to cross the proposed road development (the section of embankment between Ch. 9+600 and Ch. 10+100), lines of closely spaced (approximately 2m centres) trees, greater than 3m in height, will be planted along the top of the embankments of the proposed road development; 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 proposed road development above the road traffic.</p> <p>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 proposed road development.</p> <p>The locations where planting will be used to reduce the risk of Barn owl mortality from road traffic are shown on Figures 8.23.1 to 8.23.14 and on the landscape drawings (Figures 12.2.01 to 12.2.14).</p> <p>The following monitoring measures are proposed:</p> <ul style="list-style-type: none"> • 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 proposed road development will be conducted once per week for a period of two years by a suitably qualified and experienced ornithologist. The proposed road development will be driven at a steady pace in both directions so that all sections and both sides of the route will be surveyed correctly. Where noted, all barn owl mortalities will be assigned to either the “breeding” season (March to July) or “non-breeding” season (August to January). Location details of the casualty will be recorded, including a 10-digit GPS co-ordinate, position on the route (central median, hard shoulder, or verge) and orientation (southbound, northbound, eastbound, and westbound). The age class of the bird will be determined and classed as either “pre-breeding” if first or second calendar year recovered before March, or “adult” if the bird is second calendar year recovered later than March or older. The adjacent habitat feature will be noted. This methodology is in line with that utilised for <i>Barn Owl population status and the extent of road mortalities in relation to the Tralee Bypass</i> (O’Clery et al., 2016); • Monitoring to determine activity and breeding status of all active sites within 5km of the proposed road development over two breeding seasons (March 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). <p>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.</p> <p>Wintering Birds Measures to Protect Wintering Birds during Operation <i>Disturbance/Displacement</i></p> <p>Despite the assessment conclusion that disturbance during operation of the proposed road development is not likely to result in any population level effects on wintering birds, hedgerow planting along the proposed development boundary (at the locations shown on the landscape drawings (Figures 12.2.01 to 12.2.14) will further minimise the potential disturbance to wintering birds from road traffic.</p>	<p>Breeding birds</p> <p>No likely significant residual effect on breeding bird species, at any geographic scale, with the exception of the Peregrine falcon. Due to the likely permanent loss of Lackagh Quarry as a nesting site, the proposed road development is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale.</p> <p>Wintering birds</p> <p>No likely significant residual effect on wintering bird species, at any geographic scale.</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
Amphibians, Reptiles	<p>Measures to Protect Amphibians during Operation</p> <p>Habitat Severance & Barrier Effect</p> <p>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 proposed road development. 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 proposed road development such that the conservation status of amphibian species is not likely to be negatively affected. The locations are described in Table 8.36 of Chapter 8, Biodiversity and shown on Figures 8.23.1 to 8.23.14.</p>	No likely significant residual effect on the Common frog or the Smooth newt, Common lizard, at any geographic scale.
Soils		
Lackagh Tunnel	<p>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 TII (Transport Infrastructure Ireland) maintenance schedule. In the extremely unlikely event that instability within the rock mass is observed additional support measures outlined above Sections Error! Reference source not found. and Error! Reference source not found. of Chapter 9, Soils and Geology, 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.</p> <p>Operation mitigations measures for Lackagh Tunnel are further discussed in Appendix A.7.3.</p> <p>The implementation of the design, construction methodology control measures and mitigations measures results in no other operational phase mitigation measures for avoiding potential direct and indirect impact to the soils and geology environment for the proposed road development.</p>	No likely significant residual impact.
Hydrogeology		
Groundwater Quantity and Quality	<p>During the operational phase of the proposed road development inspection and maintenance will occur to ensure that the infiltration basins continue to operate as intended for the design life of the proposed road development.</p> <p>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.</p> <p>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.</p>	Residual hydrogeological impacts remain for groundwater level drawdown impacts below the location of five Annex I habitats on the Galway Granite Batholith noted above for the construction stage.
Hydrology		
Flood Risk	<p>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.</p> <p>The flood relief mitigation measures to eliminate the flood risk of the proposed road development and reduce the existing flood risk in this area are described above in Table 20.1 for hydrology.</p> <p>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:</p> <ul style="list-style-type: none"> 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. 	<p>The will be no likely significant residual negative hydrological impacts on drainage and general flood risk, water quality, channel morphology or key ecological receptors.</p> <p>As noted above in Table 20.1 under Hydrology, there will be a significant positive residual impact on the N83 Tuam Road flood risk.</p> <p>However negative slight residual flood impacts associated with the N83 flood relief measures noted in Table 20.1 will remain.</p>
Landscape and Visual		
Project-wide Landscape Measures	<p>Measures proposed to mitigate the landscape and visual impacts of the operation stage of the proposed road development are considered under Project-wide Measures and Specific Measures.</p> <p>Project-wide measures are outlined below and shown on Figures 12.4.01 to 12.4.14 of Chapter 12, Landscape and Visual</p> <ul style="list-style-type: none"> 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 proposed road development. The proposed road development 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.

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> ○ Cut slopes shall be finished to even gradients, topsoiled unless otherwise stated in this table or elsewhere in the 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 <ul style="list-style-type: none"> ○ Embankments shall be finished to even gradients, topsoiled unless otherwise stated in this table or elsewhere in the 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 <ul style="list-style-type: none"> ○ 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. <ul style="list-style-type: none"> ○ 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. ● Noise barriers/bunds <ul style="list-style-type: none"> ○ 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. <p style="margin-left: 20px;">* Note: Due to the risk of Ash Dieback (<i>Chalara fraxinea</i>) and until further notice, ash (<i>Fraxinus</i> 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 (<i>Sorbus aucuparia</i>).</p> <ul style="list-style-type: none"> ○ Transparent noise barriers will be used on the River Corrib Bridge ● Plants and planting areas <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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. <p>The above project-wide measures will be applied over the entire proposed road development, depending on the nature of the particular road section. Where feasible landscape measures shall include for the re-connection of existing field boundaries and hedgerows along the proposed road development. Where appropriate trees species as noted above and in Tables 12.8 of Chapter 12, Landscape and Visual, shall be randomly spaced in a visually naturalistic manner within such hedgerows.</p> <p>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</p>	<p>As such, initial operational-stage landscape and visual impacts will continue to be pronounced and negative in the short-term (<i>i.e.</i> pre-establishment stage). With the development of mitigation planting, the significance and severity of landscape and visual impacts will gradually abate over time.</p> <p>Negative visual impact will also continue to arise for residential and other properties located close to or adjoining the boundary of the proposed road development for some time (<i>i.e.</i> post-establishment stage).</p> <p>Therefore, significant or notable residual landscape impacts will continue to arise:</p> <p>Along the edge of Sruthán Na Libeirtí, Bearna</p> <p>On the open elevated landscapes of Ballagh, Ragoon, Letteragh, Barnacranny and Dangan Upper</p> <p>On the recreation sports and amenity landscape of NUIG Sports Campus</p> <p>On the lowland landscape valley of the River Corrib, and the setting of Menlo Castle</p> <p>On the limestone landscape of Menlough and Coolough</p> <p>On the rolling landscape through Castlegar, south of Ballindooley Lough</p> <p>Locations of these significant landscape impacts are provided on Figures 12.4.01 to 12.4.14.</p> <p>Significant or notable residual visual impacts will continue to arise for properties:</p> <p>At the crossing of local roads north and northeast of Bearna (Foraf Maola Road, Troscaigh Road, Ann Gibbons Road, Aille Road)</p> <p>At the crossing of local roads northwest of Galway (Cappagh Road, Ballymoneen Road, Ragoon Road and Letteragh Road)</p> <p>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)</p> <p>On the recreation sports and amenity landscape of NUIG Sports Campus</p> <p>On the lowland landscape valley of the River Corrib, and setting of Menlo Castle</p> <p>At the crossing of Bóthar Nua and Seanbóthar north/northeast of Galway City</p> <p>At the crossing of the N84 Headford Road, at Castlegar, (including crossing of School Road) and at the N83 Tuam Road, northeast of Galway</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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.</p> <p>Proposals will ensure that planting is distributed along the proposed road development 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).</p> <p>Treatments will take into consideration the assessment and recommendations of the mitigation measures described in the Biodiversity section 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.</p> <p>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 road development. Stable rock slopes will be retained as an exposed face for natural colonisation and as a local landscape features.</p> <p>Along the length of the proposed road development, landscape areas within junctions and small areas of severed fields, plots or other property acquired for the construction of the proposed road development 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 road development will assist in the improvement of the longer-term visual character of the proposed road development 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).</p> <p>Certain areas along the length of the proposed road development 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.</p> <p>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.</p> <p>Where used, tree species will be selected from a list of primarily native, naturalised and indigenous species, which will include alder, common ash (<i>subject to planting restrictions at time of works</i>), 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>At Ballybrit/Parkmore, at Racecourse Avenue, Ballybrit Crescent, Monivea Road and Coolagh-Briarhill east of Galway</p>
Specific Landscape Measures	<p>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.</p>	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>Specific mitigation measures are set out on Figures 12.4.01 to 12.4.14 and in Table 12.8 of Chapter 12, Landscape and Visual 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.</p> <p>All of the following specific mitigation measures will be taken account of in the detailed design and implementation of landscape measures:</p> <ul style="list-style-type: none"> • 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 road development • Locations where rock is encountered in cuttings. Such rock faces may be retained as geological features of the corridor of the proposed road development • 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. <p>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>i.e.</i> horizontal to vertical dimension).</p> <p>Landscape Measures also take account of the specific protection and mitigation measures detailed in Chapter 8, Biodiversity. In particular, the measures include:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ 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 road development, which will maximise potential benefit and use ○ dense planting, with trees for improvement of connectivity along the boundary of the proposed road development: ○ west of the crossing of the L1323 Letteragh (Ch. 7+200 – Ch. 7+280) ○ along embankments to either side of the proposed bridge over the River Corrib ○ 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 road development, 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 road development, planting of closely-spaced trees (approx. 2m centres) greater than 3m 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 <p>Table 12.8, Specific Landscape and Visual Mitigation Elements and Treatments is outlined below.</p> <ul style="list-style-type: none"> • 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 12.4.01 to 12.4.14)). <ul style="list-style-type: none"> ○ 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 12.4.01 to 12.4.14)) <ul style="list-style-type: none"> ○ 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. • Stone Wall Boundaries (Stone walls as indicated on Figures 12.4.01 to 12.4.14)) 	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> • 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 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) <ul style="list-style-type: none"> ○ Primarily blackthorn (30%), hawthorn (40%) and holly (10%) hedgerow in west interspersed with other species (20%) such as elder, willow, and those found locally. ○ 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)) <ul style="list-style-type: none"> ○ 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.) <ul style="list-style-type: none"> ○ 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)) <ul style="list-style-type: none"> ○ Wildlife overpass (c.30m wide) will be landscaped to provide for connective habitat across proposed road development. 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 road development. 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.) <ul style="list-style-type: none"> ○ 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): <ul style="list-style-type: none"> ○ 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. 	

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<ul style="list-style-type: none"> ○ 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 Proposed Road Development: Refer to 'CHA' locations on Figures 12.4.01 to 12.4.14). Areas identified for compensatory habitat for mitigation of potential ecological impacts will be as outlined above for biodiversity 	
Archaeology, Architectural and Cultural Heritage		
General	<p>The proposed mitigation measures for the operational phase are detailed below. These measures are proposed to mitigate the indirect impacts of the operational phase of the proposed road development on these features. It is noted that these measures will be carried out during or prior to the construction phase:</p> <ul style="list-style-type: none"> ● Archaeological sites, AH 15, 16, 29, 11, 12, 23 and 26 will be subject to a detailed photographic and written landscape record to preserve their current setting prior to the construction and operation of the proposed road development. This shall be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a 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 proposed road development. This shall be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a TII Project Archaeologist. ● Cultural heritage sites CH 20, 23, 8, 25, 30, 35, 42 and 54 will be subject to a detailed photographic and written landscape record to preserve their current setting prior to the construction of the proposed road development. This shall be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the Department of Culture, Heritage and the Gaeltacht and a TII Project Archaeologist. 	<p>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 proposed road development on the setting of the following sites:</p> <p>AH 15/BH 19 Menlo Castle – post mitigation the operation of the proposed road development will have an indirect moderate negative impact on the castle</p> <p>AH 16/BH 10 Summer House – post mitigation the operation of the proposed road development will have an indirect moderate negative impact on the castle</p>
Agriculture		
Operational Road	<ul style="list-style-type: none"> ● The loss of agricultural land due to the construction of the proposed road development is a permanent loss which cannot be mitigated except through compensation. ● Landowners who lose buildings to the proposed road development 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 proposed road development will be diverted to attenuation ponds before discharging to watercourses or to ground. The drainage design of the proposed road development will intersect existing field drains and carry the drainage water to suitable outfalls. ● 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 proposed road development 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 proposed road development will minimise the visual impact on farms along the route of the proposed road development and will over time improve shelter in affected farms. 	<p>The 41 Significant, 8 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</p>
Material Assets Non Agriculture		
Operational Road	<p>The proposed road development will result in a 20 per cent reduction of the NUIG Sporting Campus at Dangan, due to the encumbrance caused by the viaduct support structures. This will result in the removal of two grass based GAA sized playing pitches.</p> <p>As a consequence, the NUIG Sporting Campus will require a new sporting campus plan and strategy. The provision of a viaduct structure at the NUIG Sporting Campus will provide access to the north and south of the Sporting Campus and the River Corrib during the operational phase, maintaining connectivity and permeability beneath the proposed road development.</p> <p>The current road which provides access to Hewlett Packard and Boston Scientific will become a through road at the operational phase of the proposed road development. The additional traffic will present new severance compared with the Do-Nothing scenario. However, a speed of 50kph will limit speeds and traffic will be generally for local access only.</p> <p>The stable yard and associated facilities for Galway Racecourse will be relocated as shown on Figure 15.4.1 and detailed in Appendix A.15.2 mitigating the operational impacts on the racecourse.</p> <p>Noise barriers will be provided across the length of the proposed road development to mitigate potential increase in noise as detailed in noise and vibration and shown on Figures 17.1.1 to 17.1.15.</p>	<p>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 road development, 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.</p> <p>The residual impact on NUIG 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.</p> <p>There will be a positive residual impact on Galway Racecourse once the mitigation measures have been</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
		constructed with the provision of enhanced access to the premises and a new stable yard.
Air and Climate Change		
Air Quality	As it is predicted that all air quality standards for the protection of human health and vegetation will be complied with, no specific mitigation measures are required.	No likely significant residual impact.
Climate	<p>The <i>Transport Infrastructure Ireland Environmental Impact Assessment of National Road Schemes – A Practical Guide</i> notes that climate change issues are largely outside the scope of an EIAR for individual road schemes as the issues and mitigation measures are the subject of specific policies and strategies set out by government.</p> <p>However, it is anticipated that the proposed road development will assist with the removal of traffic congestion from within Galway City and its environs by transferring existing and future traffic from the existing road network to the new road infrastructure. Therefore, journey times will reduce and journey time certainty will increase for both public transport and private vehicle users. The reduction in traffic congestion will facilitate the reallocation of available road space for cyclists, pedestrians and reconfigure the public transport network. This will result in reducing the number of short commuter journeys by car by facilitating journeys by bicycle/on foot. The positive impact of this modal shift is difficult to quantify in terms of carbon emissions, however, it will help to reduce emissions.</p> <p>Improvements to the Galway bus network have been identified as necessary to better cater for existing and future travel patterns in Galway City. The reallocation of road space for public transport will assist with the delivery of an improved bus network resulting in carbon emission reductions.</p> <p>In addition, the provision of improved public transport, traffic management measures, cycling and walking facilities and the introduction of the ‘Cross-city Link’ by the GTS will encourage a modal shift in line with Smarter Travel - A Sustainable Transport Future, A New Transport Policy for Ireland 2009 – 2020. This shift has the potential to reduce greenhouse gas emissions associated with the proposed road development in the future.</p> <p>CO₂ emissions for the average new car fleet were reduced to 120g/km by 2012 through EU legislation on improvements in vehicle motor technology and by an increased use of biofuels.</p> <p>The National Mitigation Plan outlines a number of existing mitigation measures and future possible mitigation measures under consideration relating to road transport, as follows: Existing:</p> <ul style="list-style-type: none"> • Taxation system where a lesser road tax is paid where CO₂ emissions are within lower bands • Grants provided by Sustainable Energy Authority Ireland (SEAI) to incentivise the purchase of electric vehicles • Deploy natural gas refuelling stations and gas injection facilities • Using intelligent transport systems (ITS) to enhance the efficiency of infrastructure and fuel use in a transport network <p>Under consideration:</p> <ul style="list-style-type: none"> • Further measures to accelerate the take-up of low carbon technologies • Increase in carbon tax on transport fuel • The motor tax and VRT system could be further amended in line with improvements to energy efficiency and emissions reductions in cars and vans to additionally incentivise or maintain the advantages of purchasing of the lowest emitting vehicles • encourage the take-up of alternatively fuelled vehicles, removing or reducing supports or preferential treatment for petrol and diesel fuelled vehicles • Reduce maximum speed limits on motorways to 110km/hr in order to reduce emissions. It is noted that the design speed for the proposed road development at 100km/hr is less than the 120km/hr that usually applies to motorway schemes 	It is expected that potential carbon emissions generated by the proposed road development can be offset by measures outlined in the Galway Transport Strategy, removing congestion in Galway City and measures outlined in the National Mitigation Plan.
Noise and Vibration		
Operational Road	<p>The mitigation measures required to reduce traffic noise levels are specified based on the predicted noise levels for the Design Year of 2039 and noise mitigation is required for 102 properties along the proposed route of the proposed road development for the Design Year.</p> <p>Low Noise Road Surface (LNRS) will be used to reduce noise generated at source.</p> <p>Noise barriers as detailed in Table 17.14 in Chapter 17, Noise and Vibration and Figures 17.1.01 to 17.1.14 will be implemented to reduce noise levels along the propagation path between the source (proposed road development) and the specific receivers (houses, schools, churches etc.). These screens may be constructed as earth bunds, proprietary noise barriers or a combination of both.</p>	No likely significant residual impact.
Human Beings		
Socio-economics	<p>Socio-economics</p> <p>The provision of crossing facilities at the Forá Maola Road, Troscaigh Road, Bearnna to Moycullen Road L1321, Cappagh Road and Ballymoneen Road junctions to facilitate occasional pedestrian and/or cyclist crossings of the proposed road development. Pedestrian crossing facilities are also proposed at the terminus of the N59 Link Road North Junction at the N59</p>	<p>Socio-economics</p> <p>There will be significant positive residual impacts (and in some cases profound) due to improvements in</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
	<p>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.</p> <p>The following specific mitigation measures are proposed to improve journey amenity and minimise severance:</p> <ul style="list-style-type: none"> • Provide pedestrian crossing facilities at junctions with minor roads serving local rural communities • Provide pedestrian crossing facility at Bushypark Junction with N59 Link Road North during construction and operation • Provide pedestrian crossing facilities at N84 Headford Road Junction during construction and operation • 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 both the construction and operational phases <p>The proposed road development will facilitate the full implementation of all of the walking, cycling and public transport measures set out in the GTS. The transference of traffic from the existing N6 through Galway City to the proposed road development 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.</p> <p>Material Assets Non-Agriculture above outlines the proposed mitigation measures for the NUIG Sporting Campus facilities and Galway Racecourse.</p>	<p>journey times and connectivity between locations to the east and west of Galway City.</p> <p>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 proposed road development and by improved access into Galway City.</p> <p>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.</p> <p>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 which will be mitigated by vehicle and pedestrian crossing facilities.</p>
<p>Irish Language</p> <p>Human health</p>	<p>Irish Language</p> <p>Place names shall be cited in accordance with the relevant Place Name Order issued under the Official Languages Act 2003</p> <p>Human health</p> <p>Mitigation measures proposed for the potential air quality, noise, water and soils 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.</p>	<p>Irish Language</p> <p>There will be positive residual impact on the Irish Language once the proposed road development is operational.</p> <p>Human Health</p> <p>Health Protection</p> <p>From a community perspective, overall the implementation of the mitigation measures will result in a residual slightly positive impact.</p> <p>Similarly, from a psychological health point of view overall from community perspective the impacts of the proposed road development are assessed as being positive. Again, 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.</p> <p>Health Improvements</p> <p>There is the potential for a very significant opportunity for health improvements associated with the proposed road development. These include the potential for economic development as well as tourism which in</p>

Source/Scale of Effect	Control and Mitigation	Significant Residual Impacts
		<p>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.</p> <p>Improvement of Access to Services</p> <p>There is potential for significant improvement in access to services. The benefits of this apply to both the residents of Galway City and beyond. The residual impact will be very positive.</p>

20.4 Compensatory Measures

20.4.1 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.

20.4.2 Biodiversity

Where there are significant residual biodiversity impacts as a result of the proposed road development, despite the mitigation measures proposed, compensatory measures are proposed to offset or reduce the predicted impacts³. 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 NIS, the proposed road development will not adversely affect the integrity of any European site.

Habitat loss

The areas of residual alluvial forest [*91E0], Dry heath [4030], Calcareous grassland [6210] and *Molinia* meadow [6410] that will be lost outside of any European site as a result of the proposed road development will be compensated for. In each case the area of each habitat type being provided is greater than that being lost.

The losses of Limestone pavement habitat (outside any European site), a Petrifying spring (outside any European site) and Wet heath habitat [4010] (outside any European site), associated with the proposed road development cannot be directly compensated. However, areas of related habitats will be created to provide a biodiversity gain for both peatland and limestone associated habitats locally. The area of Dry heath habitat being created is c.7.06ha which is greater than the combined losses associated with this habitat type and any Wet heath/*Molinia* meadow mosaics (c.4.78ha). The area of Calcareous grassland habitat being created is c.7.14ha which is greater than the combined losses of Limestone pavement and Calcareous grassland habitat combined (c.1.24ha).

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.8.26**. The areas where compensatory habitats will be created are shown on **Figures 8.23.1 to 8.23.14**.

In compensating for the losses of these habitat types, the proposed road development 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] post compensation measures.

³ “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)

This is summarised below in **Table 20.3**.

There are a number of habitat types of a local biodiversity importance that will be permanently lost as a result of the proposed road development, 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 proposed road development, as follows:

- (Mixed) broadleaved woodland (WD1) - > 2.62ha
- Hedgerows (WL1) - > 7.8km
- Treelines (WL2) - > 4km

In compensating for the losses of these habitat types, the proposed road development 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 proposed road development is likely to have a significant residual negative effect, at the local geographic scale, as a result of the permanent loss of fifteen calcareous spring features (FP1), c.7.81ha of Dry-humid acid grassland (GS3) and c.0.13ha of poor fen and flush habitat (PF2).

Table 20.3: 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
Petrifying springs [*7220]	One Petrifying spring feature	n/a	One Petrifying spring feature	Likely significant residual effect at the county geographic scale
Residual alluvial forest [*91E0]	c.0.1ha	c.0.18ha	None	No likely significant residual effect
Limestone pavement [*8240]	c.0.54ha	n/a	c.0.54ha	Likely significant residual effect at the international geographic scale
Wet heath [4010]	c.2.06ha	n/a	c.2.06ha	Likely significant residual effect at the national geographic scale
Dry heath [4030]	c.1.85ha	c.7.06ha	None	No likely significant residual effect
Wet heath/Dry heath/ <i>Molinia</i> [4010/4030/6410]	c.0.87ha	n/a	c.0.87ha ⁴	Likely significant residual effect at the national geographic scale
Calcareous grassland [6210]	c.0.7ha	c.7.14ha	None	No likely significant residual effect
<i>Molinia</i> meadow [6410]	c.0.28ha	c.0.49ha	None	No likely significant residual effect

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.

⁴ Assumed to be Wet heath, the loss of which cannot be directly compensated for.

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 proposed development 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**). 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

The detailed fit-out 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 and are detailed in **Chapter 8, Biodiversity**.

Artificial roost structures will be screened 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 20.2**, has included ensuring that passage underneath the proposed road development in the vicinity of the roosts has been facilitated by including culverts underneath the proposed road development in locations as close to the roosts as possible.

Retrofitting of Existing Structures

At Ch. 12+960 the detached converted garage (next to PBR183) to the south of the proposed road development 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 proposed road development 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 proposed road development 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) as these have been demonstrated as being successful for these species in Ireland⁵. 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 F of the bat derogation licence application) will be installed at Ch. 3+320 near the roost at PBR241 (ref **Figure 8.21.1**) 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 8.24.1 to 8.24.15**, 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: 4 boxes to be erected on the entrance road into Lackagh Quarry
- Ch. 15+100: 4 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 proposed development 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 proposed road development.

Protection of proposed artificial roosts during construction works

- Newly created roosts and bat boxes within the proposed development 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 proposed development 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 proposed road development will include fast growing shrub species, or fast-

⁵ 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>

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 proposed development boundary, in a state that they are accessible and usable by bats, will be carried out by the Contractor until the completion of the proposed road development 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. 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.

Planting of new hedgerows in fields between the proposed road development and Menlo Castle will improve the foraging resources of this core foraging area. 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 8.6.7.2**). The fields will still be grazed and the hedgerows can be fitted with field gates as required providing 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 proposed road development amounts to approximately 8ha. (refer to **Figure 8.24.7**).

The monitoring programme for bats outlined in **Tables 20.1** and **20.2** above also relates to the compensation measures for bats described in this section.

Summary

The proposed road development, despite the implementation of the mitigation and compensation measures proposed, will have the following likely significant residual effects on biodiversity:

- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.54ha of the priority Annex I habitat Limestone pavement [*8240]
- A likely significant residual effect, at the national geographic scale, for the permanent loss of c.2.93ha of the Annex I habitat Wet heath [4010]⁶
- A likely significant residual effect, at the county geographic scale, for the permanent loss of a Petrifying spring [*7220] feature at Lackagh Quarry
- 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 due to the presence of the proposed road development within their foraging areas
- A likely significant residual effect, at the local geographic scale, for the permanent loss of 15 calcareous springs (FP1) at Lackagh Quarry, c.7.81ha of Dry-humid acid grassland (GS3) and c.0.13ha of Poor fen and flush habitat (PF2)

These significant residual impacts will also affect the following local biodiversity areas:

- 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] 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

⁶ As noted in **Table 8.40**, this is comprised c.2.09ha of Wet heath dominated habitat and an additional c.0.82ha of habitat mosaic which contains Wet heath.

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 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

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 and limestone associated habitats locally. The area of Dry heath habitat being provided is c.7.06ha which is greater than the combined losses of all peatland habitats combined (c.4.78ha). The area of Calcareous grassland habitat being provided is c.7.14ha which is greater than the combined losses of Limestone pavement and Calcareous grassland habitat combined (c.1.24ha).

20.5 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 proposed road development 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 proposed road development will deliver, described above and in **Chapter 3, Need for the Proposed Road Development**.

Numerous alternatives have been considered which are more damaging in terms of property demolitions and other potential environmental impacts in comparison to the proposed road development. 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 NUIG Sporting Campus.

The proposed road development 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 Proposed Road Development** and supports more sustainable travel for the following reasons:

- It will provide a **strategic route** 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
- 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 proposed road development and will provide a link to the Western Region of the standard of a comprehensive route in accordance with TEN-T
- This route provides connections to **essential city links** to better distribute traffic
- 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 N6 Galway City Ring Road is 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 N6 Galway City Ring Road, in the relevant Galway Development Plans.