

mitigating noise, dust and visual impacts associated with construction activities, I consider it to be a suitable location for the primary compound. The other twelve Site Compounds are generally well distributed along the PRD alignment in close proximity to major structure locations or areas of extensive cut or fill.

10.10.11. Additional rock crushing plants will be located at a number of Site Compounds in proximity to areas where extensive cut is required to minimise haulage distances for excavated material and a mobile crushing plant may also be utilised. A number of additional concrete batching plants will also be installed at Site Compounds.

10.10.12. A number of parties in the Twomileditch, Castlegar area objected to the proposed construction site compound SC 14/01 due to its proximity to their houses and the sloping nature of the site which they contend will require substantial earthworks to level. The applicant's response to this issue was that separate compounds will be located on the lower and higher levels of this field, which is adjacent to the N83 Tuam Road and that, therefore, there is no requirement to excavate/redeposit material in this area to create the compound. This compound is immediately adjacent to the proposed N83 Tuam Road Junction and I consider it to be suitable location in the interests of minimising haulage distances. Measures to address noise and dust and protect residential amenity are considered in the CEMP and assessed elsewhere in this report.

10.10.13. A submission (Ref. 98) was made on 30th October 2020 by Julian Keenan of Trafficwise on behalf of Professor and Dr Kerin, residents of Ard an Locha regarding construction and traffic issues. The applicant subsequently submitted a response document entitled 'Response to Submission on behalf of Prof. Michael and Dr Annette Kerin to Oral Hearing' (Ref. 103). This was followed by a further response from Mr Keenan on 4th November 2020 and questioning by Mr Michael O'Donnell, representing the Kerin family.

10.10.14. Mr Keenan contends that the applicant has underestimated the excavation volumes in the vicinity of the Kerin's property, particularly with respect to rock, and thus underestimated construction traffic and associated impacts. The applicant disputes Mr Keenan's analysis. Ms Fleming, on behalf of the applicant and responding to questioning by Mr O'Donnell, stated that she did not accept Mr

Keenan's methodology contending that it was very basic, compared to the 3-D modelling undertaken by the applicant.

- 10.10.15. Having reviewed the information provided by both sides, and noting that the applicant's assessment is based on 3-D modelling data, rather than the more simplistic assessment undertaken by Mr Keenan (which is understandable given his lack of access to the model), I consider that there is no reasonable basis for believing that the applicant's figures for excavation volumes are materially inaccurate or underestimated.
- 10.10.16. With regard to Mr Keenan's comparison of the proposed deep cutting at the Letteragh Junction to a commercial quarry, I consider that while the processes undertaken are very similar, the two are not equivalent. The proposed cutting is a temporary activity that will take place over a limited period of time, unlike a quarry where excavations will be ongoing for decades in most cases. Construction in a built-up area may result in temporary impacts that are acceptable on a time limited basis but which would not be acceptable on a long-term basis.
- 10.10.17. The proposed MDAs and treatment of excavated materials are addressed in more detail below and in the Land and Soils section 11.8.

Construction Traffic and Haul Routes

- 10.10.18. A number of parties raised issues with regard to construction traffic, haul routes and the impacts associated with same on residential amenity, road safety and environmental matters such as air, dust and noise pollution.
- 10.10.19. A Construction Traffic Management Plan (CTMP) is contained within the Draft Construction Environmental Management Plan (CEMP) included in Appendix A.7.5 of the EIAR, while the potential haul routes identified across the PRD are identified in Table 7.4 of the EIAR, and illustrated in Figures 7.001 and 7.002, and in more detail in Figures 7.101-7.124.
- 10.10.20. I note that the CTMP, as with the overall CEMP, is a draft or 'live' document which will be finalised by the contractor when appointed. While it could be argued that this creates a degree of uncertainty, it is appropriate in my opinion that the contractor would input to the finalisation of construction management protocols and procedures, based on their experience and detailed design considerations. The Schedule of Environmental Commitments includes a number of commitments to

ensure that the updated CEMP is consistent with the version before the Board and that it is appropriately enforced, including:

- Item 1.1: Contract documents will include a requirement for the Contractor to update and finalise the CEMP for the PRD prior to construction once appointed and to implement and maintain it during the construction phase.
- Item 1.2: The final SoEC will be included in the CEMP. The CEMP will detail implementation methodologies for all environmental commitments.
- Item 1.3: There will be a contract management team appointed by the client on site for the duration of the construction phase. The team will supervise the construction of the works including monitoring the Contractor's performance to ensure that the proposed construction phase environmental commitments are implemented and that construction impacts and nuisance are minimised.
- Item 1.19: All project staff and material suppliers will be required to adhere to the CTMP. As outlined within the CTMP, the Contractor shall agree and implement monitoring measures to confirm the effectiveness of the CTMP and compliance will be monitored by the resident engineer on behalf of the client. Regular inspections/spot checks will also be carried out to ensure that all project staff and material supplies follow the agreed measures adopted in the CTMP.

10.10.21. The draft CTMP includes requirements that will be placed on the contractor in relation to site access/egress, traffic signage, speed limits, delivery timings, road and vehicle cleaning, road condition monitoring and road closures. It also addresses emergency procedures during the construction phase.

10.10.22. As noted above, the haul routes are identified in Table 7.4 of the EIAR, together with an overview of their condition, while the increase in HGV percentage in each construction zone is set out in Table 7.6. The applicant has taken a conservative approach to construction traffic since, as the mainline progresses, it will be used as a major haul route.

10.10.23. With regard to the impact of heavily laden construction traffic on existing roads, I note that pre and post-construction structural condition surveys are proposed for the haul routes, with monitoring for deterioration throughout the

construction phase. This commitment is contained within both the SoEC (Item 1.18) and the CEMP.

- 10.10.24. A number of residents of The Heath, a residential estate located off Circular Road, raised concerns in relation to the proposed acquisition of their internal access road and its use by construction traffic.
- 10.10.25. The acquisition issue is addressed in the CPO Section of this report. With regard to construction traffic, I note that there is no access to the PRD mainline construction site from Circular Road or from The Heath. The only construction traffic that will enter The Heath will be the traffic required to construct a proposed 4m wide access road serving severed lands. These works will generate c. 250 truck movements over a 4-week period and given this short duration and the commitments regarding covering of trucks, wheel washing etc. I do not consider that construction traffic will significantly impact residents of The Heath.
- 10.10.26. A number of parties living in the vicinity of Lackagh Quarry, including Ms Linda Rabbitte and Mr Patrick McDonagh, expressed concern about pedestrian safety and access to a local greenway/boithrín, due to construction traffic accessing Lackagh Quarry. The applicant made an undertaking at the oral hearing to provide a pedestrian crossing at the entrance to Lackagh Quarry prior to the commencement of construction and to restrict speed on the access road to the site compound to 15km/hr. This is included as Item 18.15 in the final version of the Schedule of Environmental Commitments submitted at the oral hearing and I consider that it will improve pedestrian safety at what will be a busy access road during the construction phase.
- 10.10.27. Two submissions on behalf of the residents of Racecourse Avenue, to the north of the proposed Galway Racecourse Tunnel, raised concerns regarding the use of this road by construction traffic. I note that this road is identified as a restricted access Haul Route HR 15/02, and that it will be used for delivery of materials only and not for hauling excavated materials. I consider that this restricted use, together with the CEMP measures for mitigating construction impacts will be sufficient to ensure that construction of the PRD does not have an unacceptable impact on Racecourse Avenue.

10.10.28. With regard to construction phase road closures and diversions, these are detailed in Section 7.4.5 of the EIAR. Two locations are identified where temporary road diversions will be put in place in order to construct bridge structures. These are at Aille Road L5384 (Ch. 3+300) and School Road, Castlegar L2134 (Ch. 13+150). Temporary night-time closure of existing roads may also be required where overbridges are to be constructed (e.g. at Ragoon Road, Letteragh Road, N59 Moycullen Road, Menlo Castle Bóithrín, Bóthar Nua, An Seanbóthar, N84 Headford Road, N83 Tuam Road, Briarhill Business Park Road and R339 Monivea Road). These closures will be of limited duration but given the potential impact on local residents I consider it important that a robust public communications strategy is put in place. An outline of such a strategy is set out in Section 13 of the CEMP, and the applicant states that the final strategy will be put in place by the contractor. I note that it will include complaints management procedures as well as procedures to inform people who may be directly affected by particularly disruptive construction activities (e.g. blasting, demolition, road closures and diversions, pile driving etc.)

10.10.29. In addition to the temporary road diversions/closures, two permanent road closures are proposed: the Ann Gibbons Road L13215 (Ch. 2+500) in Troscaigh will be severed by the PRD and a permanent diversion for local traffic will be required via the existing Bearna to Moycullen Road L1321; and the existing link road from the Western Distributor Road Roundabout at Gort na Bró to the Knocknacarra Shopping Centre will be closed and replaced with a new link road connecting to the Gort na Bró Road. While these road closures may inconvenience some road users, I am satisfied that the alternative travel arrangements are acceptable.

10.10.30. With regard to access arrangements along the PRD route, I note that the applicant has committed to maintaining access to all existing residential areas, business premises and public facilities during the construction phase.

Material Deposition Areas and Lackagh Quarry

10.10.31. The applicant intends to minimise the importation of material from outside the site by reusing materials arising within the site area to the greatest extent possible. Where surplus materials arise which cannot be incorporated into the construction fill activities, it is proposed that it will be placed in a series of material deposition areas

(MDAs) at various locations along the route of the PRD which will significantly reduce the deposition of material off-site.

- 10.10.32. Approximately 366,000m³ of surplus material will be generated, comprising c. 76,000m³ of peat and c. 290,000m³ of U1 non-hazardous material. This U1 material includes topsoil, made ground, unsuitable rock and clay, logs and stumps etc. This equates to a total volume of excess materials of c. 476,000m³ when a bulking factor is applied (i.e. 1m³ of material in the ground may be greater than 1 m³ when excavated and placed elsewhere).
- 10.10.33. The locations of the MDAs are illustrated in Figures 7.301 and 7.302, and they are listed in Table 11.27 of the EIAR, together with their area and approximate capacity. The Board should note that the EIAR incorrectly identifies 40 MDAs. A revised version of Table 11.27 was included in the Corrigenda presented at the oral hearing. The applicant clarified that 32 No. MDAs are proposed and the capacity of a number of the MDAs was altered. One of the MDAs was also omitted in error from Figure 7.301 and an updated version of this drawing was submitted with the Corrigenda.
- 10.10.34. There was much discussion at the oral hearing in relation to the proposed MDAs in Lackagh Quarry. This included submissions and questions by Dermot Flanagan SC and Senan Clandillon representing McHugh Property Holdings (19th October and 29th October 2020) and questions by the Board's consultant Hydrogeologist and Ecologist.
- 10.10.35. Mr Flanagan's clients do not object to the PRD in principle, but are seeking to minimise the impacts on their landholding, either through a reduction in the extent of acquisition or through temporary rather than permanent acquisition, where possible.
- 10.10.36. It is proposed that Lackagh Quarry will be utilised as the main construction compound during the construction phase of the PRD. As outlined above, having regard to the characteristics of the quarry, I consider it to be a suitable location for the main construction compound.
- 10.10.37. Similarly, given the volumes of excess material that require a deposition site, and the primarily defunct void that is Lackagh Quarry, I consider that it is, in principle, a suitable location for material deposition. Quarrying activities at the site have been ceased for a number of years, leaving behind potentially unstable rock

faces and a secondary purpose of the MDAs within the quarry is to provide stability to these existing blast-damaged rock faces. Parts of the existing quarry void is currently subject to groundwater flooding and there is some evidence of antisocial behaviour on the site, such as graffiti etc. The judicious use of part of the quarry for material deposition and subsequent habitat creation and active use of the site for the PRD and the associated tunnel operation building have the potential to result in positive impacts for the local environment, in my opinion.

10.10.38. In support of the proposed use of Lackagh Quarry, the applicant notes the “Waste Action Plan for a Circular Economy” published during the course of the oral hearing, which highlights that improvements in waste management practices can offer many opportunities in terms of reduced environmental and financial costs to the industry and society. The applicant contends that the deposition in Lackagh Quarry is consistent with the objectives of this Plan.

10.10.39. The proposed arrangement and design of the MDAs within Lackagh Quarry have been modified over the course of the application. The information initially submitted by the applicant with regard to the proposed final layout for Lackagh Quarry was insufficiently detailed and unclear. This issue formed part of the Request for Further Information, and Appendix A.1.11 of the applicant’s RFI Response provides a significantly greater level of detail of the proposed final layout of the quarry and also provides a deposition assessment for the quarry and modifications to the MDA layouts and capacity. The 3-D modelling images and cross-sections contained in the report are particularly instructive in understanding the final layout of the quarry. Annex 2 of Appendix A.1.11 is a ‘Material Deposition Areas - Baseline Report’, which provides updated details of all of the MDAs, their capacity and design. I note that the total allowable capacity of all MDAs is 806,700m³. Taking various errors into account, as corrected in the corrigenda, the total spare capacity in the MDAs is c. 26%. The applicant contends that this level of spare capacity within the MDAs is appropriate based on their experience from previous construction projects. I would tend to agree that this is a reasonable level of ‘headroom’, without overprovision of MDAs.

10.10.40. I refer the Board to the submissions made by Mr Flanagan (Ref. 82) and Mr Clandillon (Ref. 82A) and the document submitted by the applicant at the oral hearing entitled ‘Response to Queries raised in Module 2 of the N6 Galway City Ring

Road in respect of Lackagh Quarry Material Deposition Areas' (Ref. 76). This document clarifies the applicant's proposals with regard to the MDAs in Lackagh Quarry and includes a Corrigenda Appendix correcting various errors in Appendix A.1.11 of the RFI Response.

- 10.10.41. It is proposed to place approximately half of the total peat deposition material in Lackagh Quarry, with the remainder placed in certain specified MDAs (see. Table 3.1 in Appendix A.1.11). On foot of the remodelling exercise undertaken by the applicant following engagement with the quarry owners, MDAs DA24, DA27 and DA28 were reshaped, DA 25 was created and DA 23 (southernmost MDA) was removed, enabling the return of c. 3.01 ha of land post-construction to the landowner.
- 10.10.42. The applicant contends that DA 24 and DA 25 are critical MDAs for the purposes of the safe and sustainable deposition of materials arising and, in particular, the peat material. Of the 3 no. MDAs containing peat the largest is DA24 where 37,000m³ is proposed to be deposited. In order to deposit that quantity of peat the applicant contends that 67,000m³ of U1 material is required to be placed in DA 24, so as to ensure upper shelf stability, to stabilise the quarry face and to allow mixing/binding of peat within DA 24.
- 10.10.43. Mr Flanagan stated that his client had no difficulty with DA28 (to the north of the PRD mainline) or the proposed attenuation ponds within the quarry but contended that the other MDAs within the quarry were excessive. Mr Clandillon, in his submission, set out alternative geometries for the MDAs, making the argument that DA28 alone could cater for most or all of the deposition requirement or that DA27 and DA28 together would be sufficient, allowing Plot 583a.210 to be returned to the landowner. The applicant's response was that the capacity of DA28 was maxed out and that the size and design of the MDAs was driven by the peat placement and storage criteria.
- 10.10.44. There was much discussion at the oral hearing regarding the design of the MDAs within the quarry and the proposals put forward by Mr Clandillon. However, noting the multi-purpose nature of these MDAs, which provide a deposition site, a rock face stabilisation solution, and a basis upon which habitats can be created, I consider that the applicant has provided sufficient justification for the scale, location,

design and capacity of the MDAs. Noting that a considerable volume of peat will be placed in the quarry, I consider the contained nature of the void to be suitable for such material and, given the characteristics of peat, it is appropriate that a degree of caution and a suitably conservative design is utilised, rather than seeking to maximise the volume of peat in more constrained parts of the quarry. The applicant has engaged with the landowner and reduced the permanent landtake by redesigning the MDAs and I consider that the revised layout is acceptable.

10.10.45. With regard to the proposal put forward by Mr Flanagan that the calcareous grassland area to be created within the quarry be made available for public use as an amenity area, I do not consider that this would be appropriate or warranted. The habitats are being created for ecological mitigation and compensatory reasons and given the scale of the PRD and its impacts on a wide variety of habitats, I consider that such replacement habitats are a critical element of the scheme. Having regard to the nature and characteristics of Lackagh quarry and the presence of the proposed tunnel operation building and the oversize vehicle road within the quarry, I do not consider it appropriate that general public access to this area be encouraged. There are many more suitable areas in the vicinity for amenity uses.

10.10.46. Other issues at Lackagh Quarry, such as biodiversity and hydrogeological issues, are addressed elsewhere in this report.

Galway Racecourse Tunnel

10.10.47. Submissions on behalf of Galway Racecourse Committee (GRC) were made at various stages in the oral hearing, with the substantive submissions made on 14th October 2020 by Dermot Flanagan SC accompanied by Peter Kingston (Indecon Economic Consultants), Senan Clandillon (Engineer), and Pamela Harty (MKO). Mr Kingston presented a document (Ref. 75) outlining the importance of the racecourse to the economy of Galway and the economic impacts of a once-off closure of the summer race meeting. Ms Harty presented a document (Ref. 75A) outlining the policy support that the racecourse benefits from.

10.10.48. Mr Flanagan made a legal submission (Ref. 75C) outlining various legal provisions and case law relating to EIA and CPO. In particular, he drew attention to the need for conditions to be sufficiently clear as to avoid any doubt, and to the need for monitoring. These issues are stated to be of considerable concern to the GRC in

the context of the construction proposals for the tunnel, stables and the CEMP. Mr Flanagan stated that the GRC agreed with the applicant's position with regard to the acquisition of the Brooks site, where the proposed replacement stables are to be located. He stated that the GRC refers to and relies upon the statement made in Section 15.5.3 of the EIAR that "Galway Racecourse will continue to operate and function to a level of service as is the current situation" and in this regard there can be no ambivalence or uncertainty in the development consent. He summed up the position of his client as requiring 'racing certainty' on the construction process.

- 10.10.49. Mr Clandillon, in his submission (Ref. 75B), sought clarification regarding certain provisions of the EIAR and again identified the need for certainty and enforceability of conditions/commitments.
- 10.10.50. The economic and social importance of the Racecourse to the city, county and region is recognised by the applicant, and indeed is reflected in the extensive mitigation proposed in respect of this property and, in particular, the proposed Racecourse Tunnel and the temporary and permanent replacement stables.
- 10.10.51. Mr Flanagan's concerns outlined at the hearing regarding the need for certainty and no gaps was founded upon the currently unknown nature of the construction contracting and procurement process and the concern that a contractor on a 'design-and-build' contract may seek to value engineer aspects of the PRD or otherwise deviate from the commitments made in the EIAR and associated documents.
- 10.10.52. The Galway Racecourse Tunnel Constructability Report, which was included as Appendix A.7.4 of the EIAR, outlines the construction methodology and sequencing for the tunnel and other PRD works affecting the Racecourse in considerable detail. The tunnel is a c. 240m long cut-and-cover tunnel comprising a twin-tube reinforced concrete structure which will either be precast or cast in-situ. Excavation for the tunnel will be up 11.3m in depth, requiring the excavation of c. 25,000m³ of rock by means of blasting and mechanical excavation. The location of the tunnel segments within rock will allow for a steeper gradient in the cutting, minimising the width of excavation. The report notes that karst features may be encountered and will be evaluated and treated in accordance with the protocol set out in the CEMP. Dewatering will be required to construct the tunnel and

waterproofing systems will be utilised on the tunnel structure to prevent water ingress.

10.10.53. Other construction phase impacts on the racecourse include the loss of wells due to dewatering of the bedrock aquifer. It is proposed to replace these wells and monitor their quality and yield prior to construction.

10.10.54. Vibration and noise impacts will be monitored and mitigated in accordance with the provisions of the CEMP.

10.10.55. A very detailed construction programme for the works affecting the racecourse over the three year construction phase is set out in Section 3.2 of the report, with a series of associated sequencing drawings included as an Appendix. The programme is informed by a number of criteria set out in Section 3.1 of the report which seek to avoid impacts on the operation of the Racecourse. The programme clearly identifies all works, including both enabling works and construction works, and the time periods associated with each aspect of the development. In particular, I note that the applicant has outlined arrangements to be put in place during each year of construction to ensure that the Summer Festival can proceed and that no construction will occur during this period.

10.10.56. I consider that the construction programme is sufficiently detailed as to avoid any significant ambiguity or uncertainty around impacts on the racecourse and its ongoing operation. With regard to the potential for 'value engineering' or design-and-build contracts to undermine or contradict the commitments made, I note that Item 9.11 in the Schedule of Environmental Commitments states that "construction of structures will be completed in accordance with the CEMP in Appendix A.7.5. The construction of the [...] Galway Racecourse Tunnel will meet the requirements of the Galway Racecourse Tunnel Constructability Report Appendix A.7.4. 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".

10.10.57. I also note the commitments in the SoEC that "Galway County Council will continue to liaise with Galway Race Committee in relation to the implementation of any approval granted in so far as it relates to Galway Racecourse" (Item 14.15) and

that the applicant has also committed to employing an equine expert or veterinary practitioner for the duration of the construction contract (Item 14.13).

10.10.58. While the construction of the Racecourse Tunnel and the other works on the racecourse lands clearly have the potential to adversely affect the operation of the racecourse, I consider that the applicant has set out a broad range of mitigation measures relating specifically to the racecourse and more general construction mitigation measures which will be effective in minimising impacts.

10.10.59. With regard to the proposed replacement stables, I consider that the temporary stables are adequate and that the proposed permanent stables are of an extremely high quality which will enhance the amenities and facilities at the racecourse. With regard to the appropriate standards for the stables, I note the additional commitment added by the applicant that “the design and construction of the temporary stables and permanent stables will be carried out in consultation with the Irish Horseracing Regulatory Board (Horse Racing Ireland HRI). The British Horse Racing Association guidelines will be used as a benchmark in the design in the absence of any future specific HRI guidelines”. I consider that these commitments will ensure that the stables are at least of equal quality to the existing stables, or more likely of considerably greater quality.

10.10.60. Jarlath Fitzsimons SC, on behalf of the applicant, responding to Mr Flanagan noted that they were *ad idem* on many matters and that the applicant was acutely aware of the importance of the racecourse. Mr Fitzsimons referred to the information submitted, contending that was in excess of EIA requirements, contained a full suite of information, and that the degree of consultation undertaken and the lack of ambiguity was clear. With regard to the issue of enforceability, Mr Fitzsimons contended that the applicant would be bound by mitigation and monitoring obligations under the EIA Directive, and the provisions of section 51C and 51D of the Roads Act, as amended, which make it compulsory for the developer to comply with environmental conditions attached to a consent by the Board and which assign an enforcement function to TII “to take all reasonable steps to ensure that the developer complies with the modifications and conditions specified in the notification”. Mr Fitzsimons also noted the standard ‘Condition No. 1’ requiring development to be undertaken in accordance with the plans and particulars submitted and drew the

Board's attention to the judgement in the case of Lanigan v Tipperary County Council where the standard condition was deemed to be an enforceable condition.

10.10.61. Mr Fitzsimons went on to assert that it would be unlawful for the Board to impose a condition making the GRC a party required to approve matters and that such a condition would be straying out of planning law and into private contract law. He stated that measures identified in respect of Galway Racecourse would be implemented and there was neither a requirement nor an ability to interpose the GRC into such matters.

10.10.62. I would generally agree with the position set out by Mr Fitzsimons and do not consider it appropriate that a third party would have decision making or veto power over the fine-grained details of the construction programme. It must be noted, however, that Mr Flanagan stated that the GRC was not trying to interpose themselves into contractual matters and that he would welcome the standard 'Condition No. 1'.

10.10.63. In conclusion, I am satisfied that the construction of the PRD within the racecourse lands, and including the construction of the Racecourse Tunnel, its associated portals and the replacement stables and horsebox parking has been fully and adequately considered by the applicant. I am also satisfied that the likely impacts of the construction phase, including the potentially disruptive tunnelling works, have been identified, and that a comprehensive suite of mitigation measures and construction management and monitoring proposals are incorporated within the scheme before the Board. In particular, I note the commitment made by the applicant to continue to liaise with the GRC in relation to the interface of the PRD and the racecourse.

10.10.64. I am satisfied that the PRD, if approved, can be constructed without a significant impact or interruption to the continued successful operation of the racecourse, and I further consider that the racecourse will benefit from the PRD as a result of the proposed provision of high-quality replacement stables and improved access arrangements.

Waste Management

10.10.65. Surplus materials will be generated as a result of demolition, excavation, construction and operation of the PRD. During demolition works, an estimated

47,400 tonnes of surplus demolition materials will be generated. During excavation works, the majority of the excavated material will be reused within the PRD or placed in the MDAs as addressed above, while c. 15,200 tonnes (7,600m³) of excavated material that is classified as hazardous material (Unacceptable Category) will require disposal. With regard to general construction waste (e.g. scrap timber and steel, machinery oils and chemical cleaning solutions) the applicant refers to BRE benchmark waste generation data which found a rate of 26.07m³ waste / £100k for civil engineering projects. Based on the estimated construction cost for the PRD, the applicant estimates that 25,300 tonnes of construction waste will be generated. It is clearly difficult to accurately estimate likely quantities of general construction waste in advance, but I consider that the use of BRE guidance is a reasonable approach for estimation purposes.

10.10.66. The applicant states that all wastes will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996-2016. By only using licenced/permitted facilities it is contended that any environmental emissions (noise, dust, water) will be managed at the destination site and will, therefore, be the legal responsibility of the owner/operator of the destination site. The applicant considers that they can, therefore, be satisfied that the off-site waste management aspect of the PRD is legally compliant with environmental and waste management legislation.

10.10.67. A Construction and Demolition Waste Management Plan (CDWMP) is included in Section 7 of the Draft CEMP, included as Appendix A.7.5 of the EIAR. I am satisfied that this plan, which includes measures to reduce waste arising, to re-use the majority of excavated materials arising, and to dispose of unsuitable wastes to suitably licensed facilities, meets the requirements of the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (Department of Environment, Heritage & Local Government. 2006) and the TII Guidelines for the Management of Waste from National Road Construction Projects. I also consider that it is consistent with applicable waste policy provisions.

10.10.68. I note that a series of commitments are made in the Schedule of Environmental Commitments (Items 7.1 – 7.10 refer) that are consistent with the submitted CDWMP. Subject to compliance with these commitments, I consider that construction and demolition waste arisings will be appropriately managed.

Invasive Species Management

- 10.10.69. Construction of the PRD will entail site clearance and earthworks in a wide variety of locations, including in proximity to various watercourses, and will also entail the movement of very substantial quantities of materials, as outlined above. I, therefore, consider that the management of non-native invasive species during the construction phase requires consideration.
- 10.10.70. Ecological surveys undertaken for the EIAR recorded 13 locations of invasive plant species at various locations along the route of the PRD, including Himalayan knotweed (*Persicaria wallichii*), Japanese knotweed (*Fallopia japonica*) and Rhododendron (*Rhododendron ponticum*). The locations where the plant species were found is shown in EIAR Figures 8.15.1 to 8.15.14.
- 10.10.71. A Non-native Invasive Species Management Plan is included in Section 9 of the Draft CEMP, included as Appendix A.7.5 of the EIAR. The Management Plan is stated as having been developed with reference to the following guidelines:
- Best Practice Management Guidelines Japanese knotweed *Fallopia japonica* (2008) - prepared for NIEA and NPWS as part of Invasive Species Ireland.
 - NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008).
 - Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency.
- 10.72. The measures included in the Management Plan include a re-survey prior to the commencement of construction, advance treatments, fencing-off of infested areas, and chemical and/or physical treatment during construction, inspection of vehicles etc. The Management Plan sets out the various chemical and physical treatment options, in accordance with the abovementioned guidelines.
- 10.10.73. As well as the risk of invasive species present in the vicinity of the PRD being spread by construction works, there is also a risk associated with the introduction of new or additional invasive species in topsoil or fill material brought into the site. The applicant has undertaken to inspect this imported material using British Standard BS3882:2015 Specification for Topsoil.

10.10.74. A number of items within the Schedule of Environmental Commitments also set out commitments regarding the control of invasive species during the construction phase (Items 8.2, 8.11 – 8.15 refer). With regard to ongoing control of invasive species in the operational phase, I note Item 7.10 in the SoEC, which states that:

“Following construction, the Non-native Invasive Species Management Plan will be updated for the operational phase, taking into account the results of the detailed construction non-native invasive species management plan and operational maintenance requirements. Follow on treatment methods such as chemical treatment may be employed if specified in the requirements for ongoing control.”

10.10.75. Given the difficulties in eradicating invasive species, I consider this operational phase management to be an important and welcome aspect of the applicant’s strategy. I am satisfied that the implementation of the above measures will minimise the risk of invasive species being spread within the site or to lands outside the site during the construction and operational phases. The potential Biodiversity issues associated with invasive species are addressed in the Biodiversity and Appropriate Assessment sections of this Report.

Pest Control

10.10.76. The HSE’s submission to the RFI Response queried the lack of information provided by the applicant regarding pest control measures during the construction phase. They noted that demolition of buildings which are infested by rodents can result in dispersal of these rodents into the surrounding area and that the control of pests on site is essential in the interest of the protection of public health.

10.10.77. The applicant responded to this issue in Section 4.15.21 of their Main Brief of Evidence at the oral hearing. They stated that a Pest Control Plan (PCP) will be incorporated into the CEMP, in accordance with guidance provided by the Environmental Health Service and the HSE. The PCP is stated to be consistent with the environmental commitments contained within the EIAR and NIS, including the CEMP. The PCP outlined by the applicant includes a site survey by a professional pest control company at least four weeks prior to any demolition works commencing. Where rodent infestations are identified, appropriate treatments will be first agreed

with the Project Ecologist and implemented prior to demolition. Pest monitoring shall also be undertaken on site during demolition/construction works.

10.10.78. Construction site management measures to control pests include removal of all refuse from site, filling or removal of old drains and other disused pipes and backfilling of old foundations, cesspits, cavities, etc. with suitable hardcore and a concrete cover. During the laying of new drains, the sewers, open pipe ends and manholes will be protected against entry by rodents when work is not in progress. Surface water pipes discharging into a watercourse will also be fitted with an anti-flood flap valve at the outlet.

10.10.79. It is stated that a good standard of hygiene will be maintained on site during the course of construction, with waste food, empty food tins, and other waste which might attract rodents stored in bins with tight fitting lids. Accumulations of old timber, bricks and debris will be cleared away as quickly as is possible, and stocks of building material will be neatly stored.

10.10.80. The updated Schedule of Environmental Commitments submitted before the close of the oral hearing included Item 1.22, which states that:

“A Pest Control Plan (PCP) has been developed to implement pest control measures during construction of the proposed road development and this will be incorporated into the CEMP. A summary of the measures included in the PCP are outlined in the Statement of Evidence – Responses to Engineering, Need for the Project, Alternatives Considered and Material Assets Non-Agriculture Objection/Submissions as read into the record on day one of the oral hearing on 18 February 2020.”

10.10.81. The HSE did not appear at the oral hearing and, therefore, it is not clear if they are satisfied with the applicant’s proposed PCP. However, noting that the outlined measures are consistent with the recommended measures set out in the HSE submission and with published HSE guidance¹³, I consider that the applicant has adequately addressed the issue of pest control and, subject to compliance with the PCP, I do not consider that any significant issues with regard to pest infestations or dispersals are likely to occur.

¹³ ‘Rodent Control for Construction Industry’ HSE Environmental Health.

10.11. Consultations

10.11.1. The issue of consultations was raised by many objectors over the course of the project. A common theme was that there was inadequate or selective consultation and insufficient consultation particularly with respect to those people who will have their houses compulsorily acquired should the Board approve the subject proposal.

10.11.2. I consider that it is evident with respect to the public consultation reports included as part of the EIAR (Appendix A1.1, A1.2 and A1.3) submitted by the applicant that there were a number of formal events, public displays, advertisements, display boards as well as brochures. In addition to these public information sessions, the applicant noted that over 950 meetings with landowners have taken place since May 2014. A project website was also created, and a project office, located in Ballybrit, was set up for consultation purposes, with a dedicated land liaison officer in place to answer queries or concerns. I also note that the project manager appears to have given generously of her time and responded to individual queries, which I consider constitutes a high level of service. This was evident at the oral hearing, in particular, whereby it was clear that she knew many of the parties personally having engaged with them over the course of the process.

10.11.3. The project has been long in planning. During that time there have been many rounds of consultation with members of the public and other stakeholders. I consider that there is evidence that the applicant attempted to respond in a meaningful way to views expressed and that this approach continued during the planning application process.

10.11.4. I am of the view that the people losing their homes may have been better served by being treated as a separate group albeit I accept the CPO process with respect to compensation is outside the remit of the Board. This is addressed further in section 13 below. Mr Murphy referred to a 'Town Hall' meeting whereby the N6 Action Group asked the applicant to attend. Ms McCarthy explained that in her opinion 'Town Hall' type meetings do not work but restated her availability during the project.

10.11.5. I am of the view that the consultation undertaken was meaningful and thorough. I note that the HSE commended the level of consultation undertaken during the course of the project. Furthermore, having regard to the duration of the oral hearing and opportunities afforded to observers and objectors to make a submission(s) and

question the applicant, I am satisfied that the various parties were provided many opportunities for full participation.

10.11.6. In conclusion, I am satisfied that public consultation in the process, together with the provisions made for written and oral submissions to be made to the Board, whereby each individual/group who expressed an interest in making a submission was facilitated during the course of the hearing, is in accordance with the statutory obligations and with the requirements of the Aarhus Convention.

10.12. Implications of Covid-19 Pandemic for Proposed Development

10.12.1. At the oral hearing, a number of parties (e.g. Gerald Lawless, Galway N6 Action Group, Senator O'Reilly) contended that the Covid-19 Pandemic had undermined the rationale for the proposed development, due primarily to the increased level of working from home, virtual meetings, reduced level of commuting etc. I also note that, subsequent to the close of the oral hearing, the Rural Development Policy 2021-2025 – Our Rural Future was published by the Department of Rural and Community Development. This Policy document seeks to support rural development through a range of measures, including an increased level of remote working.

10.12.2. In response to this issue, the applicant presented a document at the oral hearing on the 19th October 2020, entitled 'Response to Queries raised in Module 2 of the N6 Galway City Ring Road in respect of Traffic and Climate', Submission no.78. Section 8 of that document, and the associated Appendix B, provide a 'Covid-19 Sensitivity Test'.

10.12.3. As the oral hearing had to adjourn for an extended period as a result of the Pandemic and was completed remotely, via Microsoft Teams, this is clearly a pertinent issue. The Pandemic is ongoing at the time of writing this report and I would, therefore, agree with the applicant that the likely medium and long-term effects on future travel behaviour are difficult to accurately predict at this stage.

10.12.4. The Sensitivity Test seeks to predict a potential likely outcome based on identifying those people whose working circumstances allow them to work remotely and estimating what proportion of these people may do so in the future and for how often. This is based on CSO information on journey purposes and employee trips, in

addition to attitudinal surveys which gauge the impacts of Covid-19 on travel behaviours. The methodology utilised had 3 No. steps:

- **Step 1:** Identify the trip types which may be affected by changes in working patterns.
- **Step 2:** Determine what proportion of affected trip types/ user classes will have the ability to work from home.
- **Step 3:** Estimate how often those who can work from home, will work from home.

10.12.5. The WRM which has been used to assess the impacts of the PRD breaks down traffic on the road network into 5 No. User Classes, as follows:

1. Taxi.
2. Business trips (Travel for business purposes e.g. face to face meetings).
3. Commuting trips (Trips from home to work).
4. "Other trips" (includes parent dropping a child to school, food shopping trips, visits to friends/relatives and trips made by retired people).
5. Freight (Trips that involve the transport of goods, produce etc. by light and heavy goods vehicles).

10.12.6. The Sensitivity Test assumes that, in a post-Pandemic environment, User Classes 1, 4, and 5 will not substantially change travel habits and consequently, only User Classes 2 and 3 will be substantially impacted by increased home working. I would generally concur with this analysis but consider it likely that freight trips will remain elevated due to the shift to online shopping over the course of the Pandemic and which may endure into the post-Covid environment. However, given that HGVs represent a relatively low percentage of overall traffic movements, I do not consider that this would alter my conclusion below.

10.12.7. The total pre-Covid traffic demand in the AM peak hour across the WRM network in the 2039 Design Year is 181,278. User Classes 1, 4 and 5, which are expected to remain largely unchanged, account for c. 66% of this figure. The remaining c. 34% (61,628), comprising a mix of Business Trips (7,512) and Commuting Trips (54,116) will be impacted by increased levels of home working.

10.12.8. Based on occupation types reported in the 2016 Census for Galway City and County, it is estimated that in the City 64% of workers have the potential to work remotely in the future, reducing to 57% for the County as a whole. The remaining workers are in areas such as skilled trades, caring, service, machine operatives, elementary occupations etc. who are considered unlikely to be able to work remotely. I would agree with this assessment and note that that the higher City figure of 64% was utilised in the sensitivity analysis which is suitably conservative, in my opinion, noting that in reality some office staff will be unable to work remotely.

10.12.9. With regard to commuting trips, SYSTRA, the applicant's traffic consultant, administered a travel behaviour and attitude survey of office workers in the UK, in June 2020, which found that respondents were making commuting journeys (i.e. not working from home) 84% of their working days before the introduction of Covid-19 restrictions. Once all restrictions are lifted (i.e. in a post-Covid environment), respondents predicted making commuting journeys on 50% of their working days. This would be equivalent to a 34% reduction in all commuting journeys carried out by office workers.

10.12.10. With regard to business trips, SYSTRA has again undertaken a series of monthly surveys in Scotland, with working respondents asked about their expectations regarding business meetings post-Covid. Before Covid-19 restrictions, a third (34%) of working respondents took part in business meetings, with the majority (61%) travelling to attend between one and four business meetings in an average month. Following the Covid pandemic, the results of the survey indicate that approximately 55% of all face-to-face meetings could be replaced by virtual meetings. Given the inherent uncertainties in determining business practices in a post-Covid environment, this would appear to be a reasonable assumption, in my view.

10.12.11. Table 14, included in the applicant's abovementioned 'Response to Queries raised in Module 2 of the N6 Galway City Ring Road in respect of Traffic and Climate' incorporates these assumptions on changes to working patterns post-Covid, and contends that, as a result of the drop in business trips and commuting trips outlined above, there could be a total 9% drop in traffic in the AM peak hour across the entire region post-Covid.

10.12.12. The applicant notes that the current NPF demographic forecast results in a 32% increase in traffic on the road network by 2039 and contends that, when viewed in the context of this forecast growth, the impacts of the Covid pandemic will not alter the outcome of the appraisal to date and that full implementation of the GTS is still needed to support the sustainable growth of the city.

10.12.13. Having considered the points made by the objectors/observers and the applicant's response, as detailed in the abovementioned response submission and its associated Appendix B technical report, I find the applicant's reasoning to be persuasive. I note in this regard the data from the TII Traffic Monitoring Units (TMUs) on the National Road network in Galway City and County that are included in Section 2 of Appendix B. This data compares traffic for 2019 and 2020 at the TMU locations and shows a severe reduction in traffic in April 2020 (i.e. during the period of complete lockdown restrictions). However, by September 2020, when restrictions had eased somewhat, traffic levels had returned to c. 90% of those seen in September 2019. Comparison of the daily traffic profile for the average workday across the TMUs in September 2019 and September 2020 also supports the applicant's contention that post-Covid traffic reductions will primarily relate to commuting journeys and business trips, with the AM and PM peak periods dropping to 82% and 87% of the 2019 values, respectively, whereas the Inter Peak period reached 95% of the 2019 values. Taken together, this analysis would imply that, rather than fundamentally reshaping traffic demand, the post-Covid environment may result in a relatively minor reduction in traffic demand, particularly outside of peak periods.

10.12.14. Having regard to the considerable level of population and economic growth forecast for Galway in the NPF, and the European, National, Regional and County-level strategic importance of the proposed development, I do not consider that changes to working practices and associated travel patterns arising from the Covid-19 pandemic undermine or negate the need or purpose of the proposed development.

10.13. Planning Conclusion

10.13.1. It is clear that the road has policy support at all plan levels from National, Regional to local and will assist the Council in realising the aims of the Galway Transport

Strategy. The design of the road is in accordance with the requirements of the European TEN-T network and has adequately provided for future demand. There will be positive socio-economic benefits with respect to balanced regional development as well as tourism and the Gaeltacht. There will not be an unacceptable impact on services or utilities subject to appropriate conditions.

10.13.2. It is clear that there are some significant negative impacts associated with this project most notably on those people who will lose their homes and where community severance occurs.

10.13.3. There will be construction impacts on the community, but I am satisfied that the applicant has demonstrated that mitigation measures will be taken to minimise disruption and inconvenience. I am also satisfied that the commitments given in the Schedule of Environmental Commitments are enforceable and will serve to mitigate the impacts to an acceptable level for the duration of construction.

10.13.4. I am satisfied that the public have been adequately consulted and that the applicant has complied with statutory and non-statutory requirements.

10.13.5. I am satisfied that the applicant has put forward a cogent argument that the Covid-19 pandemic will not result in such significant changes to the movement of people such as to result in the road no longer being necessary.

10.13.6. I conclude, therefore, that the policy support for the proposed road is robust and comprehensive and that the need, justification and purpose of the road has been adequately demonstrated such that the proposed development would be in accordance with proper planning and sustainable development of the area.

11.0 Environmental Impact Assessment

11.1. Introduction

- 11.1.1. This section of the report comprises an environmental impact assessment of the proposed development. Some of the matters considered have already been addressed in the Planning Assessment above. This section of the report should be read, where necessary, in conjunction with relevant sections of the Planning Assessment and the Appropriate Assessment section below.
- 11.1.2. The Environmental Impact Assessment Report (EIAR) accompanying the application has been prepared by ARUP on behalf of Galway County Council. As noted elsewhere Galway County Council on behalf of itself and Galway City Council is proposing the subject development.
- 11.1.3. The EIAR is presented in the grouped format. The Non-Technical Summary (NTS) is set out as a separate document as Volume 1 which is required to provide a summary of the EIAR in non-technical language. Volume 2 of the EIAR is split into 5 parts, 2A to 2E. Volume 3A and 3B contains all the figures associated with the proposal in A3 format. Volume 4 includes the Appendices split into 12 parts, 4A to 4L.
- 11.1.4. This application was submitted after 16th May 2017, the date for transposition of Directive 2014/52/EU amending the 2011 EIA Directive therefore the subject application falls within the scope of the amending 2014 EIA Directive (Directive 2014/52/EU). It is, therefore, proposed to apply the requirements of Directive 2014/52/EU herein.
- 11.1.5. As is required under Article 3(1) of the amending Directive, the EIAR describes and assesses the direct and indirect significant effects of the project on the following factors: (a) population and human health; (b) biodiversity with particular attention to the species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC; (c) land, soil, water, air and climate; (d) material assets, cultural heritage and the landscape. It also considers the interaction between the factors referred to in points (a) to (d). Article 3(2) includes a requirement that the expected effects derived from the vulnerability of the project to major accidents and / or disasters that are relevant to the project concerned are considered.

11.1.6. I have carried out an examination of the information presented by the applicant, including the EIAR, the response to the Further Information request, and the submissions made during the course of the application and during the oral hearing including the corrigenda and the revised Schedule of Environmental Commitments. A summary of the results of the submissions made by the prescribed bodies and observers, including submissions received following the request for Further Information and those submissions made at the oral hearing, has been set out at Section 6, 8 and Appendix 1, 2 and 3 of this report.

11.1.7. These issues are addressed below under the relevant headings, and as appropriate in the reasoned conclusion and recommendation. I am satisfied that the EIAR has been prepared by competent experts to ensure its completeness and quality, and that the information contained in the EIAR and supplementary information provided by the developer as part of the response to the Request for Further Information and during the oral hearing is up to date, adequately identifies and describes the direct and indirect and cumulative effects of the proposed development on the environment, and complies with article 94 of the Planning and Development Regulations 2001, as amended.

11.2. Consultations

11.2.1. Details of the consultation entered into by the applicant as part of the preparation of the application and EIAR are considered adequate. I am satisfied that the participation of the public has been effective, and the application has been made accessible to the public by electronic and hard copy means with adequate timelines afforded for submissions.

11.2.2. In conclusion, I am satisfied that the information provided is reasonable and sufficient to allow the Board to reach a reasoned conclusion on the significant effect of the project on the environment, taking into account current knowledge and methods of assessment. Overall, I am satisfied that the information contained in the EIAR is up to date, complies with the provisions of Article 3, 5 and Annex IV of EU Directive 2014/52/EU amending Directive 2011/92/EU. The content and scope of the EIAR is considered acceptable and in compliance with the requirement of Articles 94 (content of EIAR) and 111 (adequacy of EIAR content) of the Planning and

Development Regulations, 2001 (as amended), the Roads Act, and the provisions of the new amending Directive.

11.3. Alternatives

11.3.1. Chapter 4 addresses the alternatives considered. I have also had regard to the Route Selection Report that was submitted in response to the Further Information Request. At the oral hearing the applicant made submissions responding to the alternatives issues raised in written submissions/objections. These were presented by Ms Eileen McCarthy on the 18th February 2020. A number of parties made further alternative related submissions over the course of the hearing, including questioning of the applicant's consultants. These matters are addressed in the assessment section below.

11.3.2. Article 5(1)(d) of the 2014 EIA Directive requires:

(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;

Annex (IV) (Information for the EIAR) provides more detail on 'reasonable alternatives':

2. A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

Furthermore, Section 50(2)(b) of the Roads Act 1993, as amended, states that the EIAR is to contain:

a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment;

11.3.3. Subsequent to the 2006 Galway City Outer Bypass (GCOB) scheme and the decision of the European Court of Justice and the key constraint of the Lough Corrib SAC, alternatives considered by the applicant included: i)Do-Nothing Alternative, ii)Do-Minimum Alternative, iii)Do-Something Traffic Management Alternatives, and iv)Do-Something Road Based Alternatives.

11.3.4. The applicant provides an overview of the traffic issues and the causes currently being experienced in Galway including:

- Congestion throughout the city road network
- Over capacity of existing junctions
- Journey times unreliable due to uncertain quantum of delay
- Journey time variability throughout the day
- Peak hours traffic delays
- By-passable traffic is in conflict with internal city traffic
- Strategic traffic is in conflict with local traffic
- Inadequate transport links to access employment centres/shopping/ commercial districts within the city
- Inadequate transport connections from Galway onwards to Connemara
- Lack of accessibility to the Western Region as a whole
- Lack of available space to facilitate the improvement of non-motorised modes of transport

11.3.5. It is contended that traffic congestion in Galway City and its environs is crippling and stifling city living as well as cutting off access from the wider region to employment and services in the city. It is stated that the total breakdown of the transport network in Galway occurs on a frequent basis as there is no resilience in the network. It is further stated that this random unpredictable shutdown of Galway's transport network costs millions and has the real potential to prohibit Galway functioning as a city or economic engine for the Western Region.

11.3.6. It is stated that alternatives considered will be assessed against the Galway Transport Strategy (GTS) which is considered to be the overarching strategy in place

for Galway. A constraint study was undertaken within the study area shown in Plate 4.1 which is considered to be the area within which it is possible to develop a transportation solution for the city and its environs. Constraints of a physical and environmental nature were identified.

11.3.7. It is stated that the physical form of the city in terms of the built and natural environment and residential areas on both sides of the River Corrib, together with the limited available space between the lake and the bay, plus the presence of the designated sites presents significant constraints for developing new infrastructure for the city. The presence of these constraints focuses attention on the importance of considering reasonable alternatives in order to minimise the impact on the human environment and the designated sites. The significant constraints are depicted on Plate 4.2 in the chapter.

11.3.8. Each of the four alternative scenarios referred to above are considered in detail in the EIAR.

Do-Nothing Alternative

11.3.9. It is considered that the Do-Nothing alternative will only compound congestion issues experienced across the city. It is concluded that a Do-Nothing alternative would not offer positive economic benefits, would result in further decrease in efficiency of the transportation infrastructure over time, would not offer any safety improvements, would not benefit from smart-mobility/public transport initiatives as it does not facilitate any improvements on these fronts, does not involve any construction works thereby not causing disruption, and would not facilitate the implementation of the GTS measures. It is considered that the Do-Nothing option is not a real option in this case.

Do-Minimum Alternative

11.3.10. It is stated that the 'Do Minimum' definition had to be modified due to the planned and likely investment in transportation infrastructure. It is considered that a more realistic alternative was one which included planned and likely transportation schemes including smart mobility measures. The 'Do Minimum' alternative involved an examination of the existing transportation networks and infrastructure and existing policy and plans for Galway City and its environs. Likely and committed

transportation schemes were identified – 11 projects are listed including roundabout upgrades, bus corridors and pedestrianisation of streets.

11.3.11. It was concluded that the Do-Minimum alternative would not serve to reduce the existing congestion sufficiently, would not achieve sufficient results to ensure a further decrease in efficiency of the transportation infrastructure overtime would not arise, would not offer significant safety improvements (albeit would contribute to improving safety at a local level), overall would not achieve sufficient results to enable the full implementation of improvements to the public transport and cycling alternatives as capacity will be restricted, would not relieve sufficient traffic congestion and the associated environmental effects on the city centre and would not facilitate the complete implementation of the GTS measures.

Do-Something Traffic Management

11.3.12. This option seeks to maximise the value of existing infrastructure without construction of major new infrastructure. The traffic management measures alternative can include some or all of the following: local road safety improvements, fiscal or traffic control measures to manage demand, public transport priority, capacity and/or public transport services, improvements to pedestrian and/or cycling provision and Intelligent Transport Systems (ITS) to improve reliability, safety and operation capacity.

11.3.13. The Public Transport Only element of this alternative was developed and analysed as part of the initial studies on the N6 Galway City Transport Project (GCTP). This alternative includes all measures, options and schemes identified by Galway City Council in conjunction with the National Transport Authority as a result of the recommendations of the Galway City Council study entitled Galway Public Transport Feasibility Study of 2010 including Bus Rapid Transit, increasing frequency of all city bus services, bus priority measures, reallocation of road space on the Salmon Weir Bridge, and Light Rail. It is noted that the 2010 study assumed the 2006 GCOB was in place. The Public Transport Only Alternative as modelled in the initial studies of the N6 GCTP does not. The applicant provided further details in particular by Mr Andrew Archer at the oral hearing on bus and light rail options. It was concluded that the 'Public Transport Only' alternative does not provide an adequate transport solution as it does not reduce congestion levels in the city when considered in

isolation. Therefore, the 'Public Transport Only' alternative does not represent an effective 'Traffic Management Alternative' that responds to transportation problems as it does not resolve these problems in isolation. Analysis on the Public Transport Only Option demonstrated that it does not provide a solution in isolation, however, it does form part of the overall holistic transportation solution and is included in the GTS.

- 11.3.14. The GTS is discussed in this section of the chapter. It is stated that through consultation with key stakeholders including TII, NTA, Galway County Council and Galway City Council, it was agreed that a wider integrated transport strategy was required for Galway to identify the level of service requirements for each mode of transport; including walking, cycling, public transport and private vehicle. The more comprehensive 'Traffic Management Alternative' culminated in the GTS which provides Galway City and its environs with a clear implementation framework for transportation over the next 20 years. It is further stated that this is an incremental strategy which seeks to implement sustainable transport solutions to manage traffic demand. A portion of these incremental measures will provide some relief to the traffic problems experienced in Galway City and its environs. However, to fully realise the overall transport solution all measures are required.
- 11.3.15. The development of this strategy involved reviewing and consolidating various existing transport proposals, including the bus study and a light rail study amongst other measures, to form a coherent and integrated transport strategy for Galway City and its environs. It continues stating that this transport strategy seeks to deliver an integrated network of 'links' (routes) and 'nodes' (stops and interchange locations) along which people can travel seamlessly, changing corridors and modes as necessary to make their journey. A synopsis of the range of solutions for each mode is outlined including for pedestrians and cyclists, public transport, cross-city route for journeys not possible by non-car modes, and parking availability. The bus and light-rail information was discussed further at the oral hearing. It was concluded that a high-quality bus-based public transport service will most appropriately cater for the forecasted passenger demand and provide significant flexibility in terms of network options and the ability to integrate with other modes. The reallocation of road space to public transport in the city centre will be accompanied by an associated improvement in the public realm.

11.3.16. It is further stated that, in order to implement the level of service required for each mode of transport, including walking, cycling, public transport and private vehicle as outlined in the GTS, a new crossing of the River Corrib is required. Alternative options for the new River Corrib Crossing were considered as part of the road component for the N6 GCTP. These alternatives are outlined in the 'Do Something Road based Alternatives'.

11.3.17. It notes that the GTS is an incremental strategy which seeks to implement solutions to manage traffic demand. It is noted that a portion of these incremental measures will provide some relief to the traffic problems.

Do-Something Road Based Alternative

11.3.18. This section notes that numerous alternatives for connecting the east and west of the city and county were considered. Alternatives across Lough Corrib and Galway Bay or a tunnel from the far west to the east were all considered and discounted. Alternatives for a new crossing of the River Corrib were considered.

11.3.19. Lough Corrib Route Options, Coastal Route Options and tunnel over project extent alternatives were discounted from further consideration as they were deemed not to meet the project objectives. Plates 4.5, and 4.6 within the EIAR illustrate the options.

11.3.20. In terms of the River Corrib Crossing Alternatives (section 4.7.2 of the EIAR) it is stated that the development of route options for a new crossing of the River Corrib and a road based alternative included designs which avoided existing properties as identified on OS and aerial mapping as much as possible. The N6 Galway City Outer Bypass, 2006 was included in these route options. During the course of the development and appraisal of these alternatives it became evident that more detailed information was available along the route of the 2006 GCOB than other areas of the scheme study area and hence the development of these alternatives was paused until the necessary detailed environmental studies were undertaken on the entire study area. Detailed ecological surveys, ground investigations at Ragoon and archaeology geophysics at Ballybrit were carried out before the route options were further progressed. In parallel to this a study was undertaken to identify an on-line option which reutilised as much of the existing road infrastructure including the existing N6.

11.3.21. Once the environmental studies and on-line option development were completed the route option development process recommenced. Based on the initial route options, OS and aerial mapping, transport demand analysis and the results of the ecological surveys, option development zones were developed by the Design Team. These zones are identified on plate 4.7. Option development zones were areas within the scheme study area which from a human beings and ecological perspective the more beneficial route options could be developed whilst also bearing in mind that the need to connect back to the city to effectively resolve existing transportation issues. It was noted that all options developed within these zones still had to be assessed by other environmental specialists which further reduced the zones available. It is stated that the situation arose where route options were developed outside these zones to reduce impacts on other key environmental constraints.

11.3.22. The development of these feasible route options was a two-stage process with the initial routes developed known as Stage 1 Route Options. These route options comprised on-line options which included an upgrade of the existing infrastructure, partial on-line/off-line options and total new construction off-line and are shown on Plate 4.8 and a schematic of these options is shown on Plate 4.9 within the EIAR.

11.3.23. Following public consultation and further studies the route options were further refined to become the Stage 2 Route Options – Plate 4.10 and 4.11 refer. In addition, the 2006 GCOB, a modification of the 2006 GCOB, the Cyan Route and a switch between two of the off-line route options were also considered. It is stated that given the urban environment, density of residential development and the presence of the designated sites a horizontal and vertical alignment for each option was designed. The vertical alignment for some of the route options included sections of tunnels to reduce the impact on key constraints.

11.3.24. Stage 1 route options are each described and identified as the Red Route Option (online route option), the Orange Route Option, Yellow Route Option, Blue Route Option, Pink Route Option, and a Green Route option. Stage 2 options were established after the major amendments and alterations were made, in order to address concerns raised and issues identified through public consultation. It is further noted that the 2006 GCOB road was assessed as an alternative as there was significant knowledge and detail available on this option and it was possible to comparatively assess and rank other road based alternatives with the 2006 GCOB

Route Option. The Cyan Route Option is a reconfiguration of the 2006 GCOB to address issues raised by ABP in its refusal of the western section. The Cyan route reflects the GCOB to the east of the River Corrib and follows an alternative route to the west. A Green-Blue Switch route option was added at Stage 2.

11.3.25. A summary of the key potential significant environmental impacts for each route is provided in Table 4.2. A comparative assessment of property demolitions required is provided in Table 4.3.

11.3.26. Information is provided as to why the 2006 GCOB option was not pursued further. It is stated that full analysis showed that there are other alternatives which better meet the project objectives in terms of capturing existing travel demand. It is noted that the boundary of the Lough Corrib SAC was extended post lodgement of the 2006 GCOB planning application with ABP, resulting in a greater length of this Route Option crossing through the Lough Corrib SAC and, therefore, having a greater impact on its integrity than originally anticipated. It was also considered that the 2006 GCOB would not deliver the optimum intermodal transport solution as extensive traffic modelling showed that it would not deliver relief to congestion to the same level as other road based alternatives.

11.3.27. Likewise, the Cyan route was not advanced further for specified reasons. It is stated that the Cyan Route Option would not deliver the optimum intermodal transport solution as extensive traffic modelling shows that it would not deliver relief to congestion to the same level as other road-based alternatives.

11.3.28. The Green-Blue route provided an alternative crossing of the River Corrib, connecting the Green Route Option west of the river with the Blue Route Option east of the river with the benefit of the avoidance of impacts to NUIG Sporting Campus and reduction of direct impacts on the Dangan area west of the River Corrib, and the avoidance of Menlough Village to the east of the River Corrib. It is considered that this route option had a greater impact on Menlo Castle; the direct impact on residential properties for this alternative route option is also greater with the highest number of residential acquisitions when compared to that of the Blue or Green Route Options considered alone; potentially an impact on flood risk; due to the presence of soft and peat soils, the location of the River Corrib Bridge crossing presents a major negative in terms of soils and geology; significant impacts to a qualifying interest of

the Lough Corrib SAC habitat (Alkaline fen) on the west bank and would affect the integrity of the SAC; and, potentially the most damaging with respect to the local Lesser horseshoe bat population given its proximity to Menlo Castle and the core foraging area, and so it was not advanced further.

11.3.29. Each of the remaining route options were then ranked with respect to their impacts for each environmental discipline as Preferred (P), Intermediate (I), and Least Preferred (LP). The overall ranking for each route option in terms of the environment took into consideration the overall number of preferred, intermediate, and least preferred rankings. During the course of the assessment process Human Beings, Ecology, Landscape & Visual, and Material Assets – Non Agricultural were identified as disciplines which had key significant constraints.

11.3.30. The road was broken down into 3 sections and the different routes were assessed against each other within the specific section. It was concluded that the yellow route option is the preferred route for Section 1 (Bearna area). In Section 2 it is noted that Lough Corrib SAC is one of the more significant constraints and ecology is discussed in detail. The orange and pink route are the preferred route options overall for Section 2. It is noted that the orange route includes a 3.5km tunnel and avoids direct impact on the SAC and its impact on many other ecological receptors is reduced due to the tunnel. It is, however, stated that a 3.5km tunnel has the potential to indirectly impact on groundwater and groundwater dependent habitats within the Lough Corrib SAC and the Galway Bay Complex SAC. With respect to Section 3, it is stated that all route options have a similar number of preferred, intermediate, and least preferred rankings. The pink route is, however, the preferred option.

11.3.31. An overall summary of the rankings for the engineering, environmental and economic appraisal for each alternative, including those discounted as they were considered unfeasible or did not meet the project objectives, are presented in Tables 4.4, 4.5 and 4.6 for the purposes of comparison only.

11.3.32. It is stated that the outcome of the assessment is that the route option selected was a combination of route options which had the least number of residential properties acquired in each section. The yellow route is chosen for section 1 (with slight modifications to reduce potential property impacts), pink in section 2 and pink in section 3.

11.3.33. The alternatives chapter then proceeds to consider the N59 Link Road. It is stated that there are three options to connect the N59 to the mainline when the mainline is offset from the N59. An engineering appraisal of the options under the headings of geometry, length, junction strategy, constructability and traffic, was completed. From an engineering perspective the preferred N59 Link is the Orange N59 Link. An environmental appraisal was also carried out. Human Beings, Ecology, Landscape and Visual and Materials Assets – non agricultural were identified as disciplines which had key significant constraints. The Orange N59 Link was the preferred route option from an environmental perspective.

11.3.34. The emerging preferred route corridor was developed as an amalgamation of different route options over two sections, namely R336 to the Galway City boundary and the Galway City boundary to existing N6. At this point it was acknowledged that significant engineering infrastructure was required to enable advancement of this preferred route. It is stated that the provision of the River Corrib Bridge, Menlough Viaduct, Lackagh Tunnel and the Racecourse Tunnel are significant infrastructure in proximity to the urban environment but are a justified and proportionate response to deliver a solution in the correct location to solve the transport issues facing Galway.

11.3.35. It is further stated that once the emerging preferred route corridor was chosen it was refined as much as possible to eliminate and reduce impacts on the human environment. Significant design measures such as steeper earthwork slopes, steepened green embankments and retaining walls have been incorporated in the design to minimise the impact on the human environment. Additional mitigation measures such as noise barriers and landscaping are utilised to minimise the overall impact. It is stated that the process of producing the design from a route corridor was an iterative process. The input from various groups resulted in c. 20% of the length of the route moving outside the published corridor. It is noted that of the 20%, 4% moved wholly outside the corridor.

11.3.36. Amendments made throughout the length of the proposed road development include development of accommodation works via consultation with directly impacted property owners, refinement of local junction and access arrangement layouts in order to improve accessibility and performance and horizontal alignment alterations in order to minimise impact on property owners. These amendments are detailed in section 4.8.1 of the EIAR.

11.3.37. The alternatives section concludes that the road provides for the significant and much needed benefits to the EU transport network, the connectivity of the Western Region and County Galway as well as the built-up environment of Galway City and environs, meets the functionality of the road component of the overall intermodal transport solution, alleviates congestion within the city which results in reduced air and noise pollution, facilitates efficient public transport and multi-modal choice, improves safety, minimises property demolitions, improves quality of life and will deliver the additional crossing of the River Corrib and the new link road as proposed by the GTS. It is acknowledged that the road is going to have negative impacts on the receiving environment including a significant level of property acquisitions or demolitions that are unavoidable.

11.3.38. **Assessment**

11.3.39. Alternatives have been addressed above in detail in section 10.6 and should be read in-conjunction with the below assessment. As noted above and in section 10.6, based on the information before the Board, it is clear that a significant amount of work has been conducted over the duration of the project with respect to alternatives following on from the legal judgements relating to the 2006 GCOB. In my opinion the consideration of alternatives is of particular importance for this project having regard to the negative impacts that the route, the subject of this application, will have in terms of the demolition and acquisition of 54 residential properties.

11.3.40. However, ahead of that assessment, in the first instance many objectors in written and oral submissions contended that the consideration of alternatives was contrary to the EIA Directive as well as being contrary to public participation in decision making. I do not agree that the consideration of alternatives was contrary to the EIA Directive. I am satisfied having regard to the detailed work presented and carried out over the course of the project, and as required by the Roads Act 1993 as amended, that *'a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment'* has been carried out and adequately assessed. Moreover, I am satisfied that the assessment of alternatives is in accordance with Article 5(1)(d) of

the 2014 amending EIA Directive which requires '*(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;*'

11.3.41. At the hearing the applicant's Project Lead explained the process of assessing alternatives in response to many questions. The process of starting in 2013 after the CJEU judgement, the involvement of ARUP, the assessment of the numerous routes and the fact that it quickly became apparent that a road alone would not solve the issues but would be required as part of the solution, was clarified on numerous occasions including in response to, for example, Mr Michael Murphy on Day 8 of the hearing amongst others.

11.3.42. I am satisfied that the applicant did provide a description of reasonable alternatives and an indication of the main reasons for the option chosen.

Alternative Options

11.3.43. As stated in section 10.6 above, with respect to the question of whether the road itself is the correct response to the traffic issues being experienced in Galway currently, I am satisfied that the applicant has provided a description of the reasonable alternatives studied which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option. I am satisfied that a reasonable assessment of option alternatives including 'do nothing', 'do minimum' etc. has been carried out. I would also draw the Board's attention to the fact that the road is included in the City and County Development Plans which were themselves subject to a Strategic Environmental Assessment (SEA) as was the relevant variation to the County Plan. Of note is the fact that the Galway Transport Strategy (GTS) which is part of the Statutory Plans was also subject to SEA. The GTS SEA reviewed four alternatives as part of that assessment including:

- Do-minimum approach
- Prioritisation of a Road Transport based approach
- Prioritisation of a Public Transport based approach
- Provision of an Integrated Transport based approach

11.3.44. I have described the Integrated Transport based approach which was adopted in section 10.6 above.

11.3.45. In conclusion, I am of the view that the applicant has fully addressed alternatives to a road satisfactorily and I concur with the applicant that a road solution is required and that other alternative modes are not precluded and indeed will be supported by the provision of a road on the northern half of the city and environs. Moreover, I concur with the applicant that the transport solution must address the existing road network capacity in support of an efficient public transport option.

Alternative Routes

11.3.46. I have addressed the alternative route options for a road put forward by the applicant and considered the alternatives submitted by some of the objectors in section 10.6 above. As well as addressing alternatives to the mainline road, other alternatives considered by the applicant included alternatives at Rosan Glas housing estate for the N59 link road and at Parkmore. This is also detailed in section 11.13 below.

11.3.47. With respect to the applicant's alternative route options, the detail included in the EIAR and the Route Selection Report submitted by the applicant at Further Information stage has been considered as well as submissions raised at the hearing. I have summarised the stages considered as outlined in the EIAR in determining the preferred route above.

11.3.48. I have addressed the significant alternatives which were repeatedly raised at the oral hearing and in numerous submissions in relation to the mainline road in section 10.6 above amongst others being the 2006 GCOB, the N6 Action Group Alternative, Mr. John M. Gallagher's alternative and the alternative put forward by Mr Molinar on behalf of Mr Kilgarraff.

11.3.49. In addition, I am satisfied that the need for the extent and scale of the road required has been adequately addressed. The need for the road to be a motorway as opposed to a dual-carriageway has been adequately addressed in section 10.6 above and in detail in section 11.13 below.

11.3.50. I am of the view that the consideration of options within the selected route corridor and the strategy for key junctions was a rigorous process, which had regard to environmental considerations and to the Project Objectives. I generally concur with

the reasons for choosing the preferred route as presented in the EIAR and as revised during the oral hearing.

Stable Alternatives

11.3.51. I note that alternatives to the location of the new stables for Galway racecourse were also assessed. This is pertinent because the tenants of the lands where the stables are to be located continue to object to the CPO of the lands. At the hearing it was explained that as a result of the tunnel construction the buildings that currently occupy the land will need to be demolished. Following the construction of the tunnel these lands will be available and it was decided to locate the new permanent stables at that location. Alternatives considered included, relocating the stables on top of the tunnel, moving the stables to the infield (inside the race track), moving the stable yard to the western end of the grandstand and to either side of the public area. I am satisfied that there has been adequate consideration of alternatives for the stables with clear description of the reasonable alternatives studied by the developer.

Conclusion

11.3.52. This section should be read in-conjunction with section 10.6 above and section 13 below. Having regard to the detail provided, I am satisfied that the applicant has provided a description of the reasonable alternatives studied which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment. The consideration of alternatives is an information requirement of Annex IV of the EIA Directive, and the single most effective means of avoiding significant environmental effects. Having regard to this requirement and its purpose (i.e. avoidance of significant environmental effect) I am satisfied that the consideration of alternatives is adequate. I accept that significant environmental effects relating to demolitions and acquisitions cannot be avoided. However, I am satisfied that the applicant has adequately demonstrated that a substantial number of alternatives were considered at clearly defined stages of the project and as many demolitions and acquisitions were avoided as possible.

11.4. Major Accidents

11.4.1. **Chapter 19** addresses Major Accidents as well as inter-relationships, interactions and cumulative impacts. With respect to major accidents it is stated that risks that could not be screened out are low probability but potentially high consequence events. It is further stated that these are events that cannot be feasibly mitigated in the design or eliminated completely. Therefore, the feasible method of mitigating against them lies in developing procedures to manage their potential consequences.

11.4.2. The events requiring further assessment are considered to be: Vehicular events; structural collapse events; tunnel fire events; service utilities events; ground conditions related events; hydrogeological events; and hydrological events. Table 19.1 presents the hazards remaining following the screening process, defines the impact, assesses the likelihood of the hazard occurring, and assesses the consequent risk.

11.4.3. The outcome of the assessment identified that while these events would have very serious consequences should they occur, the risk is considered 'unlikely'. It is concluded that events have been considered throughout the design process and measures have been included in the design to reduce the severity and potential consequences of such events.

11.4.4. I am satisfied that the applicant has addressed the requirements of the EIA Directive with respect to Major Accidents.

11.5. Likely Significant Direct and Indirect Effects

11.5.1. The likely significant direct and indirect effects of the development are considered under the following headings, after those set out in Article 3 of the EIA Directive 2014/52/EU:

- population and human health;
- biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
- land, soil, water, air and climate;
- material assets, cultural heritage and the landscape;

- the interaction between the factors referred to in points (a) to (d).

11.5.2. My assessment is based on the information provided by the applicant, including the EIAR, the response to the further information request, the additional material presented at the oral hearing, and the submissions made in the course of the application and during the oral hearing by the prescribed bodies and observers.

11.6. Population and Human Health

11.6.1. Human Beings, Population and Human Health are addressed in **Chapter 18** of the EIAR. The series of Figures 18.1.001 to 18.1.002 and Figures 18.1.101 – 18.1.115 contained in Volume 3 of the EIAR indicate the land uses in the area. Appendix A.18.1 and A.18.2 contained in Volume 4 of the EIAR provides information on the Health Profile 2015 Galway City and Galway County respectively. It is noted that aspects examined in the chapter relate to impacts of the proposal on socio-economic activities and on local community health. Aspects related to socio-economic activities include journey patterns, amenity and community severance, business, tourism and employment, and the use of the Irish language. Human health impacts are primarily considered through an assessment of the environmental pathways by which health can be affected such as air, noise, water and soil.

11.6.2. At the oral hearing the applicant made submissions responding to the population and human health related written observations/objections. These were presented by Dr Craig Bullock, John Cronin and Dr Martin Hogan on the 20th February 2020. A number of parties made further population and human health related submissions over the course of the hearing, including questioning of the applicant's consultants. The Schedule of Environmental Commitments was updated during the hearing on 13th March 2020 and included additional commitments relevant to Population and Human Health (section 21.3) which were included in the final Chapter 21 Schedule of Environmental Commitments issued on the 4th November 2020. These matters are addressed in the assessment section below.

Methodology

11.6.3. In terms of **methodology**, it is noted that the assessment has been prepared in accordance with the relevant guidelines. Data has been collected through a review of

relevant documents, information gathered through public consultations, mapping, site visits, and local discussions.

11.6.4. The study area covers the lands within and adjacent to the proposed development boundary in addition to areas where changes in traffic volumes are predicted. The study area for the Irish language appraisal covers the same lands but also includes the Galway Gaeltacht. The study area for protection of human health varies depending on the emission type and its extent.

11.6.5. It is stated that socio-economic impacts due to a development of this nature fall into four key categories:

- Journey Characteristics;
- Amenity;
- Community severance; and
- Economic.

In addition, it is further noted that relative to many other road developments the proposed development will involve a high number of residential and some commercial demolitions and acquisitions.

11.6.6. It is stated that, in line with best practice, the socio-economic assessment generally addresses effects at a community level rather than for individuals or identifiable properties, although impacts for small communities are assessed where these may consist of a handful of houses or families. Impacts on individual businesses are discussed where these are especially significant. **Irish language** and **human health** methodology are addressed. With respect to human health, it is noted that there is no standalone Health Impact Assessment (HIA) carried out.

Receiving Environment

11.6.7. The receiving environment of Galway City and County is described. The increase in population is noted and the envisaged eastward extension of the city towards the Ardaun LAP area. Information on population growth, houses by year built and journey modes and journey times is provided. Information on industrial and commercial estates is provided. The character of the area is described, and it is stated that the health of the population of Galway is broadly similar to other areas in

Ireland. The significance and sensitivity of the study area is described as well as a community profile of the Gaeltacht area.

- 11.6.8. The characteristics of the proposed road development during the construction and operational phase are described. It is noted that the development will result in a number of demolitions and acquisitions. At some locations a high proportion of the total number of properties in a cluster will be acquired which will present a varying negative effect on the remaining residents as well as the impact on the householders directly affected. In terms of the operational stage, it is stated that the road will enable the reallocation of existing road space within the city to public transport. It will facilitate a more efficient public transport system and the provision of a multi-modal choice of travel.

Potential Impacts

- 11.6.9. The potential impacts of the proposal are assessed in a 'do nothing' and a 'do something' scenario during the construction and operation phase, under the headings of journey characteristics, amenity, community severance, economics and tourism, Irish language and human health. It is noted that during construction there will be some significant negative impacts on local amenity particularly at NUIG sports facilities. There will be a direct impact on part of the sports pavilion and on two playing pitches. The central part of the sporting campus will become a construction site for a period of c.18 months. The existing pitches adjacent to the river will be unavailable for use while replacement pitches are being constructed, likely to be c.9 months. It is stated that alternative pitches will be provided to replace the existing pitches. As detailed above, this was amended at the start of the oral hearing and it was confirmed that works to replace the pitches included in the application will no longer proceed. NUIG have pursued their own plans for the replacement of the pitches.
- 11.6.10. During construction of the bridge, access to the river will be restricted. To the east of the river there will be a slight negative impact resulting from the location of the construction compound off Menlo Castle boithrin. The existing unpaved An Seanbothar lane will be used by construction traffic which will impact on amenities. At the N84 Headford Road a large proportion of the total number of residential properties will be acquired. Noise impacts are likely for remaining properties. This

will be similar for the area of Castlegar. There will be an impact on general amenity on at least six households in Cappanabornia. With respect to the Galway Racecourse, the programme will involve cessation of works around racing schedules.

11.6.11. Details of the residential demolitions and acquisitions are described. West of the River Corrib it is stated that five properties will be demolished at Na Forai Maola and two will be acquired. One landholding with planning permission for a dwelling will also be acquired. Two further properties are being acquired in the community of Ballard. One property will be demolished at Ballyburke, one off the L1323 Letteragh Road and two will be demolished and one acquired at Letteragh. Approaching the N59, one property will be acquired and one demolished at Bushypark. Near Dangan, two properties will be demolished, and one acquired at Ard an Locha. Five properties will be demolished and one acquired in Aughnacurra Crescent which is an estate of 14 properties.

11.6.12. East of the River Corrib two properties will be demolished in Menlough. Construction of the N84 Headford Road junction will require the demolition of 14 properties out of a total of 22 residential properties. Further east nine properties are proposed for either acquisition or demolition in Castlegar, two demolitions along Hynes Boithrin and four demolitions and two acquisitions on School Road. Three properties are due for demolition in Cappanabornia and one is proposed for demolition in Ballybrit and two in Briarhill.

11.6.13. Community severance is addressed and it is considered that it is likely to be felt most acutely by local residents where family members or friends are located on the far side of the road. It is further stated that given the scale of construction works it will be less for locations to the east of the river. The Ann Gibbons Road will be permanently severed. Restrictions will apply but continued access will be maintained to the riverbank and to the pitches to the north of the NUIG sporting campus. It is considered that the severance will be psychological rather than physical. More significant construction related severance will occur at Castlegar.

11.6.14. In terms of the economic impact, it is noted that a very significant impact is anticipated on a business located on the N84 Headford Road which bottles water. It is noted that the impact arises from the effects of landtake on one warehouse and an

impact on the company's raw material supply. The proposal requires the acquisition of a builder's providers store and landtake from other commercial businesses. Other businesses could be affected by the need for traffic management during construction including a car dealership and An Post sorting centre. There is potential for environmental impacts on businesses adjacent to the racecourse in the Parkmore Business Park some of which are engaged in activities that are potentially sensitive to vibration and air quality. The Racecourse tunnel will require the acquisition of lands including the demolition of commercial buildings and the demolition of stables. However, the stables will be replaced. A car dealership on the edge of Briarhill Business Park will be impacted.

11.6.15. Once operational the road is deemed to introduce positive impacts in terms of improving journey times and journey amenities and positive impacts for the economy due to improved accessibility and connectivity. There will be positive impacts for areas to the west of the county. It is stated that there will be negative impacts, for example noise and visual intrusion, into areas that are currently quiet and semi-rural, as well as introducing an element of social severance. It is expected to help sustain tourism and to provide new tourism opportunities.

11.6.16. The **potential impacts to health** are addressed under the headings of Health Protection, Health Improvements and Improving Services. In terms of Health Protection with respect to noise it is stated that construction noise is expected to have some negative effects; however, it will be short term and limited by work practices and restricted working hours. The results of the noise modelling carried out for the operational phase shows that there may be potential noise impacts on residential properties adjacent to the proposed road development but that the implementation of low noise road surfacing and noise barriers will mitigate these potential impacts. The noise assessment also shows that there will be a benefit for a significant number of people within the city due to a proportion of current traffic being transferred from their current routes. On the basis of WHO night-time noise guidelines, there will be beneficial effects for the community living along existing roads where traffic will be reduced. Those few residences that may exceed the 55dB level do so by only small margins and are not considered to be enough to have significant health impacts noting that the WHO Guidelines were updated post submission of the EIAR.

11.6.17. Air quality has been considered in both the construction and operational phases.

Given the proposed mitigation measures with regards to control of dust and other air emissions during the construction phase and the relative limited period of time duration, air quality impacts are not expected to have an adverse effect on human health during the construction phase. Detailed modelling based on worst case traffic scenarios identify that Air Quality Standards will not be breached thereby protecting the vulnerable such as asthmatics, the elderly, the very young or the sick in general. The impact on individuals whose homes are being compulsorily acquired is noted and the stress and anxiety they may experience is recognised.

11.6.18. In terms of Health Improvement and Improvement of Access to Services, it is noted that the potential for socio-economic gain will have a positive impact on health outcomes. Other areas of improvements are noted as being a potential decrease in traffic accidents and the potential for improving walking and cycling environments and the health benefits therein. It is considered that there are significant opportunities for improved access to services. This will include those living within Galway City and its environs and those in the west of Galway.

Mitigation Measures

11.6.19. In terms of mitigation measures a number are proposed to improve journey amenity, amenity and minimise severance. Human Health and the Irish Language mitigation measures are addressed.

Residual Impacts

11.6.20. With respect to residual impacts, it is stated that once operational the road will provide for a very significant positive residual impact in terms of improved connectivity across and beyond the city, which in turn will maximise the transfer of cross-city movements to the new road, thereby releasing and freeing the city centre and inner suburbs from congestion. It is expected that the reduction in traffic on the road arteries will provide a residual positive contribution to journey amenity.

11.6.21. There will be a very significant negative impact on householders who will be directly impacted by compulsory purchase. Furthermore, as the proportion of properties to be acquired at three locations is high in relation to the number of properties in the area, a significant negative residual impact could occur at a community level for those households that remain. There will be a significant residual amenity impact on

visitors to Menlo Castle and very significant impact on NUIG Sporting Campus in the absence of a new University Sports Masterplan. It is considered that an appropriate level of master planning would reduce the residual impact to moderate. It is stated that the residual impact on the 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.

11.6.22. It is considered that the improved connectivity will help stimulate economic development and the tourism sector.

11.6.23. There are potential benefits for human health protection. There are individuals who have slight negative impacts because of their proximity.

11.6.24. **Cumulative impacts** are assessed. The EIAR lists the committed projects and planning files for the city and county. The cumulative impacts are addressed under the headings of socio-economic, Irish Language, and Human Health. It is considered that the proposal will provide an opportunity to fully implement the GTS and to provide for improved public transport facilities and facilities for pedestrians and cyclists. It is considered that no significant negative cumulative impact upon the status of Irish as a community language will occur. It is not considered that there will be any negative cumulative effects on human health. The distances between the projects listed and the proposed road development results in no cumulative noise or air quality impacts. There is potential that reduced journey times and fewer unforeseen delays could have a potential benefit on psychological health. Any projects which make roads safer and reduce the probability of road accidents and fatalities can only be seen in positive terms from a human health perspective.

11.6.25. **Assessment**

11.6.26. I consider the potential impacts on Population and Human Health to be of key importance for the Board in deciding on this application. There are significant negative impacts on people who are losing their homes as well as community severance. There are also potential significant impacts on businesses and community amenities both positive and negative. This section should be read in-conjunction with the Planning section of this report as well as **Alternatives, Noise, Air and Material Assets Non-Agriculture**. In addition, some individual impacts have been dealt with under the CPO process rather than specifically addressed

herein. I draw the Board's particular attention to Table 18.14 and 18.15 within the EIAR.

11.6.27. I consider the potential significant impacts on Population and Human Health are:

- Loss or acquisition of dwellings
- Severance of communities including the Gaeltacht
- Impact on amenities
- Impact on commercial facilities/socio-economic impacts
- Impact on journey times and journey amenity
- Impact on health

Loss of dwellings

11.6.28. The loss of dwellings is addressed in section 10.8 above and 11.17 below. As previously noted, the loss of a person's home and the unavoidable demolition or acquisition of 54 dwellings to make way for this road is one of the most significant negative impacts of this project which will occur at construction stage. Many of the homeowners do not want to leave their homes and very articulately spoke about the impact of the loss of their homes at the oral hearing.

11.6.29. At the hearing the applicant provided a useful overview of the general location of the dwellings to be demolished or acquired and the numbers of objections received by those homeowners. I also draw the Board's attention to Figures 15.3.1 to 15.3.15. As I consider this to be one of the most significant impacts, for the Board's benefit, I consider it is worth detailing the numbers involved. (note first number is demolition and second is acquisition).

- R336 to N59 Letteragh Junction: Total 11¹⁴ (7 Demo, 4 Acq). Only one objection received. This objector stated at the hearing that his house was to be acquired and he made it very clear that he wished to hold onto his house. He stated that he clearly understood the impacts faced by himself and his family during construction but that as this was temporary, he was willing to accept this. The applicant sought to proceed with the CPO as it was believed

¹⁴ Note error in submission – 5 houses noted for acquisition, 4 is the correct number for this area.

that the impact would be too great during construction. This is addressed further in section 13 below.

- N59 Letteragh Junction to River Corrib: Total 13 (9 Demo, 4 Acq.). Three objectors whose homes are to be acquired made a submission, with one homeowner wishing to proceed with the acquisition. Five homeowners whose homes are to be demolished objected to the demolition.
- River Corrib to the N84 Headford Road Junction: Total 2 (all demo). Both homeowners objected.
- N84 Headford Road Junction: Total 14 (all demo). Six homeowners objected (One objection relates to two dwellings).
- School Road, Castlegar: Total 8 (6 Demo, 2 Acq.). Seven objections were received.
- N83 Tuam Road to Coolagh Junction: Total 6 (all demo). Three objections received.

11.6.30. It is clear from a review of the drawings that, based on the route of the road proposed, these dwellings are directly in the path of the road or would be severely negatively impacted due to proximity. The applicant stated many times in both the EIAR and throughout the course of the hearing that the loss of dwellings was unavoidable given the proximity of the road to residential areas. The applicant also acknowledged that for many of the occupants the loss or acquisition of a private home is of considerable significance. The EIAR states that the residual impacts remain as very significant/significant as no mitigation is possible. Compensation is outside the scope of the EIA process and the remit of the Board. As addressed elsewhere in this report, the loss of homes is a significant impact and, in some cases, no amount of compensation will replace a family home. In my opinion, this is one of the most difficult issues to be addressed and the Board needs to be satisfied that the greater good is properly served by this project to justify the loss of so many family homes. However, as noted above the road is grounded in policy at all levels. I am satisfied that the applicant has provided a robust assessment of alternatives addressed elsewhere and demonstrated that every effort was made to minimise the number of demolitions.

Severance of communities including the Gaeltacht

11.6.31. While a substantial number of dwellings are being demolished or acquired, a significant residual effect will remain for other households and communities in the vicinity of these demolitions or 'those left behind'. This includes communities in the vicinity of Bearna, Na Forai Maola/Troscaigh, Dangan/Bushypark, Headford Road, Cappanabornia and Castlegar. The EIAR considers that the severity of the effect will vary depending on how established the community is, the ties between households, and the physical character of the location. I concur with the applicant's findings that the effect will be significant in areas such as Aughnacurra and Ard an Locha which are distinctive housing estates as well as around the junction with the N84 Headford Road, due to the scale of acquisition, and in the well-established communities of Castlegar. The applicant stated that over time the effect will diminish as new ties are formed and as new people move into the locality. This may be the case in some areas but there will be limited opportunities in others. At best there will be some mitigation in terms of communication during construction, landscaping and screening of the road in the longer term operation phase, provision of pedestrian crossings of existing radial roads, but the loss of community will be significant.

11.6.32. In addition, in some locations particularly to the west of the road, whether there is a loss of dwellings or not, the road will bisect the community and sever people from their neighbours and community facilities. I note that where paths and access routes are being severed, alternative access will be provided where possible. The Ann Gibbons Road will be severed but traffic is light on this road and there are no properties north of the severance point along the road. Objectors from Bearna in particular made strong points at the hearing about severance of their community and that, while alternative routes were provided, they were cumbersome and it may no longer be easy to quickly pop into neighbours. At the hearing the applicant made the point that the residual severance is mainly of a psychological nature, in part due to the character of the landscape or where the proposed road is on an embankment. This was disputed at the hearing by many parties. I am of the view that there will be a significant impact on some communities with respect to severance. However, similar to the loss of dwellings discussed above, this is an unavoidable impact as a result of this project. Mitigation measures put forward will not avoid the significant negative impact. Measures outlined as part of the Communication Strategy in the

CEMP will keep members of the community informed of scheduled activities and the applicant has committed to provide ongoing liaison throughout the construction stage. However, the residual impact will be medium to long-term significant negative depending on location.

11.6.33. I am satisfied that any severance caused by construction traffic such as on Headford Road, or locations north and south of the road development along its length, will be short term and slight negative. I am satisfied that traffic management mitigation measures as detailed in the CEMP will help to mitigate such causes of severance.

11.6.34. The applicant highlighted many times that a positive aspect of this development during operation would be the relief from commuter traffic in areas such as Bearna Village and Castlegar village, thereby enabling further opportunities to provide pedestrian and cyclist facilities which would reduce severance. I agree that relief from severance currently caused by traffic in villages is a positive impact of this project.

11.6.35. Some objectors raised concerns that the road would be a barrier to future residents of the Ardaun area and essentially lead to a separate settlement. The route of the road has been identified in the various statutory plans and any future design of the area will take account of the potential future road. This is also addressed in section 11.13 below.

11.6.36. Another potential impact is with respect to the severance of the Gaeltacht areas. The proposed development extends through an extensive area of the Galway Gaeltacht which abuts and surrounds Galway City. It is noted that this area has experienced rapid population and urban growth in the last few decades and which it is not of Gaeltacht origin. Submissions made by Údarás na Gaeltachta considered that the proposed development would help sustain the Irish Language as the road would give more efficient access to the Gaeltacht and would have a beneficial effect on attracting new industries to the Gaeltacht and Connemara areas. I concur that this in turn would enable Irish speaking people to continue to live in the area and, therefore, result in a positive impact on the Irish language. Severance issues in Gaeltacht areas close to the city are as noted above.

Impact on amenities

11.6.37. During the oral hearing, NUIG withdrew their objection and requested that the proposed mitigation measures included as part of this project be omitted (3G pitches etc.). However, several community and sports groups continued to object to the works and the impact on the **sports campus at NUIG** which is used very frequently. Many written and oral submissions were made highlighting the importance of the amenity for a variety of groups. It was repeatedly stated that the amenity so close to the city and open to everyone was a rarity and should not be impacted in anyway.

11.6.38. The applicant committed at the oral hearing that access to the NUIG lands will be maintained and that welfare facilities will be provided during construction works to the Sports Pavilion. Safe access across the construction site within NUIG Sporting Campus will be maintained for the duration of the construction contract. Following completion of the works a commitment was made by the Council to provide a right of way for NUIG to use the lands under the proposed viaduct for sporting/athletic purposes by way of a long lease. These commitments were added to the Schedule of Environmental Commitments which was continuously updated at the hearing.

11.6.39. As noted elsewhere NUIG decided to pursue their own development of replacement pitches. During construction noise and visual impacts, loss of use of pitches and modification to the sports pavilion will occur. Mitigation measures are detailed in the CEMP including managing construction traffic, providing welfare facilities for the sports clubs and maintaining access at all times. During operation and following the completion of these works, as well as the right of way and access to lands under the viaduct, I am satisfied that the impact on the facilities will be reduced somewhat, but there will continue to be a long-term moderate impact on the sports campus.

11.6.40. Access to the **riverside** during construction was raised as a concern. During construction there will also be noise and visual impacts. I noted on site visits that many people walked alongside the river and availed of this amenity so close to the city centre at all hours and days of the week. The applicant stated that construction traffic and works for the River Corrib bridge will be managed to minimise interference. I am of the view that impacts during construction will be moderate, negative and short term and can be managed to minimise impacts.

11.6.41. I agree with the applicant and indeed many of the observers that during operation the main effect for users of the sports facilities and the river walk on both sides of the

river will be the presence of traffic on the bridge overhead. Noise screening will be provided as mitigation, but there will be a residual negative effect as the bridge will induce a loss of general amenity in the vicinity of the River Corrib and Menlo Castle.

11.6.42. I am satisfied that while there may be some temporary disruptions for **Galway Racecourse** which serves as an amenity for residents and visitors alike, having regard to the fact that commitments have been given by the applicant to avoid works during the various festivals, the impact is acceptable. Furthermore, I am satisfied that the temporary and permanent stables being developed as part of this project will ensure that there is no long-term negative impact for the racecourse.

11.6.43. Other impacts on **general amenities** which were raised in submissions and at the hearing include access to rural roads for walking, jogging and cycling. This is also addressed under Noise, Air and Landscape and Visual assessments. While some roads may experience an increase in construction traffic, as outlined in the haul route drawings, this will be temporary and the roads will continue to be safe for use by the general public at all times. New over/underbridges and diverted routes will provide access to rural roads during the operation phase unless the road is clearly being severed (such as the Ann Gibbons Road). Some rural roads will benefit from reduced traffic as traffic will no longer use them as rat-runs. However, in the operation phase there will be some existing roads that will experience an increase in traffic as these roads are used to navigate towards the new road. This concern was articulated at the hearing. The impact of noise and air in these localities as a result of the traffic increases are addressed in Section 11.11 and 11.12 of this report. Section 11.13 details how adjacent roads are impacted.

11.6.44. As a result of construction of the mainline and link roads, there will be an impact on the amenities of residential and community areas, such as Rosan Glas, Gort na Bro, and Bushypark Church. Impacts will be as a result of construction traffic movements along the identified haul routes, as well as noise and dust. However, I am satisfied that the mitigation measures outlined by the applicant and, in particular, the CEMP will reduce these impacts to an acceptable level. I am also satisfied that because the project is of a linear construction the impacts will be for a set period of time of limited duration. I am satisfied that there will not be an unacceptable impact on these communities during operation.

Socio Economic Impacts

- 11.6.45. A number of commercial enterprises will be impacted by the proposed road development. Some businesses will be fully acquired and others will lose some road frontage with ensuing concerns about the visibility of their business. Most businesses welcomed the road and made submissions about the positive benefits that the road would bring in providing journey time reliability, both for their products as well as employees. Other businesses expressed concerns with potential impacts during construction with respect to dust and noise. At the hearing the applicant addressed these concerns and restated the mitigation measures proposed to reduce the impacts. Additional mitigation measures were agreed at the hearing and added to the Schedule of Environmental Commitments.
- 11.6.46. Two industrial properties (one of which includes four buildings) and two commercial properties will be demolished. There will also be full acquisition of one commercial property. At the time of the hearing there remained one outstanding objection to the CPO which is dealt with in section 13 below and in detail in section 11.17 below.
- 11.6.47. With respect to the impact during construction I am satisfied that while there will be some disturbance and nuisance for businesses, it is short-term temporary. Mitigation measures include noise and dust control as detailed in the CEMP. Partial land-take is required from some businesses but I am satisfied that, with appropriate signage, impacts will be reduced to slight negative. Tunnel works near the racecourse and businesses in Parkmore will be undertaken in compliance with the CEMP resulting in an acceptable impact of short duration. I have addressed the Galway Racecourse above under amenities and I am satisfied that it will not be impacted under the heading of socio-economic. Overall mitigation measures are proposed which will manage the impacts and reduce them to an acceptable level.
- 11.6.48. During the operation phase I am satisfied that there will be positive impacts with respect to journey time reliability and amenities which will be of benefit to businesses and commercial enterprises. This includes easier access and connectivity between the various Business Parks, the N83, N84 and the existing N6. Furthermore, the addition of the Parkmore Link Road will be a significant positive impact to the many businesses in the area both in terms of employee access and for manufacturing/movement of goods.

11.6.49. I am satisfied that there will be positive benefits to tourism because there will be improvements in journey times, journey characteristics, journey time reliability and easier access to Connemara and the Gaeltacht areas to the west of the city.

Journey Amenities

11.6.50. During construction there will be some impacts on journey amenities and characteristics as a result of temporary night time closure or diversions of roads which carry significant traffic including the major roads in the area, N59, N83, N84. This is also the case for smaller roads such as where minor roads meet construction works. However, I am satisfied that traffic management will minimise delays and I consider that this is temporary short-term.

11.6.51. During operation, the applicant considers that there will be positive impacts on journey amenities having regard to the reduced journey times, improved accessibility, including the accessibility of Gaeltacht areas, as well as improvements that can be brought about as part of the GTS. I am satisfied that the road will have significant positive residual impact in terms of improved connectivity across and beyond the city, releasing and freeing the existing city centre and inner suburbs from congestion, providing opportunities to improve pedestrian, cycling and public transport improvements thereby improving journey characteristics and amenities. This is the key positive impact of the proposal and is further detailed in section 11.13. There will be some negative impacts on existing journey amenities in currently quiet rural areas due to an increase in traffic seeking to access the new road or due to re-routing of roads. This will also be the case around the north link road as additional traffic will be introduced at Bushypark. This will be mitigated by screen planting and noise mitigation but there will be a long-term moderate impact in some areas.

Human Health

11.6.52. Throughout the hearing many objectors raised concerns with the potential impact on human health and were of the opinion that this topic was not properly addressed in the EIAR. The applicant addressed those concerns about the health effects of the road both during construction and operation. The applicant stated that the topic of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as noise or

air). The pathways through which the proposed road could impact on health were assessed primarily through vectors such as noise, air, soil and water. These areas are considered in detail in the relevant sections of this report (section 11.11 and 11.12 in particular).

11.6.53. With respect to construction, potential impacts can occur as a result of noise, dust and air in addition to the psychological impacts of people losing their homes. The applicant has proposed mitigation measures to ensure that impacts are reduced to acceptable levels as discussed in the relevant air and noise chapters herein. I note that, where it is not possible to reduce impacts below acceptable levels, the applicant has included the dwellings in the CPO.

11.6.54. The stress and anxiety of losing homes will remain even in the face of compensation. As noted above there is no doubt that there has been significant stress that has been ongoing for years on some people losing their homes. Some of the objectors verbalised the stress experienced and toll on their mental health at the oral hearing and I accept that there is simply no mitigation outside of compensation for people who are totally opposed to losing their family homes.

11.6.55. The applicant referred to the health benefits of the project, including easier access to services, improved cycling and pedestrian facilities, removal of traffic from villages etc. I agree that there will be improved benefits for cyclists and pedestrians which will have a positive impact on health and safety as well as improved general environments within villages. However, as noted by the applicant's health expert, Dr Martin Hogan, in his submission to the hearing, while the project will have an overall significantly positive impact, the health benefit of the road is not automatically distributed equally and it required consideration of individuals to ensure mitigation is targeted to ensure maximal benefit and least adverse outcomes. I address noise and air in detail below, noting that there is overlap across both topics. Moreover, I draw the Board's attention to the detailed assessment of air and noise (section 11.11 and 11.12). These two topics have been comprehensively addressed and the assessment has greatly informed the assessment under the heading of health.

Health - Noise

11.6.56. Many objectors raised concern with *noise* issues both in written and oral submissions. They referred to the latest WHO Noise Guidelines. These guidelines

were issued after the submission of the project to the Board. This is dealt with extensively in section 11.12 of this report. While noise concerns were raised in relation to loss of sleep and impacts on vulnerable persons, I am satisfied that construction noise is temporary and the linear nature of the project reduces the duration of activities at any one location. In addition the applicant has provided suitable mitigation measures, including additional measures committed to during the hearing. During the operation phase, there will be traffic noise introduced to areas that have been previously quiet and rural in nature. Equally there will be many receptors who will benefit from the reduction in traffic noise – both within the town and village centres as well as areas that have been used as rat-runs. The noise concerns in relation to the impact on health was raised by many objectors (for example Mr Kevin Gill, Galway City Harriers, Mr Damien Kelly, Caiseal Gael Teoranta – Castlegar Nursing Home, Kerin Family).

11.6.57. Dr Martin Hogan at the hearing discussed the WHO Guidelines and considered that the lower levels recommended are for purposes of annoyance criteria rather than more serious health effects. The applicant stated in the response to the Kerin submission (see further below) that: *"It is of note that the WHO ranked the evidence on which the 53 dBLden, annoyance level, is based as "moderate" quality which was downgraded because of inconsistent reports in the literature. The only evidence that was rated as "high" quality was the level of 59.3 dBLden in relation to ischaemic heart disease. Nevertheless, it is accepted that the WHO made strong recommendations whilst also noting that, as reiterated on a number of occasions, these guidelines are for populations rather than individual households"*.

11.6.58. Dr Hogan placed an emphasis on the fact that the Guidelines are for 'populations' and the *overall* impact on the population rather than individual households. The applicant concluded that as the population impacts due to environmental noise will be largely positive, the PRD would be in keeping with the WHO Guidelines. I refer the Board to Dr Hogan's submission to the hearing presented on the 20th February 2020 (submission no.24) whereby he explained that *"It is conservatively calculated at the level of noise that may be associated with a 5% increase in relative risk of a cardiovascular event. For the vast majority of people, the risk of a cardiovascular event in the next year is less than 1%. For an individual who has that risk of 1%, even allowing for the worst effects, the risk is 1.05%. The difference is therefore*

imperceptible on an individual basis. It is simply a far less significant effect than other risk factors, which is the reason that it is not considered one of the factors when calculating one's own cardiovascular risk. From an individual basis it simply is not significant. However, when one applies this across a large population, such as the population of Europe, even small changes can make a significant difference. This explains why the WHO guidelines are applicable for populations but not for individuals". I find this argument persuasive and accept that the guidelines are applicable for populations and I accept the applicant's contention that "The WHO realise that every individual residence will not be below 45bDL_{night}" in relation to sleep.

11.6.59. In response to individual issues raised at the hearing, for example by the Kerin family represented by Michael O'Donnell BL, accompanied by Professor Michael Kerin, Dr Annette Kerin, Dr Imelda Shanahan (TMS Environment Ltd.), Julian Keenan (Traffic Wise) and Karl Searson (Searson Associates), who are residents of Ard an Locha on the south side of the N59 Moycullen Road, the applicant reiterated that all residential dwellings were considered to be highly sensitive receptors (Applicant's Submission 103 in response to the Kerin submissions). The Kerin family supported by their Consultants made a substantial submission at the hearing relating to the WHO Guidelines and various medical articles (including New England and Lancet Journal). Professor Kerin shared information on the European Environmental Agency 2020 report on environmental noise which gives the most recent number of people exposed to greater than 55 dBLden (c.1 million) and 50 dBLnight (c.500,000). The applicant stated that the numbers exposed to these levels are actually falling in Ireland and it is explained that a reason for a fall in Irish numbers is because the dates correspond with the time when motorways and other road infrastructure opened taking large volumes of traffic away from heavily populated areas. Professor Kerin did not agree that the noise levels proposed by the road are acceptable stating that the noise levels exceed WHO and European Guidelines and stated that various health conditions would increase as a result of this motorway. He stated that it is documented that noise above 59dBLden increases cardiovascular diseases by 5% and respiratory diseases based on the catalogued exposure to noise and that is unconscionable that we would accept this. Professor Kerin noted that large cities (citing Birmingham) are spending large sums of money restructuring motorways.

Professor Kerin stated that the road should be located away from built up areas and contends that if the road had been subject to an appropriate EIA with respect to human health and population it would never have been proposed as a response to the transport issues. Professor Kerin stated that the WHO Guidelines are here for Galway too and we have to apply them. He concludes that the *“GCRR will not reduce exposure to pollution or increase the air quality in the city- the proposed GTS might do that. The GCRR project will sunder communities, destroy areas of tranquil fit for purpose living, increase psychological burden of disease and increase ischaemic heart disease, respiratory problems including asthma in children and pulmonary disease in adults...”* and that the proposal jeopardises Galway’s population health now and into the future.

6.60. I have referred to various points made by the Kerin family above and elsewhere. I am satisfied that there will be health improvements as a result of taking traffic out of the city and villages and, furthermore, enabling the GTS to proceed. As noted by Professor Kerin, the GTS may reduce exposure to pollution or increase air quality. The road is a key component of the GTS and I am persuaded that, without the road, it will be difficult to implement other projects outlined in the GTS which will lead to such improvements.

11.6.61. Addressing Professor Kerin’s comments regarding the EIA, I am satisfied that the project was subject to an appropriate EIA with respect to Health and that the relevant vectors were assessed. Sections 11.11 and 11.12, which comprehensively address noise and air, comprehensively conclude that there will not be exceedances of the TII Guidelines and criteria and, therefore, will not result in changes to health outcomes.

11.6.62. Concerns were also raised by the Nursing Home, Caiseal Gael Teoranta, in Castlegar with respect to noise and the impact on the health of the residents. It was considered that the impact on the residents of the Nursing Home had not been assessed within the EIAR. Mr Michael O’Donnell made a submission on their behalf about the impact of the construction works outside the Nursing Home and considered that the rerouting of the gas pipe and foul sewer had not been adequately assessed and in fact an assessment was “completely absent”. He queried the level of detail included in the drawings and in the description or the methodology to build the bridge near the Nursing Home and the assessment of the

likely significant effects on this facility contrary to the EIA Directive. He was of the opinion that, if the applicant was aware of the Nursing Home, this scheme relative to this facility would not have proceeded in the manner that it has and the Board cannot grant the scheme due to the fact that it does not comply with the EIA directive. I do not accept this and note that the applicant in response identified fully how and where impacts on the Nursing Home were assessed in the EIAR. This is addressed further below as well as in Section 11.17.

11.6.63. As noted elsewhere I am satisfied that due to the linear nature of the project, construction impacts will be temporary and will be mitigated as detailed in the CEMP, including restricted working hours, noise monitoring and the appointment of liaison officers.

11.6.64. As noted in section 11.12 below the applicant's noise consultant, Ms Jennifer Harmon, reiterated statements made in her submission regarding the purpose of the WHO Guidelines which used a range of population studies from around the world and which seek to prevent the majority of the population being highly annoyed and to prevent increased risk of heart disease. She contended that they align closely with TII guidelines but that it would take a further 80% reduction in traffic volumes on the mainline to achieve the values in WHO Guidelines. She contended that the criteria from the TII guidelines protect the majority of people from being highly annoyed and protect populations that may be exposed to more significant health effects.

11.6.65. I would, therefore, concur with the applicant that the WHO Guidelines, while useful in understanding the relationship between noise and health issues, are primarily of benefit at a macro or population scale, i.e. at a strategic and land use planning policy level, rather than in the case of specific road projects. I note in this regard that the TII Guidelines have been used in the assessment of all new national road projects in Ireland since their publication and that they are tried and tested in an Irish environment. I also consider it relevant that the TII design goal is comparable to that associated with the prevention of the more significant health effects of environmental noise such as cardiovascular effects as set out in the WHO guidelines.

11.6.66. I consider that the applicant has proposed a comprehensive and robust suite of mitigation measures, the majority of which are relatively standard for proposed road developments. I consider that these proposed mitigation measures will adequately

address construction phase noise and vibration which will in turn reduce residual health impacts to an acceptable level.

Health - Air

11.6.67. With respect to impacts on human health as a result of *air*, it is noted that concerns were raised, particularly the potential impact on the local schools, including pre-schools as well as residential dwellings. As noted for noise above, some observers appointed Consultants to review air in relation to the impact on human health including the Kerin Family and Castlegar Nursing Home. Much debate took place at the hearing between the applicant's air specialist, the applicant's health specialist and the consultants appointed by the above-mentioned parties, as well as other observers representing themselves.

11.6.68. In a similar manner to noise impacts during construction, I am satisfied that the potential impacts as a result of air and dust during construction will be mitigated in accordance with the CEMP. As also noted above due to the linear nature of the project potential impacts will be limited in duration. The applicant contended that the mitigation measures for dust control, including spraying of spoil, covering of trucks, dust screens etc. and air emission controls were suitable for reducing impacts on the sensitive environments. Monitoring during construction is identified as a mitigation measure. The monitoring will allow direct comparison with the PM₁₀ and PM_{2.5} air quality standards on a daily basis, which I consider to be appropriate given the health implications of exposure to these forms of particulate matter. The applicant has committed to particulate monitoring to be carried out at the nearest sensitive receptors upwind and downwind of the construction works where sensitive receptors have been identified within 25m of the works. The applicant has also outlined the procedures to be followed in the event of limit values approaching an exceedance or, in the event of a complaint due to elevated dust, and has incorporated this procedure into the Schedule of Environmental Commitments.

11.6.69. At the hearing there were debates about the guidelines used by the Kerin's family Air Specialist and the applicant. Different guidelines had been used by both parties – the Kerin's Consultant referred to USEPA AP-42 methodology while the applicant noted that the EIAR measures have been developed having regard to TII guidance, the British Research Establishment (BRE) document 'Controlling particles, vapour and

noise pollution from construction sites' and IAQM 'Guidance on the assessment of dust from demolition and construction', 2014. I am satisfied that these latter documents are the most appropriate guidance documents for assessing potential dust impacts in Ireland, are tried and tested and, having regard to the monitoring noted above, I am satisfied that there will not be an unacceptable impact as a result of dust and air emissions on health. This is detailed further in section 11.11. below.

11.6.70. As noted there was much debate about the impact of the road on human health in terms of noise and air. Dr Hogan stated at the hearing "*Given that air quality standards will not be exceeded, we can be confident that no new health conditions will occur*" (submission 24 Dr Hogan 20th February 2020). Debates ensued regarding levels of PM_{2.5} in particular. The applicant stated that "*the maximum increase in PM_{2.5} calculated at the nearest modelled receptor to the Kerin property is 1.9 µg/m₃. This results in a total concentration of 7.3 µg/m₃ which remains in comfortable compliance with the WHO guideline*". Professor Kerin in response stated "*The project models for an increased PM_{2.5} concentration of 1.9ug/m₃ at the nearest receptor to our home. The evidence from Queensland suggests that there is an increased mortality rate of 2% for each 1 ug/m₃ increase in PM_{2.5} level and it is very likely that this will be reflected in upcoming WHO guidelines. There is no justification in suggesting that reducing peat use in Ard an locha or Aughnacurra is responsible for our PM_{2.5} levels and the concept that we should not take notice of increased PM_{2.5} concentrations from a project like this is negligent*" (submission 98C Professor Kerin response to applicant's response). I note the applicant concludes that "*the proposed road development will have negligible effects on PM_{2.5} levels*" and that "*Essentially, the Do-Nothing and Do-Something scenarios are the same*" (section 6.1.10 of the applicants response to the Kerin submission, submission 103). While I do not consider the 1.9ug/m₃ potential increase negligible, I am satisfied that 7.3 µg/m₃ is well below the WHO and the Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011 (see Table 16.1 of EIAR).

11.6.71. Castlegar Nursing Home made submissions to the hearing expressing concern with air emissions on their facility. A number of reports were read into the record of the hearing and concerns were expressed relating to works around the home including the amount of material to be excavated, the diversion of School Road, the overbridge to be constructed with associated diversion and reinstatement of a gas pipeline and

foul sewer, blasting, mobile rock crushing and length of construction of 18 months in the vicinity. Mr Michael O'Donnell referred to and summarised a Report prepared by *Care Comply* with respect to compliance with the Health Act 2007 and *National Standards for Residential Care Settings for Older People in Ireland (2016)* (submission 83C). The Nursing Home is concerned that during construction and operation it will fail to meet minimum standards. The *Care Comply* report answers a number of posed questions and concludes that the construction and operation of the road in close proximity to the home will have negative health and social care outcomes for residents and may result in compliance issues with HIQA standards.

11.6.72. In response to those concerns raised specifically in relation to the Nursing Home, the applicant at the hearing addressed the concerns for both noise and air. Ms Sinead Whyte for the applicant restated the mitigation measures and the additional measures being taken where construction takes place in proximity to sensitive receptors. Dr Hogan stated that the EIAR Chapter 18 refers to a Nursing Home and notes that it is the only Nursing Home in the study area so refutes the suggestion that it was not assessed in the EIAR. Dr Hogan stated that the objector's air specialist relied on a number of incorrect assumptions and, therefore, her conclusions were incorrect. Dr Hogan states that at all times the relevant standards will be met and he can be confident that there will be no issues in this regard.

11.6.73. Having considered the issues raised in the written and oral submissions, I conclude that dust and air quality emissions will arise during the construction phase and that this has the potential to impact upon sensitive receptors. However, I consider that the applicant has proposed a comprehensive and robust suite of mitigation measures, the majority of which are relatively standard for proposed road developments. I consider that these proposed mitigation measures will adequately address construction phase air pollution and thereby health impacts.

11.6.74. During the operation phase the air quality section of the EIAR states that no specific mitigation measures are proposed, on the basis that all air quality standards for the protection of human health and vegetation will be complied with.

11.6.75. Dr Imelda Shanahan, in her separate submissions to the oral hearing representing the Kerin family and Castlegar Nursing Home, stated that "*while it is unlikely based on the information provided in the EIAR that an exceedance of Air Quality Standards*

would occur, in my opinion there would be a noticeable impact on air quality during the operational phase”.

11.6.76. Having regard to the fact that during operation predicted concentrations are all well below air quality standards, although there are some exceedances of WHO PM_{2.5} guideline levels which is stated to be due to high background concentrations, I am persuaded that there will not be an unacceptable impact on health as a result of air or dust emissions during the operational phase.

11.6.77. No concerns were raised about the impact on health as a result of soil or water. During construction, mitigation measures are described to prevent contamination of soils or water. I am satisfied that there will not be an impact on the Terryland Water Supply intake as detailed in section 10.9, 11.10 and 11.13 which could result in an impact on human health.

11.6.78. Other objectors such as Galway Athletics Board (Galway AAI) stated that that a health economics-bases study, cost benefit analysis and relevant studies are required. I am satisfied that the applicant carried out the necessary assessments to enable the Board to carry out an EIA in accordance with EU and Irish Legislation.

Conclusions on Health

11.6.79. As can be seen from the above there was substantial discussion in relation to the health impacts of the proposed project at the hearing. All of the parties remained entrenched in their opinions. The information provided by all parties who spoke or made submissions indicates that the WHO Guidelines with respect to noise cannot be met for all individuals but I am persuaded that the Guidelines are already exceeded in some cases and that they are to be considered at a population level rather than an individual level. Moreover, I am satisfied that the TII Guidelines have been used in the assessment of all new national road projects in Ireland since their publication and that they are tried and tested in an Irish environment. I also consider it relevant that the TII design goal is comparable to that associated with the prevention of the more significant health effects of environmental noise such as cardiovascular effects as set out in the WHO guidelines. With respect to air emissions, during construction I am satisfied that the mitigation measures proposed will reduce the impacts to below acceptable levels. During operation I concur with the applicant's Health Consultant Dr Martin Hogan who considered that there are no

adverse effects on human health predicted to arise from impacts to air quality because the Air Quality Standards will not be breached. As a result, I am persuaded that there will not be a seriously negative impact on human health.

Parkmore Link Road Proposed Modification

11.6.80. Having reviewed the information submitted by the applicant and having inspected the site, I do not consider that the proposed Parkmore Link Road modification would result in any additional or increased impacts on Population and Human Health.

Conclusion on Population and Human Health

- **Loss of dwellings:** There are 54 dwellings proposed for demolition or acquisition to make way for this project. This will result in a significant to profound permanent negative impact on homeowners. This impact will not be avoided, mitigated, or otherwise addressed by means of condition. There is no mitigation for this impact available within the EIA process.
- **Severance of Communities (including the Gaeltacht areas):** As a result of the loss of 54 dwellings with loss of clusters of dwellings in areas such as Na Forai Maola/Troscaigh, Castlegar, and Dangan, there will be a severance impact on remaining communities which will be a significant long-term negative impact that will not be avoided, mitigated or otherwise addressed by means of condition.

Where minor roads are closed (e.g. Ann Gibbons Road), diverted or re-routed severing communities, there will be a significant medium to long-term negative impact depending on density of development and extent of re-route. This will not be avoided, mitigated or otherwise addressed by means of condition.

There will be long-term positive impacts for some communities that are currently severed due to traffic volumes because traffic will reduce in villages, such as Bearna and Castlegar, thereby resulting in easier access for pedestrians and cyclists and improved amenities for more vulnerable persons.

During construction there will be slight negative and short term severance issues caused by construction traffic which will be mitigated by measures outlined in the CEMP.

- **General Amenities:** There will be slight to moderate short-term negative impacts during construction on general amenities in areas such as Rosan Glas, Gort na Bro and Bushypark church and school as a result of construction traffic, noise and dust along haul routes. These will be mitigated by measures set out in the EIAR Schedule of Environmental Commitments as well as the CEMP. During operation there will be a slight negative impact on amenities.

During construction there will be significant negative impacts on the population using the **NUIG Sports campus** as a result of loss of pitches, modification to the sports pavilion as well as noise and visual impacts. These will be mitigated using standard construction practices as detailed in the EIAR Schedule of Environmental Commitments and the CEMP. During operation there will continue to be a long-term moderate impact on the general amenities of the sports campus that will be mitigated by the provision of the right of way and access to the lands under the viaduct as well as noise mitigation measures.

During construction there will be restricted access to the **riverside** in Dangan and there will be noise and visual impacts on both sides of the River Corrib. These will be mitigated using standard construction practices as detailed in the EIAR Schedule of Environmental Commitments and the CEMP. At no time will access to the riverside be completely restricted. Impacts during construction will be moderate negative and short-term. During operation mitigation measures include the retention of existing vegetation and noise barriers. Impacts will be long-term moderate to significant negative due to the general loss of amenity.

Construction impacts on **Galway Racecourse** can be avoided by measures including the provision of temporary stables and the cessation of works during festival seasons.

During the operation phase, a positive benefit will result for Galway Racecourse due to the mitigation measures including the construction of a permanent access off Parkmore Road and new state-of-the-art permanent stables.

- **Socio-Economic:** During construction there will be some negative short-term impacts for businesses as a result of noise and dust which will be mitigated by measures outlined in the CEMP. Where visibility to businesses is impacted, mitigation measures include the addition of signage. Demolition of some industrial and commercial properties will not be avoided, mitigated, or otherwise addressed by means of condition. During operation there will be significant positive impacts with respect to journey times, journey reliability and amenities.
- **Journey Characteristics:** During construction there will be some short-term temporary moderate negative impacts on journeys as a result of road closures or diversions which will be mitigated by the Traffic Management Plan. During operation the road will have significant permanent positive impacts in terms of improved journey times, journey times reliability and journey amenities. There will be improved connectivity across and beyond the city, releasing and freeing the existing city centre and inner suburbs from congestion.
- **Health:** During construction potential impacts on health arising from air, noise and water emissions will be mitigated using construction practices set out in the CEMP and commitments as set out in the EIAR Schedule of Environmental Commitments. During operation impacts will be avoided having regard to the project's compliance with air and noise standards set out in TII guidelines.

11.7. Biodiversity

- 11.7.1. The Board appointed consultant Ecologist, Mr Richard Arnold of Thomson Environmental Consultants to assist with the examination and assessment of this topic for the purposes of EIA. Mr Arnold's Ecological Impact Assessment Report (EclA) is included as Appendix 4 of this report and should be read in-conjunction with the below.
- 11.7.2. Biodiversity is addressed in Chapter 8 of the EIAR which is 384 pages long and is supported by a substantial number of Figures and Appendices detailing the survey work and results carried out by the applicant. In total the initial application was accompanied by 24 sets of figures and 26 sets of appendices.

11.7.3. Following the request for Further Information additional relevant information was provided by the applicant as well as at the oral hearing. This includes:

- Request for Further Information Response Vols 1- 3, in particular the main reports pages 66 – 82, the “RFI response”;
- Statement of Evidence: Responses to EIA Biodiversity Objection/Submission dated 19th February 2020, the “Biodiversity Statement of Evidence” (101 pages);
- A Corrigenda dated 21st February 2020, and updated 11th March 2020, which corrects some details in previously submitted documents, the “Corrigenda”;
- Response to Queries raised in Module 2 [sic] of the N6 Galway City Ring Road Oral Hearing dated 10th March 2020, the “Module 1 response”;
- EIAR Cumulative Impact Assessment Addendum Update Report (Dealing with proposed and permitted projects and plans since publication of the EIAR) dated 10th March 2020, updated on 15th October 2020 and again on 3rd November 2020 and supplemented on 4th November 2020, with the last two forming the complete assessment, the “cumulative assessment update”; and
- The Schedule of Environmental Commitments which restates the mitigation measures committed to in the documents above, last updated 4th November 2020.

11.7.4. At the hearing the applicant addressed the submissions from the observers and objectors in the Biodiversity Statement of Evidence presented by Ms Aebhin Cawley of Scot Cawley (Submissions 10, 11 and 12) on 19th February 2020 in ‘Module 1’. Oral submissions from the prescribed bodies including the Department of Culture, Heritage and the Gaeltacht (NPWS), pertaining to ecology and hydrology/ hydrogeology were made on 21st February 2020. Module 1, which dealt specifically with ecology and hydrology/ hydrogeology, whereby observers and objectors made oral submissions and included questioning between parties, took place on 24th and 25th February 2020 and 10th and 11th March 2020. Module 1 was completed prior to the interruption to the oral hearing caused by the Covid-19 pandemic.

11.7.5. These documents together are taken to be the information provided by the applicant and the observers. Additional information is provided in other planning documents including the Natura Impact Statement Report, the "NIS" and the "Design Report" (submitted as part of the FIR response, Volume 4).

11.7.6. The information above has informed Mr Arnold's examination and assessment. My assessment for the Board has had regard to Mr Arnold's Ecological Impact Assessment report which has examined and assessed the biodiversity impacts of the proposed road project as well as the information provided by the applicant and observers.

11.7.7. **Assessment**

11.7.8. At the outset I draw the Board's attention to the significant, substantial and detailed desk based and field-based studies and surveys carried out by the applicant in line with standard scientific methods that informed the baseline conditions. Moreover, I note that some of the most experienced experts in their fields have been involved with this project since its inception following the ruling on the 2006 GCOB.

11.7.9. I draw the Board's attention to the different approaches taken by the applicant and Mr Arnold. The Zone of Influence of the Ecological Impact assessment has been extended in the assessment prepared by Mr Arnold to that originally presented by the applicant for terrestrial habitats, scarce habitats, plant species and local populations of bats and other mammals, and migratory birds. Mr Arnold has extended the zone of influence to include haul roads and other areas subject to heavy construction traffic. Cumulative impacts can also extend the zone of influence. The proposed road sits within a broader development plan for Galway City and Galway county, which includes new residential development, with anticipated population growth and measures to encourage tourism. The additional mobility created by the road in operation may encourage more visits by the increased population to sites of nature conservation importance in the locality, potentially causing damage by disturbance, trampling etc. Therefore, Mr Arnold proposes that such sites should also be considered in the zone of influence when considering cumulative impacts. I concur with Mr Arnold's cautious approach and expanded suite of potential impacts to be assessed having regard to the potential for significant negative impacts that the road could cause.

- 11.7.10. Furthermore, I draw the Boards attention to the slightly differing approach of Mr Arnold's assessment to that of the applicant in the area of methods for evaluation and assessment of habitats and 'sites' nature conservation value. The applicant sets out the method for its evaluation of nature conservation value in the EIAR p377, which it says was in accordance with TII guidelines (NRA, 2009). Outside of designated sites, the applicant identifies *individual habitats* as Key Ecological Receptors. The TII guidelines offers guidance for site-based assessments rather than individual habitats. Mr Arnold acknowledges that this is not straight forward in the context of the area around Galway city where the concept of 'site' is perhaps harder to define.
- 11.7.11. The applicant evaluated these individual habitats primarily on the basis of the inclusion of a habitat on a list (Annex I, etc.), so any area of Annex I habitat outside of a designated site was assigned national value, for example. However, as noted by Mr Arnold, the higher value habitat parcels along the route corridor are generally small, clustered and intermixed, sometimes with apparently lower value habitats, forming a mosaic which together have a value potentially greater than each parcel individually. Therefore, he grouped these habitat parcels into 12 clusters (equivalent to sites), and evaluated each in accordance the TII guidance, as it was considered to give a better understanding of the biodiversity value of each area.
- 11.7.12. In his assessment, Mr Arnold considered that apart from areas which have been developed or agriculturally improved, which is the minority, the general vicinity is of international importance for nature conservation due to the prevalence of a wide variety of Annex I habitats, including six priority types; limestone pavement, active lowland bog, calcareous fens, calcareous springs, turlough and calcareous grassland. The total area of **high value semi-natural habitats**, mostly within the 12 clusters within the proposed road boundary is approximately 135ha, which is just under half of the total land within the proposed road boundary.
- 11.7.13. The applicant presented the total habitat losses for Annex I types in Amended Table 4.1 Corrigenda p13-p14 and the amount of each habitat type valued at local or higher value within the development boundary are provided in the Corrigenda Amended Table 2 p14- p16. In his assessment, Mr Arnold considered that the applicant took a reductionist approach in quantifying the losses of all the habitats individually. Acknowledging that this needed to be done, he points out that there are

a lot of different habitat types and these are present in intertwined and co-dependent patches, for example wet heath, dry heath, wet (Molinia) grassland, bracken and scrub are frequently recorded together with the collective value usually being greater than the individual parts, see paragraph 7.2.5. Table 3 of the Ecological Assessment Report provides the approximate losses of habitats by cluster which should be read in conjunction with the applicant's work.

11.7.14. In terms of potential construction impacts I draw the Board's attention to Chapter 8 of Mr Arnold's report which I concur with. The report examines and assesses the potential impacts on Designated Sites (see also Appropriate Assessment Section 12 below) as well as other ecological features. Details are presented in this chapter which includes: Table 3: Terrestrial Habitats directly lost during the construction stage; Table 4: Lengths of watercourse culverted and substantially re-routed; Table 5: Bat roosts directly or indirectly affected by the proposed road; Table 6: Breeding Bird Territories of conservation concern lost to the proposed road; and, Table 7: Wintering bird populations affected by the proposed road, as well as an assessment of other habitats and species not addressed in tabular format.

11.7.15. I am satisfied that Mr Arnold has examined and assessed the potential construction impacts and has taken a precautionary approach, including an assessment of the broader zone of influence to include haul roads and other areas subject to heavy construction traffic.

11.7.16. With respect to operation impacts of the PRD, I refer the Board to Chapter 9 of Mr Arnold's report which I concur with. The report examines and assesses the potential impact on Designated Sites as well as other ecological features. A summary of potential indirect effects during operation is also provided in this chapter including: Table 8: Sources of potential indirect effects on terrestrial habitats during operation, as well as an assessment of impacts on other habitats and species not presented in tabular format. Similar to the above, I am satisfied that Mr Arnold has taken a suitably comprehensive and precautionary approach to identifying potential operational impacts.

11.7.17. Chapter 10 of Mr Arnold's report examines and assesses the applicant's avoidance, mitigation and compensation measures with references to the applicant's relevant document for further details including the Schedule of Environmental Commitments.

Of note, in a few instances, Mr Arnold did not consider some aspects of the suite of mitigation measures likely to be effective in terms of ameliorating significant effects and this is highlighted as 'Discounted Mitigation'.

11.7.18. I draw the Board's attention in particular to *Discounted Mitigation* in respect of Breeding and wintering Birds whereby Mr Arnold points out that the planting of woodland, hedgerow and grassland habitats along road development can result in an increased mortality risk for birds with these areas potentially becoming a population sink. Therefore, the consideration of this measure in remediating or replacing such habitats lost to the PRD is not likely to result in replacement habitat of similar ecological value for those species. However, I am of the opinion that this planting serves other purposes also such as landscape screening. Another measure recommended to be *Discounted Mitigation* by Mr Arnold relates to two of the three habitat areas put forward as barn owl mitigation. Mr Arnold considers it will have the opposite effect to that intended and may result in increased barn owl mortality because the route that a barn owl might take to reach these areas is too perilous. The sites in question are receptor sites 6210.R1, 6210.R2, 4030.R18, 4030.R19, 4030.R20 and 4030.R21. These areas have a primary purpose of providing compensatory habitat for lost Annex 1 habitats, so they need to be implemented for that purpose.

Predicted Residual Impact:

11.7.19. In chapter 11 of the Ecological Impact Assessment report Mr Arnold refers to predicted residual impacts. Mr Arnold considers the mitigation measures proposed by the applicant to ensure that there is no significant negative effect on Moycullen Bogs NHA, otter, most wintering birds and fish species. The potential effects on Natura 2000 sites can also be reduced to insignificance with the mitigation measures proposed.

11.7.20. I draw the Board's attention to the fact that while the proposed mitigation measures have the effect of reducing the likelihood and/or severity of the impact on many of the key ecological receptors, there are others for which a likely significant impact remains. The applicant has acknowledged this in the EIAR and, subsequently, in the biodiversity evidence. For some features the applicant concludes significant effects

are unlikely whereas it is the considered opinion of Mr Arnold that significant effects are likely despite the implementation of the mitigation measures as proposed.

11.7.21. **Table 13** in chapter 10 in Mr Arnolds ecological impact assessment report attempts to quantify the potential residual impacts based on his revaluation of key ecological features. I have reproduced Table 13 below for the benefit of the Board.

Feature	Direct Loss	At Risk	Mitigated Risk	Value	Significant Impact
Moycullen Bogs NHA	-	-	-	National	No
Cluster 1 Forramoyle	14.3ha	7ha?	21ha?	County	Yes
Cluster 2 Troscaigh	6.7ha	7ha?	14ha?	National	Yes
Cluster 3 Cloughscoltia (partly within an unnamed LBA 1)	13.9ha	15ha?	30ha?	County	Yes
Cluster 4 Ballymoneen Road to Cappagh Road (part of the Cappagh – Ballymoneen LBA)	7.3ha	9ha?	16ha	County	Yes
Cluster 5 East of Ballymoneen Road (part within an unnamed LBA 2)	2.2ha	2ha?	4ha?	County	Yes
Cluster 6 Knocknabrona/ Knocknafrosca (included in the Ballagh – Barnacranny Hill LBA),	6.0ha	8ha?	14ha?	County	Yes
Cluster 7 Menlough (included in the Menlough LBA)	5.4ha	8ha?	14ha?	Inter-national	Yes
Cluster 8 Lackagh (included in unnamed LBA 3)	1.8ha	4ha	6ha?	County	Yes
Cluster 9 Ballindooley (included in the Ballindooley – Castlegar LBA)	1.0ha	1ha?	2ha?	National	Yes
Cluster 10 Castlegar (included in the Ballindooley – Castlegar LBA)	0ha	2ha?	2ha?	Inter-national	(No)

Feature	Direct Loss	At Risk	Mitigated Risk	Value	Significant Impact
Cluster 11 Briarhill (not included in an LBA)	4.0ha	2ha?	6ha?	Inter-national	Yes
Cluster 12 Arduan (not included in an LBA)	0.7ha	1ha?	2ha?	County	Yes
Sruthán na Libeirtí etc	255m	Down-stream to coast	170m	Local	Yes
Trusky Stream, etc	240m	To coast	175m	Local	Yes
Bearna Stream, etc	150m	To coast	150m	Local	Yes
Tonabrocky Stream	495m	To coast	245m	Local	Yes
Knocknacarra, etc	385m	To coast	385m	Local	Yes
Woodsy thyme moss Plagiomnium cuspidatum	1 locality	2 localities	3 localities	National	Yes
Lesser striated feather-moss Plasteurhynchium striatulum	1 locality	3 localities	4 localities	National	Yes
Imbricate bog-moss Sphagnum affine	1 locality	-	1 locality	National	Yes
Red bog-moss Sphagnum capillifolium s. capillifolium	1 locality	-	1 locality	National	Yes
Spring gentian Gentiana verna,	-	3 localities	3 localities	Inter-national	(Yes)
Brown beak-sedge Rhynchospora fusca	-	1 locality	1 locality	National	(Yes)
Marsh Fritillary	4.7ha habitat	one 1km ²	one 1km ²	National	(Yes)
Marsh Whorl Snail	1 colony	3 colonies	1 colony	County	Yes
Lesser horseshoe bat	1 colony	2 colonies	3 colonies	County	Yes
Whiskered bat	-	1 colony	1 colony	National	(Yes)
Natterer's bat	-	1 colony	1 colony	National	(Yes)
Daubenton's bat	-	1 colony	1 colony	Local	(Yes)

Feature	Direct Loss	At Risk	Mitigated Risk	Value	Significant Impact
Leisler's bat	-	-	-	Local	No
Common Pipistrelle	1 colony?	1 colony	2 colonies	Local	(Yes)
Soprano Pipistrelle	2 colonies?	1 colony	2 colonies	Local	(Yes)
Nathusius' Pipistrelle		1 colony	1 colony	County	(Yes)
Brown long-eared bat	2 colonies	2 colonies	4 colonies	County	(Yes)
Irish hare	2 animals	Popn. South of road	Popn. South of road	Local	(Yes)
Pine Marten	1 (5ha habitat)	One population	One population	National	Yes
Red Squirrel	3-4 (5ha habitat)	One population	One population	County	Yes
Irish Stoat	In line with habitat	-	In line with habitat	Local	No
Badger	1 main sett	10 social groups	2 social groups	Local	(No)
Otter	-	3 or 4	-	Local	(No)
Other mammal populations	In line with habitat	-	In line with habitat	Negligible	No
Barn owl	-	One pair	One pair	National	(Yes)
Peregrine	-	One pair	One pair	National	(Yes)
Breeding Birds of Conservation Concern	88 territories	176 territories	264 territories	Local	Yes
Oystercatcher	-	1 flock ~30 birds	1 flock ~30 birds	Local	(Yes)
Other wintering birds	-	-	-	Various	(No)
Smooth newt	2 breed sites	2 popn.s	2 popn.s	Local	Yes
Common frog	10 breed sites	10 popn.s	10 popn.s	Local	Yes

Feature	Direct Loss	At Risk	Mitigated Risk	Value	Significant Impact
Common lizard	200 animals	200 animals	-	Local	No
European eel	-	5 colonies	-	International	(No)
Brown trout	-	2 colonies	-	Local	(No)
Sea trout	-	1 colony	-	Local	(No)
Atlantic salmon	-	1 colony	-	Local	(No)

direct loss= the area or populations directly impacted,

at risk = an estimate of the area or population which could be subject to indirect effects without mitigation

mitigated risk = 'direct loss and 'at risk' added together adjusted for the proposed mitigation, if any (Yes) = should the effect materialise it would be significant

(No) = conclusion of no significant effect dependent on mitigation

Table 11.7.1 Quantifying the Residual Impacts

Source: Table 13 of Mr Richard Arnold's EclA

Cumulative Impact Assessment

11.7.22. The applicant provided an updated cumulative impact assessment at the oral hearing, 10th March 2020 and then again in November 2020. Proposed/consented developments are identified and examined in terms of the potential for cumulative effects on biodiversity with any residual effects of the PRD. Development Plans are also set out for the County and City.

11.7.23. The principal cumulative risk to biodiversity is degradation (or development) of the land of high biodiversity value that would be encapsulated in the urban environment by the proposed road and subject to increased urbanisation effects, for example, waste dumping, informal recreation, lack of traditional management, predation of wildlife by domestic cats, spread of non-native invasive species, together with the potential for more isolated populations of flora and fauna becoming more vulnerable to dying out. This risk applies to all of the features identified in Table 13 except Ballindooley Lough and Barn owl.

Additional Mitigation

11.7.24. In the event that the Board decide to approve the proposed road development, additional mitigation measures are identified in Chapter 13 of Mr Arnold's report. It is considered that these additional measures would lessen the severity/likelihood of the impact but not change the overall significance of effects set out in Table 13. I have listed the additional mitigation measures proposed below and addressed where they are feasible and, if not, explained why I am not recommending them having regard to Mr Arnold's comments that the additional measures will not change the overall significance of effects on biodiversity, and in my opinion may in fact have a negative effect on other areas. This is particularly the case with respect to landscape measures whereby certain habitats are required for landscaping/ screening purposes.

Additional Mitigation	Commentary
<i>Designated Areas</i>	
The non-native species Fuchsia Fuchsia sp., winter heliotrope Petasites fragrans, Sitka spruce Picea sitchensis, European larch Larix decidua, Lodgepole pine Pinus contorta and Scots pine Pinus Sylvestris shall be included in the invasive species management plan, as shall the native species bracken Pteridium aquilinum and soft rush Juncus effusus to limit their spread from where they currently occur	Accept – add to SoEC
The planting and sowing scheme should not include non-native tree species in proximity to Moycullen Bogs NHA	Accept – add to SoEC
<i>Terrestrial Habitats</i>	
Scots pine is an invasive non-native species in heathland and therefore this species shall not be used for screening planting in the western section beyond the River Corrib	Accept – add to SoEC (Note - this is not a 'non-native' species)
Screen planting to the west of the River Corrib should be minimised to make space for dry heath/acid grassland habitats to develop in the soft estate	Reject - Screen planting required for landscape and visual purposes
Submit further details on the grassland seeding which shall be suitable for the soil types avoiding species that are negative indicators of Annex I habitats where these are not already abundant locally, aiming for dry heath/acid grassland in the west and calcareous grassland in the east from natural regeneration rather than seed mixes wherever soil erosion is not a major risk	Accept – add to SoEC
Moycullen Bogs and the appropriate assessment report for additional species to be included in the invasive species management plan	Accept – add to SoEC

A clearer commitment to the management of peatland habitats and other translocated/created habitats within the soft estate, ideally in perpetuity for the lifetime of the project.	Accept – add to SoEC
<i>Flora</i>	
Identify and map the extent of the six red data book plant species, plus measures to both minimise the loss and safeguard the retained areas by use of fencing, signs and ensuring workforce are aware (toolbox talks, etc), including the plants of <i>Plasteurhynchium striatulum</i> at the Menlough mitigation area	Accept – add to SoEC
If the <i>Plagiomnium cuspidatum</i> and <i>Plasteurhynchium striatulum</i> plants directly impacted are growing on moveable substrates (rocks or logs) then these should be repositioned to retained vegetation, with precisely the same environmental conditions as where currently found, with follow-up monitoring to confirm success or failure	Accept – add to SoEC
Check the identification and native status of meadow oat-grass <i>Helictotrichion pratense</i> and marsh valerian <i>Valeriana dioica</i> and implement protection measures if appropriate	Accept – add to SoEC
<i>Invertebrates</i>	
the retained part of the marsh at Castlegar to be protected during construction and measures put in place to maintain the existing hydrological regime as suitable for marsh whorl snail	Accept – add to SoEC
the infiltration basins at Castlegar to be planted with suitable vegetation for marsh whorl snail with hydrology adjusted to suit whilst maintaining the function of the basins	Accept – add to SoEC
management of all translocation sites for marsh fritillary to include management of an area at least equivalent in area to lost habitat for this species (loss is 4.7ha, while the applicant proposes to manage c1ha which is all in proximity to the road) to ensure long-term suitability for this species	Reject – land not identified or assessed as part of this project
translocation of ant hills impacted by the road to a suitable receptor site within the soft estate	Accept – add to SoEC
provision of suitable habitat for nesting bees (patches of coarse grassland) within the soft estate	Accept – add to SoEC
<i>Bats</i>	
two bat boxes to be installed on trees as close to each felled tree with potential for a bat roost, as close as possible but away from the carriageway of the proposed road and before the end of July in the year of felling, bat boxes to be a mixture of hollow (for Liesler's) and crevice types (for pipistrelles) in accordance with the potential roost that is lost	Accept – add to SoEC
the land to the south of the Castlegar overbridge is earmarked for development in the Galway City development plan, which if implemented may render the overbridge	Reject - Future development to the south of Castlegar has not been assessed as part of this project

ineffective, possible solutions include (i) change the development zoning for this land to open space, amenity or similar, (ii) ensuring the design of the development on this land accounts for lesser horseshoe bats (and other wildlife), or (iii) moving the over-bridge to a location where it would provide connectivity between high quality habitats on each side of the proposed road	and if subject to development proposals by other parties in the future it will be subject to the requirements of the EIA and Habitats Directives
clear commitments to safeguarding the new bat roosts including bat boxes, with replacements and repairs carried out as necessary for a period of ten years post-development	Accept – add to SoEC
monitoring for ten years post construction	Accept – add to SoEC
<i>Mammals other than bats</i>	
the provision of safe passage through the construction site during the hours of darkness alongside all watercourses crossed by the proposed road, including during the installation of culverts	Accept – add to SoEC
ledges to be installed in all other hydraulic culverts with a width greater than 2m to account for future range expansion or occasional use by otter as listed in EIAR p975 to p976, Table 11.20 which would be an additional eight structures, and to provide safe passage for badger	Accept – add to SoEC
monitoring “of the effectiveness of environmental commitments” requires further definition, for example, in accordance with TII guideline for otter which state quarterly monitoring for at least one year to check on the condition and effectiveness of the ledges installed in culverts; given the scale of the project, the monitoring should continue for at least three years and the maintenance of the ledges should be incorporated into the general road maintenance programme	Accept – add to SoEC
<i>Breeding Birds</i>	
reduce screening planting width as much as possible and ideally screening on one side of the road only, to reduce likely mortality and the risk of creating a “population sink” along the road corridor, except in locations where planting is required to deter barn owls	Reject - Screen planting required for landscape and visual purposes
<i>Wintering Birds</i>	
It is recommended that the Biodiversity Network to be established under the Galway City Development Plan includes a wet grassland management plan to help ensure that numbers of wintering curlew and oystercatcher are maintained	Reject – Noted – but this is for Plan making purposes
<i>Amphibian and Reptiles</i>	
replace the ponds lost to the proposed road elsewhere in the soft estate, including at the barn owl/lesser horseshoe bat mitigation area at Menlo Castle	Accept – add to SoEC

structures which could be earth banks to guide amphibians towards the tunnels and culverts where these occur in proximity to ponds	Accept – add to SoEC
an alternative drainage solution without kerbs within minimum 100m of amphibian breeding ponds	Reject – not assessed as part of drainage

Table 11.7.2 Additional Mitigation measures recommended by Mr Arnold and Inspector's recommendation whether to accept or reject the recommendation

Source: Mr Richard Arnold's EclA Section 13, and Inspector's recommendation

11.7.25. Should the Board decide to approve the proposal, the additional mitigation measures recommended are included in Section 16 *Conditions* herein.

Conclusion on Biodiversity

11.7.26. For the benefit of the Board, I have repeated Mr Arnold's conclusion herein.

11.7.27. *"As acknowledged by the applicant, the road will have a significant effect on features, valued in accordance with TII guidelines, as being of international importance for nature conservation, including small areas of two types of irreplaceable habitats, wet heath and limestone pavement. The scale of the impact is generally greater in the western part, beyond the N59, however, impacts at Menlough are also significant.*

11.7.28. *Because the main impacts of habitat loss, fragmentation and isolation are only partially addressed, the mitigation and compensation are not enough to change the conclusions on impact significance. Notwithstanding, the mitigation and compensation measures do lessen the severity or likelihood of many of the identified impacts, and many of the measures such as the use of viaducts and tunnels, habitat creation and the provision of overpasses and underpasses are beneficial. The cumulative impacts work in the opposite direction and will also reduce the effectiveness of the mitigation measures for the proposed road, such as some of the artificial bat roosts and the wildlife overpass. Areas of habitat and species populations located between the proposed road and the City being most at risk.*

11.7.29. *It would be possible to achieve a better assessment through more ambitious commitment to the safeguarding and management of the retained parts of the local biodiversity areas and equivalent land of higher nature conservation interest in the city and the county, including areas at distance from the road. The loss of woodland at Menlough could also be addressed providing compensatory habitat elsewhere.*

11.7.30. *There is the point, made by the applicant, that the road causes small losses of habitats and species populations, which whilst internationally important, are abundant locally with plenty remaining after the road is constructed. This has some validity. However, the area through which the road would pass is unusual in several respects, firstly the twin geologies of the Galway area make it rich in plant species in a small area, secondly there are apparently five rare species present in the footprint of the road and others nearby and finally, the edge of the city may be more important for bats than elsewhere due to the availability of roost sites near to high quality foraging habitat. Moreover, in the context of Galway City, the loss of 100ha of higher value terrestrial habitats is equivalent to 5 to 10% of the total present in the city boundary”.*

11.7.31. Having regard to the examination of environmental information contained above, and in particular to the EIAR and supplementary information provided by the applicant, and the submissions from the prescribed bodies, objectors and observers in the course of the application, including submissions made to the oral hearing, it is considered that the main significant direct and indirect effects of the proposed development on Biodiversity are as follows:

- Significant residual effect on habitats as a result of the loss of priority Annex I habitat (outside of any European Site) comprising Limestone Pavement [*8240], active Blanket Bog [*7130], and a Petrifying Spring [*7220] which cannot be avoided, mitigated, or otherwise addressed by means of condition
- Significant residual effect on habitats as a result of the loss of Annex I habitat (outside of any European Site) including Annex I Wet Heath [4010], and other habitats of international to local value, including within areas designated as Local Biodiversity Areas, which cannot or will not be avoided, fully mitigated, or otherwise addressed by means of condition
- Significant residual effect as a result of the loss of, or damage to, four plant species and one invertebrate species included in the Irish red data books, which cannot be avoided, mitigated, or otherwise addressed by means of condition

- Significant residual effect on lesser horseshoe bat, red squirrel and pine marten which will not be avoided, fully mitigated, or otherwise addressed by means of condition

11.8. Land, Soil, Water, Air and Climate – Land and Soils

- 11.8.1. Land and Soils are addressed in **Chapter 9** of the EIAR, entitled 'Soils and Geology'. The series of Figures 9.1.001 to 9.7.115 contained in Volume 3 of the EIAR provide soil and geology mapping and details of the ground investigations undertaken, while Appendix A.9.1 contained in Volume 4 of the EIAR provides copies of the Ground Investigation Reports. The RFI response submitted by the applicant also contained additional information relating to soils and geology.
- 11.8.2. The Schedule of Environmental Commitments, which was updated at numerous stages over the course of the oral hearing, also sets out commitments in relation to soils and geology.
- 11.8.3. A submission responding to the soils and geology-related written submissions/objections, was given at the Oral Hearing on 19th February 2020 by Juli Crowley of ARUP on behalf of the applicant (Ref. 17). A number of parties subsequently made further soils and geology-related submissions over the course of the oral hearing, including questioning of, and further submissions by Ms Crowley and other members of the applicant's team. These matters are addressed, where necessary, below.
- 11.8.4. A number of additional documents relating to soils and geology were also submitted at the oral hearing. This included a document entitled 'Response to Queries Raised in Module 1 of the N6 Galway City Ring Road Oral Hearing' (Ref. 65) and a document entitled 'Response to Queries raised in Module 2 of the N6 Galway City Ring Road in respect of Lackagh Quarry Material Deposition Areas (Ref. 76).
- 11.8.5. This section should be read in conjunction with the following hydrogeology section, where relevant, and with the Hydrogeology report prepared by the Board's consultant Hydrogeologist, James Dodd, which is attached at Appendix 5.

Methodology

- 11.8.6. In terms of **methodology** used, it is stated that the study area extends 250m beyond the proposed development boundary, which is in accordance with the TII Guidelines,

and extended as appropriate to include nearby geological features which may be impacted. Baseline data is obtained from desk studies, historic ground information, consultations as well as ground investigations and field surveys. Of interest is the extent of palaeokarst fill due to an unexpected buried valley feature which was encountered to the west of the Lackagh quarry. The impact evaluation methodology is stated as being in accordance with TII Guidelines. A list of potential likely significant impacts of the proposed development on soils and geology is identified and provided in Table 9.5 and mitigation measures and residual impacts are described and tabulated.

Receiving Environment

- 11.8.7. The **receiving environment** is described. A regional overview is provided in terms of the geomorphology, topography, soils and solid geology of the local area followed by sub sections identifying the feature importance ranking of the agricultural soils, superficial deposits, bedrock geology, soft and unstable ground, contaminated land, karst solution features, mineral and aggregate resources and geological heritage sites within the study area. The road is divided into four sections for analysis: 1. R336 to N59 Moycullen Road, 2. N59 to River Corrib, 3. River Corrib to N83 Tuam Road, and 4. N83 to the existing N6 at Coolagh.
- 11.8.8. It is noted that the general geomorphology of the western area consists of gently undulating to hummocky topography in areas overlying granite. The ground level is lowest at the shores of Lough Corrib and along the coast (10m OD) and rises to the high points at Gortacleva/Tonabrocky (111m OD), Derry Crih (96m OD) and Corcullen (90m OD). The area around River Corrib is relatively flat and rises to the east. The highest point is Coolough (65m OD) which is directly beside the disused Lackagh Quarry. Limestone Pavement is common throughout the study area east of the River Corrib and is both inside and outside the Lough Corrib SAC. The PRD intercepts several watercourses predominantly to the west of the River Corrib. To the east, due to the highly karstic nature of the terrain, there is a very sparse network of watercourse features. Lake features include Coolagh Lakes and Ballindooley Lough which are located east of the river. Blanket peat is widespread to the west of the river as well as some isolated areas of cutover peat on the east side. A summary of the agricultural soils present and their associated feature importance is provided in Table 9.7.

- 11.8.9. The underlying bedrock geology was determined based on GSI mapping and relevant ground investigation. Areas of Limestone pavement were uncovered and mapped in Sections 3 and 4. Limestone pavement which is underlain by limestone bedrock accounts for c.10% of the land cover. It occurs both within and outside the European designated sites. Most of the sections have a high crushed rock aggregate. Active and historic quarries are identified. Lackagh quarry is now disused and there is an active quarry at Twomileditch (Roadstone Quarry). A conceptual site model was developed based on the ground investigation data.
- 11.8.10. The **characteristics** and key design features of relevance to avoid or reduce impact to soils and geology features are considered to be the Lackagh Tunnel and western approach, the Menlough Viaduct and culvert, and reinforced/retained slopes.
- 11.8.11. Lackagh Tunnel is to be a drill and blast mined twin bore tunnel c.270m long beneath the Lough Corrib SAC including Limestone pavement. The potential geological impacts include: rock mass and slope instability resulting in potential encroachment onto Limestone pavement within the SAC; blasting activities resulting in potential impact on the structural integrity of the Limestone pavement; and collapse of tunnel and ground settlement from the tunnel bore resulting in potential impact on Limestone pavement. Measures are described to avoid these geological impacts including stabilisation works in advance of tunnelling works, a conservative design approach to the tunnel itself, rock mapping assessments, retaining systems and trial blasts.
- 11.8.12. The Menlough viaduct has a total length of c.320m over Limestone pavement and a Turlough and the PRD is on embankment on both approaches to it. This structure spans Limestone pavement surface outside of the SAC, avoiding the removal of this feature as well as a turlough.
- 11.8.13. A retaining wall in the Menlough area is located adjacent to the SAC. This is constructed to retain the embankment of the proposed road from encroaching on the Annex I habitat. It is stated that the construction of the retaining wall will be undertaken outside the areas of the Annex I habitat.
- 11.8.14. As well as the above, the Galway Racecourse tunnel is c.230m long and is a cut and cover type tunnel. In addition, the development requires a number of structures requiring pile foundations, embankment construction, excavation of cuts and earth

retaining structures (e.g. River Corrib bridge, culverts, underpasses, etc.). It is noted that no areas of contaminated ground were identified during investigations.

11.8.15. The road crosses numerous karst features from the N59 Moycullen Road to the existing N6. Furthermore, the ground investigation data suggests that groundwater will be encountered and dewatering will be required.

Potential Impacts

11.8.16. An appraisal of the **potential impacts** to geological features was undertaken. The potential construction phase impacts are described. Potential earthworks construction impacts are identified including compression of substrata, loss of agricultural land, loss of solid geology, and loss of future quarry reserves. Potential impacts of re-use and processing of site materials, importation, exportation and disposal of materials are identified.

11.8.17. The potential impacts of the construction of the two tunnels are outlined. This includes the potential impact on Limestone pavement (Lackagh only), loss of feature, and ground settlement. The construction of the other structures may impose impacts depending on the geology encountered.

11.8.18. The PRD traverses six locations of limestone pavement including passing under Lackagh Tunnel (within the SAC) and two locations under structures in Menlough (outside the SAC) and three other locations, all outside the SAC, and under the PRD. The road development results in the loss of small part of the Limestone pavement which is considered a significant/moderate impact.

11.8.19. During operation there is a neutral long-term impact on soils and geology along the route of the PRD.

Mitigation Measures

11.8.20. **Mitigation measures** during construction and operation are addressed. During earthworks construction, all excavated materials, excluding a small potential volume of hazardous material, will be re-used as construction fill and material deposition areas thereby minimising loss of the feature. Fill limitations will be incorporated to prevent impact to local peatland habitats. A drainage layer will be implemented for the construction of the embankment in areas prone to flooding to ensure hydraulic conductivity. Ground settlement, horizontal movement and vibration monitoring will

be implemented during construction activities to ensure that the construction does not exceed the design limitations particularly in relation to blasting.

11.8.21. During the construction of the Lackagh Tunnel the supported rock face of the quarry will be monitored as well as the vibrations at the surface. If vibration limits are exceeded blasting will cease until issue is understood.

11.8.22. Construction of the structures will be completed in accordance with the Construction and Environmental Management Plan (CEMP). Mitigation measures are proposed if contaminated ground or karst features are encountered.

11.8.23. During operation monitoring of the rock mass stability will continue.

Residual Impacts

11.8.24. In terms of **residual impacts**, it is stated that implementing the outlined mitigation measures will result in a number of significant residual negative impacts on the soil and geology at the construction stage. These impacts occur where the construction of the road development will result in the loss of Limestone pavement (all outside the European designated sites). Implementation of the outlined mitigation measures is considered to result in imperceptible residual negative impacts on the soil and geology at operation phase.

11.8.25. Table 9.19 and 9.20 outline the predicted **residual impacts** for geological features and activities during construction and operation. With respect to the Lackagh tunnel mitigation measures are listed including that the construction will be monitored, sufficient rock above the tunnel bore is maintained, a suitable pillar between the bores and tunnels to protect tunnels from collapse and suitable blasting sequences and where required stability measures will be implemented.

11.8.26. Table 9.19 also identifies the Karst Springs which will be lost as a result of construction.

11.8.27. **Cumulative residual construction and operational impacts** of the proposed development and the referred list of projects have been assessed. No other plans or projects are likely to result in a significant effect on soils and geology.

11.8.28. **Assessment**

11.8.29. I consider the potential significant impacts in terms of land and soil are:

- Loss of aggregates or resources.
- Soil contamination.
- Blasting and rock excavation.
- Loss of limestone pavement.
- Tunnelling works.
- Slope stability/earthworks.
- Material Deposition Areas.
- Land take justification.
- Proposed Parkmore Link Road Modification.

Loss of Aggregates or Resources

11.8.30. The owners of Lackagh Quarry made a number of submissions to the oral hearing which are primarily dealt with in Section 10.10 above and Section 13 below. With respect to the loss of aggregate resources, I note that the quarry has been inactive for a number of years, and that any future expansion of the quarry would likely to be constrained by the presence of a European designated site along the north and western boundaries. I agree with the applicant that the loss of a portion of future quarry reserves is a moderate impact and I am satisfied that the loss of potential aggregate resources due to the works within Lackagh Quarry is an acceptable impact. I further note that the proposal to re-use crushed rock in the construction process will result in a reduction in the impact on quarry reserves in the surrounding area.

11.8.31. The PRD will also result in a loss of agricultural soils where it traverses arable or agricultural land, as well as a loss of solid geology and potential resources where bedrock excavation is required. To mitigate the potential impacts during construction, almost all excavated material will be re-used as construction fill or placed in the proposed material deposition areas, offsetting construction material requirements for the PRD and the capacity of licensed facilities which would otherwise be required.

11.8.32. While negative residual impacts will arise from this loss, I do not consider that they will be significant impacts in terms of the soils and geology environment.

11.8.33. Geological Survey Ireland (GSI) made observations at application stage and following the RFI. They note that there are three County Geological Sites within 2km of the PRD but further note that there is no envisaged impact on the integrity of these sites. They sought, should any significant bedrock cuttings be created, that they be designed to remain visible as rock exposure rather than covered with soil and vegetated, as they consider this would improve geological knowledge and geoheritage. The applicant agreed, where safety requirements and engineering constraints permit, that significant bedrock cuttings will be designed to remain visible and where this cannot be done, photographic and/or visits from GSI will be facilitated. I consider this to be an acceptable approach to preservation of geological resources and knowledge.

Soil Contamination

11.8.34. Soil contamination concerns were raised, particularly in relation to the storage of hazardous materials.

11.8.35. The applicant stated that no areas of hazardous contamination were identified during the ground investigations and review of historical data. Potential impacts that could result in soil contamination are, therefore, considered to be associated with exposure of unknown contamination, seepage of concrete wash water or spillage of other construction related materials.

11.8.36. The applicant contends that the implementation of mitigation measures, including good housekeeping on the site, and the proper use, storage and disposal of substances and their containers that could cause contamination will prevent the generation of contaminated soil.

11.8.37. I note in this regard the provisions of the CEMP, and the Sediment, Erosion and Pollution Control Plan and Incident Response Plan, contained therein. I consider that the applicant has demonstrated a comprehensive understanding of potential soil contamination mechanisms and appropriate measures for minimising risk and mitigation measures for dealing with any contamination incident.

11.8.38. With regard to the potential for encountering existing unknown contamination, the applicant states that ground suspected of contamination will be tested during the detailed investigation and, where areas of contamination are encountered, the material will then be disposed of to a suitably licenced or permitted site.

11.8.39. I am satisfied that, subject to compliance with the identified mitigation measures and the CEMP, the PRD is not likely to result in any significant soil contamination impacts.

Blasting and Rock Excavation

11.8.40. A number of written and oral submissions raised concerns regarding potential impacts associated with blasting and/or rock excavation, particularly with regard to potential damage to properties and lands and noise, disturbance and health issues. Table 1 of Juli Crowley's submission to the oral hearing is a useful table listing each of the submissions and objections that raised concerns in relation to blasting, together with their proximity to the fenceline and the edge of the nearest cutting.

11.8.41. Noise and vibration issues associated with blasting and rock excavation are addressed in Section 11.12 below. With respect to geological impacts, the applicant provided information and clarifications at the hearing in relation to the methods of blasting, the pre-survey work and other mitigation measures proposed.

11.8.42. I note that blasting is only proposed in certain areas where it is deemed suitable based on ground investigations and depth of cut required (see Figures 7.201 and 7.202 of EIAR). In other areas, where blasting is not suitable, other extraction methods such as hydraulic breaking or splitting are proposed. In locations where it is suitable, I consider that blasting is generally the preferable solution for rock extraction, given that the impacts associated with it are momentary and that it is likely to allow the rock extraction phase to occur over a shorter time period than other extraction methods. I note in this regard that the frequency of blasting will be no greater than one blast per day in any one location.

11.8.43. As noted in the noise and vibration section of this report there will be noise and vibration limits put in place for rock excavation and blasting and blast design assessments and trial blasts will be undertaken in advance of blasting in any particular area. The applicant has committed to appointing a geotechnical expert who will be present to monitor blasting-related vibrations near sensitive receptors, including properties. In the event that the blast vibration limit is exceeded, the applicant's protocol will be to cease blasting until the basis for the increased vibration is understood and to recalibrate the blast design accordingly.

11.8.44. While I consider that the applicant's proposals for blasting, and the associated methodology and control measures, are acceptable and unlikely to result in any significant cosmetic or structural damage to property, the natural variation in ground conditions, particularly in areas of limestone bedrock and potential karst, make the applicant's commitments to undertake pre and post-construction condition surveys and carry out remedial works, if necessary, an extremely important mitigation and monitoring measure of the overall PRD. In the same vein, an effective communications and community liaison strategy will be an important means of giving local residents and businesses advance notice of blasting works and regular construction updates. I note that such a strategy is proposed, with nominated key contact persons to be appointed.

11.8.45. In conclusion, I do not consider that blasting associated with the construction of the PRD is likely to result in significant effects in terms of soils and geology.

Loss of Limestone Pavement

11.8.46. The loss of relatively small areas of limestone pavement as a result of the PRD is addressed in terms of its ecological impact in section 11.7 above and in section 12 below. With respect to the impact on soils and geology, I note that the main loss of small areas of limestone pavement outside of the designated sites is due to the land-take for the construction of the supports for the proposed Menlough Viaduct, which itself is being constructed to cross over and minimise the impact on the Annex I habitat. It is noted that there will be no loss of Annex I limestone pavement habitat within the SAC. The NPWS made a submission at the oral hearing whereby they stated, in response to specific questions posed by the Board's Consultant Ecologist, that they were of the view that while such habitat loss is undesirable and to be avoided, wherever possible, it is not inconsistent with the requirements of the Habitats Directive and the requirement of the EIA Directive should be applied to potential impacts to biodiversity including the assessment of impacts to Annex I habitats. As stated, this is addressed further in section 11.7.

11.8.47. The construction methodology for the Menlough Viaduct is detailed in Appendix A.7.2 of the EIAR. The applicant has identified three construction methods for the Viaduct and has devised a protection system to protect the limestone pavement areas during construction. These include the use of layers of geotextile, sand and

gravel and geogrids to spread the load from vehicles and prevent material entering grykes. A Karst Protocol is also contained within the CEMP, which sets out measures and protocols to be implemented where karst pathways are identified during construction. Given the inherent uncertainties associated with groundwater pathways in karst geology this protocol will be an extremely important tool for mitigating risk and it is appropriate that it forms part of the CEMP.

11.8.48. In my opinion the loss of these small areas of limestone pavement is a significant negative impact given the importance of this geology/habitat type. However, this must be weighed against the reason for the loss which is to facilitate the protection of a substantially larger area of limestone pavement by means of the proposed Viaduct.

Tunnelling Works

11.8.49. The proposed Lackagh Tunnel passes under an area of Annex I limestone pavement habitat to the west of Lackagh Quarry which is within the SAC. Concerns were raised about the potential impact of tunnelling on the limestone pavement above. A detailed Geotechnical and Hydrogeological Appraisal of Lackagh Tunnel was included in Appendix A.7.3 of the EIAR and the applicant considers the magnitude of risk to the limestone pavement to be negligible based on their tunnel feasibility assessment, design approach, construction methodology and mitigation measures. The assessment included a site specific ground investigation, with both horizontal and vertical boreholes and geophysical surveys.

11.8.50. The applicant considers their design approach to be conservative. I note, in this regard, the use of a twin-bore tunnel with a min. 7m wide separation pillar between the two bores and bedrock cover of 10 – 14.5m between the crown and the limestone pavement surface. This is substantially greater than the minimum requirement of 8m, which was based on the site-specific characteristics and which would have resulted in a 3mm settlement at the surface, according to the finite element analysis undertaken. The depth of bedrock cover and the separation pillar will allow a stable arch to develop around the tunnel and I am satisfied that there is not likely to be any material level of settlement or disturbance to the structural integrity of the limestone pavement at the surface.

11.8.51. The tunnel construction methodology and the various mitigation and monitoring proposals are set out in the Geotechnical and Hydrogeological Appraisal report

contained in Appendix A.7.3. In particular, I note that a geotechnical expert will be present to monitor the vibrations during blasting works for the construction of Lackagh Tunnel and that a more restrictive blast target vibration limit will be applied in this area. The geotechnical expert will also monitor the rock mass stability of the supported rock face of the tunnel and additional support measures have been identified, should any instability be identified. These include ground anchors, rock bolts, rock dowels, rock mesh, shotcrete. While I concur with the applicant's assessment that these additional support measures are unlikely to be required, I am satisfied that due consideration has been given to mitigating the risks associated with highly unlikely instability issues, which is an important consideration given the Annex I status of the limestone pavement and its location within the SAC. Monitoring of the tunnel will continue during the operational phase and the identified support measures will be implemented in the event that any future instability of the rock mass is identified.

11.8.52. I am satisfied that the applicant has demonstrated a full and comprehensive understanding of the receiving environment for the Lackagh Tunnel and that a suitably conservative design approach has been identified, modelled and assessed with a range of mitigation and monitoring measures proposed. I am satisfied that construction of the Lackagh Tunnel is not likely to result in significant impacts on the overlying limestone pavement. This matter is further discussed in Section 12 below, where an Appropriate Assessment is carried out on the potential impact on the SAC.

Slope Stability/Earthworks

11.8.53. Various queries were raised in relation to slope stability, earthworks details, embankment design and stability of cuts. The applicant's responses to these concerns were set out in Ms Crowley's submission to the oral hearing. With respect to embankment design and slope stability for planting purposes it was stated that the selected planting has considered a sloped surface and will not undermine the overall stability of the embankment. Planting provides additional surface support and will further reduce surface erosion.

11.8.54. With respect to rock slopes and stability of cuts the applicant stated that they have been designed based on knowledge and understanding of the underlying rock mass from ground investigation and baseline data and in turn the suitable stable slope

angles it can be constructed to. In response to a query from Galway Racecourse Committee regarding a contended discrepancy in rock slopes at the racecourse, the applicant stated that the permanent slope angles at that location have been designed to cut slope angles of 1V:1.5H and 1V:1H, and that the slope angles of temporary rock slopes may be stable at a steeper slope due to their temporary nature and reduced design life.

11.8.55. I do not consider that stability of cut slopes or general earthworks are likely to result in significant negative impacts on soils and geology.

Material Deposition Areas

11.8.56. A total of 32 No. Material Deposition Areas (MDAs) are proposed across the PRD.

The purpose of the MDAs is to provide locations where surplus excavated materials, which cannot be incorporated into the construction fill activities, can be placed at various points along the route of the PRD, in order to reduce the deposition of material off-site.

11.8.57. Approximately 366,000m³ of surplus material will be generated, comprising c. 76,000m³ of peat and c. 290,000m³ of what is referred to as 'U1 non-hazardous material'. This U1 material includes topsoil, made ground, unsuitable rock and clay, logs and stumps etc. The material equates to a total volume of excess materials of c. 476,000m³ when a bulking factor is applied.

11.8.58. The locations of the MDAs are illustrated in Figures 7.301 and 7.302, and they are listed in Table 11.27 of the EIAR, together with their area and approximate capacity. The Board should note that the EIAR incorrectly identifies 40 MDAs. A revised version of Table 11.27 was included in the Corrigenda presented at the oral hearing. The applicant clarified that 32 No. MDAs are proposed and the capacity of a number of the MDAs was altered. One of the MDAs was also omitted in error from Figure 7.301 and an updated version of this drawing was submitted with the Corrigenda.

11.8.59. Given the volume and nature of excess material arising, I consider it appropriate that it be placed in suitable locations along the route, in order to minimise off-site deposition and associated construction traffic, potential environmental impacts and in the interests of environmental sustainability.

11.8.60. I note that the theoretical total capacity of the MDAs is c. 806,700m³, reducing to 597,200m³, when the design requirements of each MDA are taken into account. This

result in c. 26% spare capacity in the MDAs and, therefore, they are unlikely to be fully utilised. The applicant contends that this level of spare capacity within the MDAs is appropriate based on their experience from previous construction projects. I agree that this is a reasonable level of 'headroom' given the scale of the project, without resulting in overprovision of MDAs.

- 11.8.61. The number, layout and composition of the proposed MDAs within Lackagh Quarry were the topic of much discussion at the oral hearing, with the design of the MDAs having been revised (refer to Appendix A.1.11 of RFI Response, corrigenda, and document submitted at oral hearing entitled 'Response to Queries raised in Module 2 of the N6 Galway City Ring Road in respect of Lackagh Quarry Material Deposition Areas'). This included submissions and questions by Dermot Flanagan SC and Senan Clandillon representing McHugh Property Holdings (19th October and 29th October 2020). As noted in Section 10.10, McHugh Property Holdings do not object to the PRD in principle, and the basis of their submissions was to seek to reduce the number/extent of MDAs in Lackagh Quarry so as to minimise the extent of land acquisition. Questions in relation to the MDAs in Lackagh Quarry were also put to the applicant by the Board's consultant Hydrogeologist and Ecologist.
- 11.8.62. Given the physical characteristics of Lackagh Quarry, i.e. a large steep-sided void, and its proposed use as the main construction site compound, I consider that it is, in principle, a suitable location for significant material deposition. I note in this regard that a secondary purpose of the MDAs within the quarry is to provide stability to the existing blast-damaged rock faces.
- 11.8.63. It is proposed to place approximately half of the total peat deposition material in Lackagh Quarry, with the remainder placed in certain other specified MDAs (see Table 3.1 in Appendix A.1.11). On foot of the remodelling exercise undertaken by the applicant following engagement with the quarry owners, MDAs DA24, DA27 and DA28 were reshaped, DA 25 was created and DA 23 (southernmost MDA) was removed. The applicant contends that DA 24 and DA 25 are critical MDAs for the purposes of the safe and sustainable deposition of materials arising and, in particular, the peat material. Of the 3 no. MDAs containing peat, the largest is DA24 where 37,000m³ is proposed to be deposited. In order to deposit that quantity of peat the applicant contends that 67,000m³ of U1 material is required to be placed in DA

24 so as to ensure upper shelf stability, to stabilise the quarry face; and to allow mixing/bunding of peat within DA 24.

11.8.64. Mr Flanagan stated that his client had no difficulty with DA28 (to the north of the PRD mainline) or the proposed attenuation ponds within the quarry but contended that the other MDAs within the quarry were excessive. There was much discussion at the oral hearing regarding the design of the MDAs within the quarry and Mr Clandillon, in his submission, set out alternative geometries for the MDAs. The applicant's response to which was that the size and design of the MDAs was driven by the peat placement and storage criteria.

11.8.65. Noting the multi-purpose nature of these MDAs, which provide a deposition site, a rock face stabilisation solution, and a basis upon which habitats can be created, I consider that the applicant has provided sufficient justification for the scale, location, design and capacity of the MDAs. Noting that a considerable volume of peat will be placed in the quarry, I consider the contained nature of the void to be suitable for such material and, given the characteristics of peat, it is appropriate that a degree of caution and a suitably conservative design is utilised rather than seeking to maximise the volume of peat in more constrained parts of the quarry.

11.8.66. Concerns were raised about the deposition of peat, particularly with regard to its mixing with other materials (U1 non-hazardous material), as well as the effects of dewatering on the peat and settlement over time. As the MDAs in the quarry are identified for dry calcareous grassland habitat creation, the likely success of creating this form of habitat on peat-containing MDAs was queried by both the NPWS and the Board's Consultant Ecologist. On foot of the discussion of these issues at the oral hearing, a number of additional commitments were added to the final SoEC by the applicant. These include:

- 9.22: Where an area of habitat planting has a requirement for a free draining layer beneath the surface and it corresponds with a proposed Material Deposition Area where peat may be placed, a free draining layer will be placed by the Contractor between the peat placement layer and the habitat to be created layer. The free drainage material will be contained within a filter separator layer (e.g. geotextile), above and below to prevent the migration of fines sediment, therefore ensuring the functionality of the layer.

For material deposition areas within Lackagh Quarry, where calcareous grassland is required, a contained drainage layer with a minimum depth of 350mm depth will be provided to ensure free drainage of surface water from the calcareous grassland. This layer will be provided between the calcareous grassland and the material deposition area.

- 9.23: Construction will adhere to all requirements outlined in Lackagh Quarry: Material Deposition Assessment Report (GCRR-4.0-03-4.23), in particular Section 6.4 Particular Commitments. This report is available in Appendix 1.11 of Volume 2 of the RFI Response Report.
- 9.25: The composition of the mixed peat in material deposition areas with calcareous grassland will ensure that the magnitude of immediate, primary and secondary consolidation will not exceed 250mm.

11.8.67. I consider that these additional commitments will assist in mitigating the impacts of the MDAs within the quarry and ensuring their effectiveness as both stable deposition areas and as a basis for habitat creation. I do not consider that significant impacts on land and soil will arise as a result of the proposed MDAs in Lackagh Quarry or elsewhere.

Land Take Justification

11.8.68. The land-take required for the construction of the PRD is due to the land required for the road itself, construction of embankments or cuts in areas of arable or agricultural land and will result in the loss of that land as a resource. The land required for the proposal is stated as being 280 Ha, although this has reduced slightly as the application has progressed. I accept that not all of the land is in use as agriculture or is a future resource and I am satisfied that the identified footprint of the development is required for the construction of the road and that significant excess or surplus lands are not being acquired. The proposed land acquisition is assessed in Section 13 below. However, from an EIA perspective, I consider that the applicant has justified the land take for the PRD and I consider the impact to be acceptable.

Proposed Parkmore Link Road Modification

11.8.69. The implications of the proposed Parkmore Link Road modification for the soils and geology assessment were briefly addressed by Ms Crowley in Section 3.11 of her

submission to the oral hearing. She stated that the proposed modification will have no effect on the soils and geology assessment results contained in the EIAR and RFI Response. Having regard to the nature and location of the proposed modification, I would concur with this assessment.

Conclusion on Land, Soil, Water, Air and Climate – Land and Soil

11.8.70. I have considered all of the written and oral submissions made in relation to Land and Soil, in addition to those specifically identified in this section of the report. I consider that there will be a significant negative impact on geology as a result of the loss of small areas of limestone pavement, which is an Annex I habitat, but which is outside of the Lough Corrib cSAC or any other Natura 2000 site. I note that this loss is associated with the construction of footings for a viaduct which will span over a larger area of limestone pavement. With regard to the other matters addressed in this section, I am satisfied that potential impacts would be avoided, managed and mitigated by the measures which form part of the proposed scheme, the proposed mitigation measures and through suitable conditions.

11.8.71. I am, therefore, satisfied that the proposed development would not have any unacceptable direct, indirect or cumulative effects on land and soil.

11.9. Land, Soil, Water, Air and Climate – Hydrogeology

11.9.1. The Board appointed Mr James Dodds of Envireau Water to assist with the assessment of this topic. Mr. Dodds' report is included as Appendix 5 of this report and should be read in conjunction with the assessment below.

11.9.2. Hydrogeology is addressed in **Chapter 10** of the EIAR and a series of associated Figures are contained in Volume 3 of the EIAR, including bedrock aquifer classification and karst features, Groundwater bodies and vulnerability, recharge coefficients for the existing environment, groundwater receptors, hydrogeology plans and profiles, and a series of figures identifying the construction and operation zones of influence, respectively. Volume 4 of the EIAR includes a number of associated Appendices, including a Well Commissioning Report, Karst Survey Report, Water Level Monitoring Database, Groundwater Quality Monitoring Report, Aquifer Tests Report, Hydraulic Calculations and HD45 Assessment. The RFI response submitted by the applicant also contained additional information relating to hydrogeology,

particularly with regard to the interaction with groundwater dependent terrestrial ecosystems.

- 11.9.3. The Schedule of Environmental Commitments, which was updated at numerous stages over the course of the oral hearing, also sets out commitments in relation to hydrogeology. A Corrigendum (Ref. 29), correcting various errors and omissions in the EIAR, was also submitted at the oral hearing on 21st February 2020.
- 11.9.4. A submission responding to the hydrogeology-related written submissions/ objections, was given at the oral hearing on 20th February 2020 by Dr Leslie Brown of ARUP on behalf of the applicant (Ref. 15). A number of parties subsequently made further hydrogeology-related submissions over the course of the oral hearing, including questioning of, and further submissions by, Dr Brown. These matters are addressed, where necessary, below.
- 11.9.5. A number of additional documents relating to hydrogeology were also submitted at the oral hearing. This included a second Corrigendum (Ref. 65) relating solely to hydrogeology matters, a document entitled 'Response to Queries Raised in Module 1 of the N6 Galway City Ring Road Oral Hearing' and two Eco-Hydrogeology Summary Reports, relating to Lough Corrib SAC and Moycullen Bogs NHA, respectively (Ref. 65C and 65B).

Methodology

- 11.9.6. In terms of **methodology** the extent of the study area was taken as 250m from the PRD boundary for the western section (west of the N59 Moycullen road) where the aquifer is classified as being poorly productive. The eastern section (east of the N59) includes regionally important karstified aquifers, and the extent of the study area was taken as the extent of the groundwater catchments that the development traverses. The existing baseline ground conditions within the study area have been interpreted from desk studies, field studies and commissioned ground investigations. All investigation locations were sited based on the design of the road. Groundwater level, groundwater quality and aquifer testing were focussed on locations of cuttings, structures and receptors. It is stated that the rating of potential impacts from the PRD on the hydrogeological environment has been assessed by classifying the importance of the relevant attributes, quantifying the likely magnitude of any impact on these attributes and determining the resultant significance.

Receiving Environment

- 11.9.7. The **receiving environment** is described. The hydrogeological environment is presented in the regional context and in detail for the study area. The hydrogeological study area is divided into two main regions on the basis of contrasting aquifer properties for the two main geological rock types in the region: the poorly productive (P1), low recharge aquifer of the Galway Granite Batholith (western section) and the regionally important karstified, high recharge aquifer of the Viséan Undifferentiated Limestone (eastern section).
- 11.9.8. On the western section the two groundwater bodies (GWB) are: Spiddal GWB and Maam-Clonbur GWB. In the eastern section the GWBs are: GWDTE Lough Corrib Fen 1 (Menlough), GWDTE Lough Corrib Fen 2, GWDTE Lough Corrib Fen 3 & 4, Clarinbridge, Clare-Corrib, and Ross Lake.
- 11.9.9. In terms of local hydrogeology, the PRD has been divided into 4 sections for description and analysis. The ground investigations undertaken in each of the 4 sections were tailored to provide data that will allow hydrogeological assessment specific for the PRD in that section. The sections are divided as for the land and soils chapter, i.e. Section 1: R336 to N59, Section 2: N59 to River Corrib, Section 3: River Corrib to N83, and Section 4: N83 to N6. The information gathered forms the basis for a conceptual site model for the study area.
- 11.9.10. It is noted that there are a number of receptors within the study area which are connected to or dependent upon groundwater to maintain their hydrogeology. The types of receptors that could be affected are: Groundwater resources and abstractions; Groundwater dependent habitats; and Groundwater dependent surface water features. Based on the developed conceptual model a number of these will not be affected by the PRD and a full impact assessment will not be required. Those which do require an assessment are assessed in this chapter of the EIAR. The importance of these groundwater receptors is ranked in accordance with TII Guidelines.

Groundwater Resources

- 11.9.11. Private wells are identified. There is one major groundwater abstraction in the Galway Batholith at Knocknacarra (W50-1) which is a group water scheme as well

as one private supply and one spring supply. These are within 1km beyond the study area.

11.9.12. In the Visean Undifferentiated Limestone there are four large groundwater abstractions within the study area, comprising of one industrial supply for a commercial water bottling facility (W50-12) as well as wells serving the Galway Racecourse. Well W50-12 has an equivalent supply of up to 1,000 houses. Galway Racecourse wells (W50-13 & W50-14) provide 2,000m³/day of groundwater and has a cumulative abstraction of >2,500 houses. Well W50-15 is used for potable purpose and has an equivalent of 1,400 houses. Other private wells are identified.

Groundwater dependent Habitats

11.9.13. European sites and nationally designated sites are considered with respect to hydrogeology. European sites that are located in separate and distinct groundwater bodies or sub catchments are not considered further as there is no groundwater connection. Table 10.11 screens European sites and identifies that there are four European sites that are either located within or receiving groundwater from catchments that the proposal traverses: Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. The Biodiversity Chapter identifies that Ballindooley Lough supports wintering birds of the two SPAs and is included for assessment. Table 10.13 identifies the National Heritage Areas to be considered further. Table 10.15 lists Annex I water dependent habitats that are outside of the European site boundaries. On the Galway Granite Batholith, the Annex I habitats outside of European and National sites include wet heath, blanket bog and Molinia Meadows. On the Visean Undifferentiated Limestone the Annex I habitats outside of European and National sites include Turloughs, Limestone pavement, Petrifying springs. Three turloughs were identified, all located within different groundwater bodies. Limestone pavement, whilst not dependent on groundwater, does require the development of free draining upper zone in the limestone that rapidly drains rainfall into the aquifer so as not to cause ponding. It is considered as a hydrogeological receptor as it is susceptible to groundwater level rise and limestone pavement ecosystems are included as potential receptors. Lackagh Quarry includes 27 no. seepage points of which 6 are petrifying springs. Non-Annex I habitat dependent on water or hydrogeological characteristics are also identified.

Groundwater Dependent Surface Water Features

- 11.9.14. The conceptual site model identifies surface water features that are dependent on groundwater. These include the River Corrib, Ballindooley Lough, Coolough Lakes, Turloughs and Terryland River.
- 11.9.15. Table 10.16 ranks the importance of all hydrogeological features within the project study area under the headings as described above.
- 11.9.16. **Characteristics** of the PRD that have the potential to change the groundwater regime are considered to be: dewatering of the bedrock aquifer for cuts or structures; accidental spillages of potentially polluting materials during construction; and discharge of road drainage or road cuts acting as barriers to flow during operation. Table 10.17 provides a summary of earthwork locations for the PRD and maximum groundwater drawdown (including the tunnels). It is noted that the construction schedules for Lackagh Tunnel and the Menlough Viaduct shall accommodate the seasonal groundwater fluctuation so that construction works always occur above the water table and dewatering in the bedrock aquifer is not required. It is stated that for this reason there will be no lowering in groundwater levels and drawdown is considered as '0m'. The drainage design is summarised.

Potential Impacts

- 11.9.17. Potential impacts during **construction** are listed as: the removal of the aquifer during excavations, changes in recharge characteristics, changes in groundwater levels and changes in water quality. Potential changes to the groundwater regime are considered and the interaction of these changes on receptors are considered for: groundwater resources, supplies, groundwater dependent habitats and groundwater contributions to surface water.
- 11.9.18. The potential impact on groundwater resources during construction phase considers the impact that the changes in the groundwater regime and quality have on the characteristics of the aquifers. Changing groundwater levels during construction activities may affect the aquifer characteristics. Eight locations have been highlighted where groundwater levels will be lowered locally during construction in the Galway Granite Batholith section. Suspended solids in site runoff is the prime concern with pollution from spillages but having regard to the overland flow this will not recharge

to ground – the low infiltration rate will promote runoff rather than infiltration. On this basis the risk is considered limited to the construction footprint.

- 11.9.19. The balance of rock excavated in cuttings and used for embankments and fill calculates a surplus of granite but a deficit of limestone. Due to the chemically inert nature of granite, if it is used in limestone areas there is no water quality concerns.
- 11.9.20. With respect to the Visean Undifferentiated Limestone the changing of recharge characteristics has the potential to impact the aquifer. The effect of an increased recharge in areas where vegetation has been removed may cause a groundwater rise. It is estimated that there will be a temporary rise in groundwater of up to 0.1m during construction.
- 11.9.21. Concrete is required as part of the construction of foundations for structures which poses a risk that it may enter the aquifer if karst is present, which could block pathways and modify flow paths to receptors. If limestone derived material is placed over granite bedrock, surface water runoff or groundwater movements have the potential to impact local areas of peatland habitat by changing the pH of the local groundwater.
- 11.9.22. If groundwater levels at wells are reduced or quality impacted, it could render the wells unusable. Table 10.18 provides the impact assessment of wells within the study area (pre-mitigation). The table highlights that five wells will be permanently impacted. It is stated that these wells will be removed as part of the PRD.
- 11.9.23. The potential impact to Groundwater Dependent Terrestrial Ecosystems (GWDTE) is assessed. These may be impacted due to accidental contamination of the groundwater which supports them, alteration of groundwater levels and/or reduction in the groundwater contribution to the ecosystem. It is stated that the chapter identifies the potential impacts to the hydrogeology that supports the ecological features and does not assess the magnitude and impact significance of the habitats themselves.
- 11.9.24. Based on the zone of influence for dewatering of the bedrock aquifer and the areas vulnerable to contamination, it is considered that there will be no impact either from drawdown or water quality on the Galway Granite Batholith to European sites. For the Visean Undifferentiated Limestone the drawdown zones of influence do not impact on any European sites or Ballindooley Lough.

- 11.9.25. Additional detail on the construction of the Lackagh tunnel is provided in the appendix A.7.3 'Lackagh Tunnel Geotechnical and Hydrogeological Appraisal'. Potential hydrogeological and geotechnical direct and indirect impacts for each of the three sections that the Lackagh Tunnel is split into are detailed.
- 11.9.26. Dewatering of the bedrock aquifer will not be permitted during construction so there is no reduction in groundwater flow transmitted by these pathways. By not dewatering, the boundary between the Clare-Corrib GWB and Lough Corrib Fen 1 (Menlough) will not be impacted. All construction works will remain above the groundwater table for the duration. It is stated that on this basis there will be no drawdown in the western approach to Lackagh Tunnel and the tunnel itself and, therefore, no impact to the groundwater divide between the GWBs or to Lough Corrib SAC. It is stated that if karst conduits are encountered during the excavation of structure foundations concrete poured in these may block conduits which may affect the hydrogeological regime. Mitigation measures are proposed.
- 11.9.27. The bridge over the River Corrib requires excavations on the east and west banks to install piers. These excavations will extend below the groundwater table and will require dewatering to enable dry working conditions. As the eastern excavations occur on the margins of the Lough Corrib Fen 1 (Menlough) GWB with the River Corrib there is no potential for impact to Western Coolagh Spring which is upgradient of the location and which feeds the Coolagh Lakes.
- 11.9.28. The potential impact on NHA's and Annex I habitats are addressed. The zone of influence for drawdown shows that impacts from groundwater lowering will occur to Annex I habitats in named townlands to the west of the River Corrib.
- 11.9.29. Table 10.19 summarises the potential hydrogeological impacts on GWDTE during the construction phase.
- 11.9.30. With respect to groundwater dependent surface water features it is noted that only the Terryland River is described under this heading.
- 11.9.31. Table 10.20 summarises the impact magnitude and significance for hydrogeological aspects of receptors at risk during construction including the loss of wells and the potential impact on Coolagh Lakes which can affect the Lough Corrib cSAC.
- 11.9.32. Potential impacts during **operation** are addressed and as with construction activities, the main impacts to groundwater arise from the potential to impact groundwater level

and groundwater quality. It is noted that operational impacts can alter the groundwater regime by lowering of groundwater level from operational dewatering, raising groundwater levels by impeding or impounding groundwater, or discharge of road runoff to ground.

11.9.33. The impact on groundwater resources is detailed. During the operation phase there are seven cuttings/tunnel in Visean Undifferentiated Limestone that have the potential to intersect the water table – including the two tunnels. Only three excavations have the potential to require operational dewatering of the bedrock aquifer. It is restated that 5 No. wells will be lost during construction and mitigation will be proposed for other wells during operation.

11.9.34. Potential impacts to GWDTE during operation derive from the interception of groundwater in cuttings and the deterioration of water quality.

11.9.35. With respect to surface water features, it is considered that there are no operational impacts on groundwater contribution to surface water features.

11.9.36. Table 10.25 provides a summary of impact magnitude and significance for hydrogeological aspects of receptors at risk during the operational phase.

Mitigation Measures

11.9.37. **Mitigation measures** during construction and operation are addressed. It is noted that, through the evolution of the design of the PRD, measures were included in the design to reduce or avoid specific impacts where possible. Following the evaluation of potential impacts as a result of the design, specific mitigation measures have been developed to avoid, prevent, reduce and if possible, remedy any significant adverse impacts on hydrogeology.

11.9.38. Measures are listed during construction including measures incorporated into the design, in addition to standard good construction practice mitigation measures.

11.9.39. A number of mitigation measures have been developed specifically for groundwater dependent receptors which are described for aquifers, supply wells and habitats.

11.9.40. The mitigation for the loss of 5 No. wells includes providing a replacement well, connecting to mains supply or financial compensation.

11.9.41. During the operational phase, inspection and maintenance will occur to ensure that infiltration basins will operate as intended for the design life.

Residual Impacts

11.9.42. Table 10.26 provides a summary of **residual impacts** to receptors during the construction phase while Table 10.27 provides a summary of residual impacts during the operational phase.

11.9.43. There are no significant residual hydrogeological impacts to European sites. However, profound residual hydrogeological impacts remain for groundwater level drawdown impacts below the location of five Annex I habitats (outside of the SAC) on the Galway Granite Batholith at the following locations:

- Na Foraí Maola Thiar (Ch. 0+650 to Ch. 0+750)
- Na Foraí Maola Thoir (Ch. 1+250 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)

11.9.44. The **cumulative impact** with the developments listed in Section 10.7.1 is considered to be negligible.

11.9.45. **Assessment**

11.9.46. I consider the potential significant impacts in terms of hydrogeology are:

- Adequacy of investigations and conceptual model.
- Groundwater pollution.
- Impact on groundwater levels (dewatering and recharge).
- Potential Impact on water quality in Ballindooley Lough, Moycullen Bogs and other wet habitats.
- Hydrogeological impacts on groundwater dependent Natura 2000 sites.
- Impact on wells and wastewater treatment systems.
- Potential groundwater flooding at Lackagh Quarry.
- Structural instability due to groundwater drawdown.
- Proposed Parkmore Link Road modification.

11.9.47. It should be noted that there is overlap with other topics which are addressed in sections 11.8, 11.10 and 10.10.

11.9.48. As noted above, the Board appointed Mr James Dodds of Envireau Water to assist with the assessment of this topic for the purposes of EIA. Mr. Dodds' report is included as Appendix 5 of this report and, while the assessment below references and is informed by Mr Dodds assessment, his report should also be read in conjunction with this section. Mr Dodds' report also informed the Appropriate Assessment section of this report.

Adequacy of Investigations and Conceptual Model

11.9.49. As outlined above, and in Section 2 of Mr Dodds' report, the geological and hydrogeological environment in the area of the PRD is complex, sensitive and significantly varied across the route alignment. Given this complexity, the potential for impacts to arise as a result of inadequate investigations or an incomplete understanding of the hydrogeological environment as typified by the conceptual model warrants careful consideration.

11.9.50. The area to the west of the N59 Moycullen Road is underlain by granite, while the area to the east of the N59 Moycullen Road is underlain by limestone. These two bedrock strata have entirely different geological, geotechnical and hydrogeological properties.

11.9.51. Granite is characterised by its strength, resistance to weathering and very low permeability which results in its inability to store or transmit water, other than in isolated and infrequent fracture zones. Consequently, the quantity of groundwater flow is very small compared to the surface run-off. In contrast, limestone is susceptible to relatively rapid chemical and physical weathering leading to a very large variation in properties such as permeability and groundwater flow termed 'the karst continuum'. In karst areas, the proportion of groundwater flow is very large compared to surface run-off.

11.9.52. In both bedrock areas more recent geological materials associated with glaciation and post glacial processes sit on top of an ancient (palaeo) land surface. The granite area would have had an undulating bare rock surface while the limestone area would have been characterised by steep and deep valleys and gorges draining a higher plateau. These were subsequently filled in by clay deposition during glacial retreat.

11.9.53. The locations of the relevant groundwater bodies (GWBs) relative to the PRD are identified in the EIAR and were elaborated upon at the oral hearing in the initial submission by the applicant's Hydrogeologist, Dr Brown, and in response to questioning by Mr Dodds. The correct definition of the GWBs is clearly a fundamental part of assessing the impact of the PRD and Mr Dodds notes that the site investigation work undertaken by the applicant shows that the Clare-Corrib GWB should be further sub-divided, as a result of the identification of the abovementioned deep clay-filled palaeo valleys, which create hydraulic barriers to groundwater flow within the GWB.

11.9.54. Based on the data and interpretation presented, Mr Dodds states that he is satisfied that the deep buried valleys are present and that, due to them, the sub-division of the Clare-Corrib GWB into the Lough Corrib Fen 1 (Menlough) and Lough Corrib Fen 1 (Lackagh) is warranted.

11.9.55. Lough Corrib Fen 1 (Menlough) lies north of Coolagh Lakes and Lough Corrib Fen 1 (Lackagh) forms a small GWB (<0.04km²) between Lough Corrib and Lackagh Quarry. Groundwater flows westwards within the Lough Corrib Fen 1 (Menlough) to the Coolagh Lakes and the River Corrib and supports Western Coolagh Spring (K25), a karst spring which provides groundwater flow to the upper lake of Coolagh Lakes.

11.9.56. The groundwater in Lough Corrib Fen 1 (Lackagh) is largely contained and disconnected from the Western Coolagh Spring (K25) due to the compartmentalisation by the deep buried valleys. Instead, groundwater flow from Lough Corrib Fen 1 (Lackagh) is likely to flow eastwards to Lackagh Quarry during peak groundwater levels, where it either evaporates or overflows into the Clare-Corrib (Ballindooley West) GWB. During periods of low groundwater levels, the groundwater in Lough Corrib Fen 1 (Lackagh) is likely to be effectively pooled and cannot move eastwards.

11.9.57. The functioning of Eastern Coolagh Spring (K45), which sits within Lough Corrib Fen 1 (Menlough), has been interpreted by the applicant as a discharge from superficial deposits and not a karst spring, due to the low permeability and thickness of the clayey subsoil. This is based on evidence from groundwater levels and measured flow rates which are not synchronous. Mr Dodds agrees that, if present, seepages

from the subsoil to the Eastern Coolagh Spring would represent a very small fraction of the groundwater contribution to Coolagh Lakes when compared to the karst inflow at Western Coolagh Spring and that the quantity and chemistry of the water in Coolagh Lakes is not materially affected by flows from the Eastern Coolagh Spring. I concur with Mr Dodds conclusion in this regard.

- 11.9.58. It should be noted that a number of further subdivisions of the Clare-Corrib GWB were also identified, generally resulting from the buried valleys.
- 11.9.59. With regard to the question of whether the applicant commissioned adequate investigations and undertook appropriate interpretation of the findings of these investigations, I note that these issues are addressed in Sections 3.2 to 3.12 of Mr Dodds report. Mr Dodds sets out details of the desk study, field investigations and baseline monitoring of groundwater level and chemistry undertaken by the applicant.
- 11.9.60. Groundwater monitoring was undertaken between February 2015 and April 2017. This included a total of 16 No. groundwater monitoring rounds. Measurements on individual wells were also taken during commissioning, well testing and spot checks. In total, 54 No. individual wells were regularly measured. While not all monitoring points were included in all monitoring rounds, the exceptionally high rainfall in the winter of 2015/16 resulted in high groundwater levels which were captured during the monitoring, allowing a groundwater high to be established in and around Lackagh Quarry.
- 11.9.61. Mr Dodds notes that all site specific investigation locations were sited based on the alignment and design of the PRD. In particular, groundwater level, groundwater quality and aquifer testing was focused on locations of cuttings, structures and receptors. With regard to the Natura 2000 related groundwater dependent receptors, these locations were investigated either by direct investigation, (e.g. water level monitoring), water sampling and analysis or by inference from the wider surveys (e.g. geophysics and groundwater level monitoring) to determine the hydrogeological regime relevant to them. Due to the ecologically sensitive nature of the Natura 2000 sites, the investigation methodologies selected were those that would not impact directly on the European sites.
- 11.9.62. Mr Dodds considers that the key data required in terms of undertaking the impact assessment and designing mitigation is the groundwater level, particularly high

groundwater levels, and aquifer permeability. He states that this data is fundamental to the definition of GWBs and the assessment of direct impacts as a result of dewatering. Mr Dodds concludes that, in his professional opinion, the applicant did commission and undertake appropriate investigations to adequately define the baseline hydrogeological conditions.

11.9.63. The results of these investigations were used by the applicant to develop a conceptual hydrogeological model. Mr Dodds challenged the conceptual model and its veracity during the course of the oral hearing, which resulted in several errata and correction documents being produced by the applicant, together with improved representation of the model. This did not materially change the conceptual model but provided a more robust baseline data set to support the model and made the understanding of the data easier.

11.9.64. Mr Dodds states that, in his professional opinion, appropriate interpretation of the findings of the investigations have been undertaken, enabling the applicant to develop a robust conceptual model which demonstrates a sufficient understanding of the hydrogeological environment. Having reviewed the information submitted by the applicant in the EIAR and at the oral hearing, I would concur with Mr Dodds that the applicant has demonstrated a clear and comprehensive understanding of the relatively complex and varied hydrogeological environment and I consider that this allows for the potential impacts of the PRD to be properly understood and assessed.

Groundwater Pollution

9.65. During construction and operation, there is a risk of groundwater pollution from hazards such as: concrete/grout pours; accidental spillages; fines (silt and clay) being washed from construction areas during storm events; accidents, fuel and other spills; run-off from the final pavement; and placement of geological materials with a different provenance from the specific locality.

11.9.66. Mr Dodds considers that these hazards pose a high risk to groundwater in the limestone areas, particularly where conduit pathways are present. The applicant seeks to mitigate these risks with the following measures:

- CEMP, including the Sediment, Erosion & Pollution Control Plan (SEPCP) and the Karst Protocol.

- The location, design and construction of wetland treatment and soakaway areas designed to the appropriate Standards.
- The drainage design, including the design of the infiltration basins, minimises the risk of a pollution event during operation affecting groundwater quality. In this regard, the risk of spillage is low (<0.5%) and any impacts that do accidentally occur will be temporary. The infiltration basin design also includes a containment area, hydrocarbon interceptor and a wetland treatment component and will promote settlement of fines and prevent entry of fines into the groundwater system.

11.9.67. The two bedrock types underlying the PRD have different chemical compositions, with the granite bedrock leading to base-poor, low pH water, while the limestone leads to base-enriched neutral or high pH water. Therefore, if limestone derived material is placed over granite bedrock, surface water run-off and/or groundwater from the placed limestone has the potential to locally impact local areas of peatland habitats by changing the pH of the run-off and/or groundwater. Mr Dodds considers that the consequence of such an impact on groundwater pH is likely to be imperceptible. Due to the largely chemically inert nature of granite, there are no water chemistry concerns in terms of hydrogeology where granite-derived materials are placed over limestone bedrock.

11.9.68. With regard to the CEMP, this summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the PRD and sets out the mechanism by which environmental protection is to be achieved. It has been prepared in accordance with industry best practice guidance including TII Guidelines and, as noted above, it includes the SEPCP which summarises the procedures and technical practices for implementing effective sediment, erosion and pollution control through a variety of delivery methods for the construction phase. The SEPCP demonstrates that run-off from the construction site can be controlled so as not to impact any receptors. The Karst Protocol, again contained within the CEMP, summarises the procedures and technical practices for the identification of karst conduits within the limestone during construction. Mr Dodds is satisfied that the full and proper implementation of the CEMP will ensure that any direct or indirect or ex-situ impacts on the non-Natura 2000 sites are avoided and on

that basis the mitigation proposals put forward by the applicant are justifiable and reasonable.

11.9.69. Within the western granite area, Mr Dodds states that, in his professional opinion, the residual risks are effectively zero. Within the eastern karst limestone area, he considers that residual risks remain due to the inherent, natural variation associated with the karst continuum. These residual risks relate solely to water quality as the design of the PRD maintains the water balance within each GWB and dewatering will not be undertaken in those GWBs with a direct link to Natura 2000 sites.

11.9.70. Mr Dodds considers that the residual risks associated with water quality are adequately mitigated by the CEMP and its associated SEPCP and Karst Protocol, as discussed above.

11.9.71. Given that the operational design of the scheme reduces the risk of contaminated water entering the ground by the provision of engineered treatment wetlands prior to soakaway areas and the incorporation of valves to hold back run-off from accidental spillages, Mr Dodds considers that the residual risks result from an incident or sequence of occurrences which overwhelm the system and/or poor maintenance of the mitigation. In the case of the former, this risk cannot be ever reduced to zero. However, the design of the systems is in line with relevant guidance and is robust. He notes that failure due to natural events will be associated with high rainfall and run-off and, therefore by definition, will be short-lived and associated with high volumes of dilution. In order to provide ongoing mitigation, he considers it important that that the drainage systems, treatment wetlands and soakaways are well maintained, in perpetuity.

11.9.72. Noting that risks of groundwater pollution are associated with all developments, Mr Dodds concludes that the measures proposed to mitigate the risks within the context of the PRD are concomitant with the nature and scale of the development and the level of the identified risks. Assuming that the CEMP is implemented in full and to a high standard, Mr Dodds states that it is his professional opinion that residual risk is very low and insufficient to undermine the conservation objectives for the River Corrib and associated lakes (or any other GWDTE in the SAC or surrounding area), and that, in the unlikely event that impacts occurred, they would be short-lived and insignificant. I agree with Mr Dodds' assessment and conclusion and consider that

the same conclusion can be drawn in respect of the residual water quality impacts on the wider hydrogeological environment. Finally, as I am satisfied that the water quality of the GWBs will not deteriorate due to the construction or operation of the PRD, I consider the PRD to be compliant with the requirements of the European Water Framework Directive.

Impact on Groundwater Levels (Dewatering and Recharge)

- 11.9.73. Mr Dodds notes that groundwater levels are a fundamental data set because they define: the location and extent of GWBs; the direction of groundwater flow; the requirement for dewatering of tunnels and cuttings; and together with permeability, the speed of groundwater flow. Clarification on groundwater levels and hydraulic gradients was requested as part of the Request for Further Information and was subsequently a strong theme of discussion between Mr Dodds and Dr Brown during the oral hearing and formed part of the corrigenda submitted during the hearing.
- 11.9.74. Based on the information submitted, the responses to questioning and the corrections submitted, Mr Dodds states that he is satisfied that the data collected and interpreted is sufficient to adequately understand the groundwater levels in and around the area, their seasonal variation, and their interaction with the PRD. I agree with Mr Dodds' conclusion on this matter.
- 11.9.75. The PRD has the potential to cause an impact on groundwater levels in the receiving environment as it will require the lowering of groundwater levels by dewatering of bedrock aquifers during construction and operation, in excavations which are deeper than the local groundwater level, at any particular time of the year. Dewatering of the bedrock aquifer will lower water levels locally which can have a direct impact on receptors which are within the Zone of Influence (Zol) of the dewatering and an indirect impact on receptors further away by diverting groundwater flows if the dewatered water is discharged outside the receptor's catchment area. In this case, the GWB is being taken as the catchment feeding a receptor, which Mr Dodds considers to be a reasonable conservative approach.
- 11.9.76. The extent of the Zol of any dewatering is dependent on the hydraulic conductivity and the drawdown imposed by the dewatering. The applicant has used what Mr Dodds considers to be a simple analytical method to calculate the Zol and he states that, in his experience, this method overestimates the value of Zol and, therefore,

gives a conservative estimate. I consider such a conservative approach to be appropriate given the nature of the receiving environment.

11.9.77. As the Zol calculation is sensitive to the value of permeability used, Mr Dodds questioned the applicant's representatives in some detail on the field testing and derived values of permeability and errata were consequently submitted during the oral hearing on this topic. The possible range of values of permeability for the granite area and the limestone area are very different and Mr Dodds considers that the methods that the applicant has used to measure permeability will produce a relatively narrow range of values. In the case of the granite area, Mr Dodds considers that the values obtained are an overestimate of the likely real values and, therefore, highly conservative in their assessment of the Zol. Mr Dodds considers that the applicant's approach may have overestimated the Zol by a factor of 10.

11.9.78. I note that the EIAR concludes that there will be profound residual hydrogeological impacts due to groundwater level drawdown impacts below the location of five Annex I habitats outside of the SAC, between chainages: Ch. 0+650 to Ch. 0+750; Ch. 1+250 to Ch. 1+500; Ch. 1+850 to Ch. 2+400; Ch. 3+300 to Ch. 3+900; and Ch. 4+800 to Ch. 5+900. Mr Dodds notes that the surface water ponding within wetland areas in the granite area is not derived from groundwater but rather is caused by ponding above rock head where the rainfall and runoff is perched and trapped by basins in the bedrock topography. Based on what Mr Dodds considers to be an overestimation of the Zol (as discussed above) his opinion is that, while dewatering of the cuttings in the granite area will remove water from the granite, based on the likely functioning of the bogs and the smaller Zol, there will be no material impact on the Annex I habitats. Where higher permeability fractures are encountered, the mitigation measures presented in the CEMP allow for the fractures to be grouted and sealed, thus preventing drainage.

11.9.79. While I generally agree with Mr Dodds assessment, which is from a purely hydrogeological perspective, I note that there will be direct impacts on portions of these habitat areas due to the fact that they are traversed by the proposed road alignment (refer to Figures 10.7.101 to 10.7.115). I consider, therefore, that there will be a profound impact on the portion of the habitats traversed by the PRD but that is due to the removal of the habitat rather than the hydrogeological impacts of drawdown. This issue is addressed in the Biodiversity section of this report.

11.9.80. In the limestone area, Mr Dodds notes that the values obtained represent one part of the karst continuum, which is recognised in the applicant's assessment and in the design of the road and construction mitigation. Mr Dodds considers that the values used in the Zol calculation and the way that the resulting numbers have been used and interpreted are reasonable and conservative. I agree with Mr Dodds' assessment of this issue.

11.9.81. Notwithstanding this, karst terrain, by its nature, is unpredictable at the construction scale and it is important that this uncertainty is managed through mitigation measures. Mr Dodds considers that the greatest risk with the PRD is the intersection of unknown and unknowable conduit flow systems, which could increase inflow to dewatering systems, greatly increase the Zol, and greatly increase the risk associated with contamination. Several design/mitigation measures have been incorporated into the scheme to protect the hydrogeological regime and minimise the risk to receptors, these include:

- No dewatering of the bedrock aquifer during construction at Menlough Viaduct or Lackagh Tunnel (and its approaches).
- During the winter groundwater high it may be necessary to limit the depth of works so that dewatering is not required in sensitive areas.
- Any groundwater intercepted will be collected and piped to the surface water receptor it would naturally have drained to within the granite area.
- In the limestone area intercepted groundwater will be controlled and infiltrated back to the same groundwater body from which it is abstracted.

11.9.82. I also note the provisions of the Karst Protocol contained within the CEMP.

11.9.83. There will be no active (pumped) dewatering required during the operation phase, but passive (gravity) dewatering of the bedrock aquifer will occur at a number of cutting locations along the alignment which will result in long-term lowering of the groundwater levels locally. Mr Dodds considers that this lowering has been assessed by the applicant in a conservative manner and that it will not impact directly on relevant receptors. In addition, all groundwater intercepted by the proposed road drainage system will be discharged back to the same GWB, thereby maintaining the overall recharge rate to the local aquifer.

- 11.9.84. Point discharges to groundwater from the infiltration basins will lead to local increases in the groundwater level. This, again, has been assessed conservatively and it has been found that it will not impact directly on sensitive receptors.
- 11.9.85. Mr Dodds conclusion, with which I agree, is that the risks associated with dewatering during the construction and operational phases have been approached and managed appropriately due to the conservative assessment of Zol in the granite area, the management of uncertainty in the limestone area and the design and mitigation measures put in place.
- 11.9.86. As well as the dewatering implications, the construction and operation of the PRD will change the manner and potential for groundwater recharge. As such, Mr Dodds considers that there is a small, but real risk of an impact to receptors. Aspects of the PRD which have the potential to affect recharge include:
- Vegetation and soil removal, leading to an increase in the quantity of rainfall reaching the bedrock surface. In the granite area this is most likely to increase run-off rather than recharge, while in the limestone area this is likely to increase recharge.
 - Pavement construction, which will lead to a loss of aquifer recharge area along the alignment of the road, and diversion of rainfall to run-off.
- 11.9.87. The CEMP provides for all run-off to be discharged either to the same surface water catchment in the granite area or the same GWB in the limestone area. As such, there will be minimal change to the quantity of water within the catchments although there will be small differences in the distribution of recharge/run-off at the small (local) scale. These changes will quickly dissipate at the medium scale and Mr Dodds states that, in his opinion, this does not pose a material risk at the catchment or GWB scale or on the cSAC/SPA scale. The exception to this is where the road pavement directly crosses the Lough Corrib cSAC, south of Menlough Castle. In this location the road pavement will prevent direct recharge to the underlying limestone. While the total quantity of groundwater reaching the cSAC will not change (due to the drainage arrangements), there will be a loss of rainfall reaching the bedrock surface directly under the pavement. This may have a negative impact on the flora below the elevated section of the pavement which is addressed in the Biodiversity and Appropriate Assessment sections of this report.

Potential Impact on Water Quality in Ballindooley Lough, Moycullen Bogs and Other Wet Habitats

- 11.9.88. Mr Dodds states that there are two mechanisms by which the water quality at Ballindooley Lough and/or Moycullen Bogs, or other wet habitats such as wet heath, could be affected by the PRD. The first is due to contaminated run-off during the construction or operation entering watercourses or groundwater and entering the lakes or other wet habitats. The other is a change in the provenance of water entering the lake or other wet habitats of such magnitude that it affects the chemistry of the water and the ecology that relies upon it.
- 11.9.89. I note that the then Department of Culture, Heritage and the Gaeltacht raised concerns regarding potential impacts to Moycullen Bogs NHA particularly with regard to potential high permeability pathways in the granite that may connect cuttings in the road alignment with the NHA. These issues were also discussed at the oral hearing.
- 11.9.90. Mr Dodds notes that all areas of the Moycullen Bogs NHA are in separate catchments or sub-catchments to road cuttings for the PRD. Based on assessment of each cutting, the maximum drawdown reach will remain with its own sub-catchment extent and, on this basis, the PRD will have no impact on the Moycullen Bogs NHA. As noted above, Mr Dodds considers the Zol calculations in the granite area to be extremely conservative, and while high permeability fractures in the granite may occur, their extent and continuous permeability are highly likely to be restricted, and any transmission of ground water will as a result be very small in comparison to the overall water balance which is dominated by rainfall.
- 11.9.91. I note that an additional environmental commitment was added to the final Schedule of Environmental Commitments submitted at the oral hearing, which states that in the unlikely event of significant flow paths (fault or fracture zones) being encountered in the Galway Granite Batholith during construction, measures set out in the Karst Protocol included in the CEMP will be implemented (Item 10.20). I consider that this is a suitably conservative mitigation measure.
- 11.9.92. Mr Dodds considers that the technical assessments undertaken by the applicant, the design of the scheme and the mitigation that is proposed demonstrate that the risks to the wet habitats in the granite area (i.e. the western area) including Moycullen Bog

are effectively zero. In the limestone area (i.e. the eastern area), and in the area of Ballindooley Lough (and Lough Corrib), Mr Dodds is satisfied that the applicant's technical assessment has shown that the lakes are effectively isolated from a significant groundwater flux, by virtue of thick underlying low permeability material. As such, he considers that any small effect on groundwater flow as a result of the PRD would have no material effect on the provenance and mix of the water chemistry. He also considers that the mitigation included in the design and management of the construction and operation of the PRD effectively reduces the risk of an impact on water quality in Ballindooley Lough and/or Moycullen Bogs, or other wet habitats such as wet heath, to essentially zero.

11.9.93. Mr Dodds concludes that, in his professional opinion, the risk of an effect with respect to a groundwater pathway or vector, sufficient to impact on the bird populations using the Galway Bay and Lough Corrib SPAs, is effectively zero. This matter is addressed in the Appropriate Assessment section of this report.

Hydrogeological Impacts on Groundwater Dependent Natura 2000 Sites

11.9.94. As noted above, Mr Dodds considers that the conceptual model demonstrates that the hydrogeology in the granite area is reasonably predictable while in the limestone area there is always a degree of uncertainty due to the naturally highly variable nature of the ground. He also considers that the potential impacts in the granite area are well understood and that the analysis of the hydrogeological data within the context of the hydrogeological conceptual model and the PRD demonstrates that there is effectively zero risk derived from possible changes in water quantity or quality on the integrity/conservation objectives of Natura 2000 sites, beyond scientific doubt.

11.9.95. In the limestone area, it is acknowledged that residual risks remain due to the inherent uncertainty in the hydraulic properties in karst terranes. To this end, it is noted that the design of the PRD incorporates features which, from a water management and hydrogeological perspective, will prevent potential impacts from occurring.

11.9.96. While Lough Corrib SPA is generally upstream of the PRD, a single outfall (the proposed drainage outfall for the N59 Link Road North) eventually discharges to a part of the River Corrib which falls within the SPA designation. It is also recognised

that the PRD also crosses GWBs that support groundwater dependent wetland habitats within European sites and traverses a number of watercourses that lie within or drain to a European site.

11.9.97. Therefore, the drainage of the scheme includes combined filter drains, carrier drains, surface water channels, narrow filter drains, cut-off and toe drains, attenuation ponds, grassed surface water channels, petrol and oil interceptors, wetlands and infiltration basins; in accordance with current TII Publications, guidance documents and industry best practice methods.

11.9.98. To maintain the existing water quality in receiving watercourses, flow control measures will be provided at all outfalls and discharge points along the length of the PRD mainline to ensure discharge does not cause any adverse effects on flow rates in the receiving watercourse or sewers and, where appropriate, to allow sufficient time for infiltration to discharge to the ground. As such, there will be 'no worsening' of flow rates outside of the site boundary up to the 1 in 100 year storm event.

11.9.99. Within the limestone area, a sealed drainage system is provided to protect the underlying sensitive aquifers, and the drainage design takes into account the distribution of groundwater bodies so that rainfall remains within the groundwater body to which it would naturally recharge.

11.9.100. Pollution control measures are provided on all networks on the PRD mainline prior to out-falling/discharging to ensure that receiving water bodies are not contaminated by run-off during the construction or operational phases.

11.9.101. To maintain the existing hydrogeological regime and minimise the risk of impacts to groundwater quality in receiving GWBs, there will be no groundwater lowering within groundwater bodies that support groundwater dependent habitats within a European site.

11.9.102. All infiltration basins include systems to remove floating hydrocarbons, dissolved metals in road run-off and suspended solids by incorporating a hydrocarbon interceptor and an engineered wetland, and include a containment area to provide an appropriate holding time to contain accidental spillages. The basins will be over excavated by 2m to accommodate the provision of a minimum of 2m thickness of appropriate subsoil (as per TII definition in HD45/15) to provide a further attenuating layer for dissolved or suspended contaminants in the road run-off.

11.9.103. As such, Mr Dodds considers that the combination of the engineered wetlands with the infiltration basins and associated features, provides an appropriate level of protection to prevent contamination of groundwater from the road run-off.

11.9.104. The area around the Lackagh Tunnel and the Menlough Viaduct is particularly sensitive due to the potential for an impact on the Lough Corrib GWB and in turn on the Lough Corrib SAC. Mr Dodds considers that the applicant has put considerable effort into understanding the hydrogeology in this area and the interactions between GWDTE, lakes, groundwater, and the PRD. As a result, the design of the PRD around Lackagh Quarry does not allow dewatering of the bedrock aquifer to be undertaken in association with Lackagh Tunnel and its western approach, and the Menlough Viaduct.

11.9.105. To avoid construction of the Lackagh Tunnel affecting QI Annex I habitats in Lough Corrib SAC or affecting the existing hydrogeological regime supporting wetland habitats in Lough Corrib SAC, a series of design and construction protocols are proposed, including:

- The Lackagh Tunnel is a mined (drill and blast) twin-bored tunnel located beneath the Lough Corrib SAC. Each bore maintains at least 8m clear rock above the crown of the tunnel to the top of the Lough Corrib SAC ground surface, and there is a 7m wide pillar separating the twin bores.
- Stabilisation of the western quarry face will be completed in advance of tunnelling works including a composite support system of rock bolts, rock dowels, steel mesh and sprayed concrete.
- Blast design and limitations are set out and include a conservative design approach and vibration limit. A monitored trial blast will be undertaken in the same bedrock formation and used to calibrate and refine the blast design to a site-specific design.
- The infiltration basin in Lackagh Quarry has been designed to retain the natural recharge pattern by maintaining recharge to the groundwater body below.

- In order to maintain recharge catchments, any inflows into the tunnel during construction will be managed by designing them to infiltrate to the floor of the tunnel until their inflow is sealed off.
- All construction works will remain above the local groundwater level for the duration of the works to ensure that the groundwater is not intercepted and dewatering of the bedrock aquifer is not required. The construction schedule will be tailored so that the excavation of the lower section will occur when the groundwater level is low and is below the construction level.
- The tunnel will be fully lined with concrete.
- On the western approach to Lackagh Tunnel a watertight seal will be installed on the underside of the road base and the cutting sides to protect against groundwater inflow and prevent contamination of groundwater.
- Retaining systems are included at pinch point locations to prevent encroachment on Annex I habitats.
- The retaining walls on the western approach will be watertight to a level of +17.7mOD to seal out any groundwater in the subsoil or bedrock and will prevent contamination of groundwater.

11.9.106. Mr Dodds considers that, while other parts of the PRD within the limestone area have the potential to impact on the groundwater system, they are not in direct contact with Natura 2000 sites and only have weak connections or pathways associated with the Inner Galway Bay SPA and Galway Bay Complex cSAC and do not pose a direct risk to either.

11.9.107. The then Department of Culture, Heritage and the Gaeltacht¹⁵ also raised a number of concerns regarding groundwater interaction between Lackagh Tunnel, Lough Corrib Fen 1 GWB and Lough Corrib SAC and whether groundwater flow paths would change post-construction.

11.9.108. In response to these concerns, Dr Brown provided further clarity and a comprehensive explanation describing the interaction between groundwater and

¹⁵ Now Dept. of Housing, Local Government and Heritage

surface water at the European sites, including the Lough Corrib SAC. These topics were also discussed at the oral hearing.

11.9.109. In summary, Coolagh Lakes are fed primarily from one significant groundwater spring, Western Coolagh Spring. The habitat around the periphery of Coolagh Lakes is identified as being water dependant and, as such, the habitats at Coolagh Lakes are GWDTE. Mr Dodds considers that robust mitigation measures have been designed so that flows to Western Coolagh Spring are not affected during any phase of the development. He is also satisfied that karst specific measures incorporated into the construction design will ensure that groundwater flow paths will not change post-construction.

11.9.110. I concur with Mr Dodds assessment of the applicant's response to the Department's queries and consider that all issues raised by the Department in relation to hydrogeology have been adequately addressed.

11.9.111. In conclusion, based on the conceptual model, the differences between the granite and limestone areas, and the design considerations of the PRD included to protect Natura 2000 sites, Mr Dodds' professional opinion is that the applicant has provided sufficient analysis to rule out any potential impacts derived from changes in groundwater quantity and quality on the integrity/conservation objectives of Natura 2000 sites, including the River Corrib, GWDTE and including consideration of any supporting aquatic habitats outside the Natura 2000 sites, such as Coolagh Lakes, beyond all reasonable scientific doubt. I agree with Mr Dodds conclusion on this matter in terms of hydrogeology, noting that these issues are also addressed in the Appropriate Assessment section of this report.

Impact on Wells and Wastewater Treatment Systems

11.9.112. A number of submissions contend that the PRD will impact on private domestic wells or commercial wells. The potential for such impacts is primarily related to lowering of groundwater levels, reducing the supply at the well or a deterioration in water quality. It is also contended in a number of further submissions that the PRD will negatively impact on wastewater treatment systems, due to groundwater level rises impeding the operation of percolation areas.

11.9.113. Dr Brown, in his submission to the oral hearing on 20th February 2020, responded to these submissions/objections and provided further information and

clarification on the assessments undertaken and put these in the specific context of the objections raised. Mr Dodds challenged aspects of Dr Brown's submission, resulting in erratum and additional clarification being submitted during the hearing. As part of this, four water supply wells that were not identified in the EIAR were assessed using the methods described in Chapter 10 of the EIAR. The assessment provides mitigation for impacts and, where necessary, identifies those wells that will need to be decommissioned and replaced.

- 11.9.114. Also of note is the proposed monitoring programme outlined in the EIAR, whereby all wells within 150m of the PRD boundary (or 50m from the calculated Zol if greater) would be monitored to ensure that any changes that occur during construction are identified quickly and a replacement water supply established. This monitoring programme includes monitoring of water quality and level for a year prior to any construction occurring, continuing throughout the construction period and for a further year into the operation of the PRD. Where impacts are detected, the applicant has committed to arranging an alternative supply. I consider that the applicant has proposed a comprehensive system of monitoring and mitigation that will address potential impacts on private wells.
- 11.9.115. Two submissions were made in relation to a geothermal well at a dwelling on the Parkmore Road, Ballybrit. The geothermal well in question is located outside the zone of influence of the PRD and, therefore, I am satisfied that it will not be impacted.
- 11.9.116. The four commercial wells identified in the objections that will be impacted by the PRD relate to Clada Group Ltd. which operates a water bottling plant and Galway Racecourse. Clada Group Ltd. have withdrawn their objection and the applicant's proposed mitigation measure in respect of Galway Racecourse is to provide alternative replacement wells. The proposed replacement wells lie within the same limestone aquifer but beyond the extent of drawdown and water quality impacts of the PRD and will be subject to testing to confirm comparable groundwater quality prior to the current wells being decommissioned. I consider this to be an appropriate mitigation measure.
- 11.9.117. With regard to the potential impact of the PRD on private water treatment systems reliant on percolation areas for treated effluent, these are examined in

Section 4.6 of Dr Brown's submission. In summary, the locations in question are adjacent to cuttings where groundwater is likely to be lowered, rather than raised. For this reason, the percolation areas highlighted in the submissions/objections are not considered to be at risk from the PRD. I concur with this assessment.

Potential Groundwater Flooding at Lackagh Quarry

11.9.118. The concerns raised regarding the flooding of Lackagh Quarry primarily relate to the level that the water level will rise and the mobilisation of suspended solids. Patrick McDonagh also raised concerns regarding the nature of flooding in the quarry and the implications for nearby residents in his submission to the oral hearing on 24th February 2020. The hydrogeology of the Lackagh Quarry area has been studied in detail and the design of the PRD through all the phases takes account of the full range of seasonal groundwater levels, including peak conditions experienced in the winter of 2015/2016, to ensure that the design is robust and does not alter the current groundwater regime. I note that Dr Brown confirmed in response to Mr McDonagh's submission that the existing flooding that occurs within the quarry is due to groundwater ingress and that the quarry is not acting as a store for surface water, and hence the deposition of material in the quarry will not displace water. Mr Dodds concludes that the mitigation measures put forward with respect to the design, construction and vegetation of the material deposition areas (MDAs) will prevent fines from being mobilised into the groundwater system. Issues associated with the proposed MDAs in the quarry are addressed in Sections 10.10 and 11.8. However, I agree with Mr Dodds' assessment in respect of hydrogeological issues at the quarry.

Structural Instability due to Groundwater Drawdown

11.9.119. Gerard and Susan O'Dell, in their written objection, raised concerns regarding the structural stability of their house where groundwater levels are to be lowered due to its location adjacent to cuttings. This property is located at c. Ch. 1+200 and is on the edge of the zone of influence created by drainage from the cutting. Based on the information provided, Mr Dodds is of the opinion that groundwater levels at this particular location may be reduced, but only by a very small amount. He considers that the risk of settlement is very low, but notes that the applicant has agreed that a property condition survey will be undertaken.

11.9.120. While I agree with Mr Dodds and the applicant that the risk of drawdown related damage to properties is very low, and that the Zol calculations are conservative, I note that the commitment to undertake property condition surveys relates to properties within 50m of the PRD boundary, increasing to 150m in areas where blasting works are proposed (Item 17.19 in the SoEC). I recommend that this commitment be broadened to ensure that all buildings within 50m of the proposed development boundary or the zone of influence of dewatering (whichever is greater) are offered a property condition survey.

Proposed Parkmore Link Road Modification

11.9.121. The implications of the proposed Parkmore Link Road modification for the hydrogeology assessment were briefly addressed by Dr Brown in Section 3.12 of his submission to the oral hearing. He stated that the proposed modification will have no effect on the hydrogeology assessment results contained in the EIAR, NIS and RFI Response. Having regard to the nature and location of the proposed modification, I would concur with this assessment.

Conclusion on Land, Soil, Water, Air and Climate – Hydrogeology

11.9.122. I have considered all of the written and oral submissions made in relation to hydrogeology matters, in addition to those specifically identified in this section of the report.

11.9.123. I am satisfied that potential impacts would be avoided, managed and mitigated by the measures which form part of the proposed scheme, the proposed mitigation measures and through suitable conditions. With regard to the profound residual impacts on certain areas of Annex I habitat outside of the SAC, as identified by the applicant, I consider that these impacts are associated with the loss of habitat where it is traversed by the PRD rather than due to the hydrogeological impacts of drawdown, noting the overestimation by the applicant of the drawdown zone of influence in the granite area.

11.9.124. I am therefore satisfied that the proposed development would not have any unacceptable direct, indirect or cumulative impacts on hydrogeology.

11.10. Land, Soil, Water, Air and Climate – Hydrology

11.10.1. Hydrology is addressed in **Chapter 11** of the EIAR and a series of associated Figures are contained in Volume 3 of the EIAR. Figures 11.1.001 and 11.1.002 identify the drainage catchments, while the series of Figures 11.2.101 – 11.2.115 and 11.3.001 – 11.4.115 relate to flood risk mapping. Figures 11.5.01 – 11.5.115 indicate the proposed drainage network, while Figure 11.6.001 relates to proposed flood relief measures on the N83 Tuam Road. Appendix A.11.1, contained in Volume 4 of the EIAR, is a Flood Risk Assessment Study and Appendix A.11.2 relates to water quality monitoring of selected surface waters. A Hydrology assessment is also contained in Appendix B of the NIS. The Schedule of Environmental Commitments, which was updated at numerous stages over the course of the oral hearing, also sets out commitments in relation to hydrology. A Corrigendum (Ref. 15), correcting various errors and omissions in the EIAR, was submitted at the oral hearing on 21st February 2020.

11.10.2. A submission responding to the hydrology-related written submissions/ objections, was given at the Oral Hearing on 20th February 2020 by Anthony Cawley of Hydro Environmental Ltd. on behalf of the applicant (Ref. 16). A number of parties subsequently made further hydrology-related submissions over the course of the oral hearing, including questioning of, and further submissions by, Mr Cawley. These matters are addressed, where necessary, below.

Methodology

11.10.3. In terms of **methodology**, the applicant states that they have followed the guidance contained in the NRA 'Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII Guidelines). They have also had regard to EPA guidance on EIA and the 'Flood Risk Management and the Planning System' guidance document.

11.10.4. The extent of the study area for the hydrology assessment is defined as the lands within a 250m buffer of the proposed development boundary and the associated upstream and downstream catchments. These catchments are illustrated in Figures 11.1.001 and 11.1.002 of the EIAR. Field surveys, walkovers and detailed stream surveys were undertaken where hydrological impacts were likely to occur without mitigation. All culvert and bridge crossing locations, proposed road drainage outfall

locations and ecologically sensitive areas were visited, and field measurements carried out along with reconnaissance of potential flood risk areas including site visits during the December 2015/January 2016 winter flood event. Surface water quality monitoring was carried out of all the main watercourses associated with the potential outfall receptors.

- 11.10.5. The key hydrological attributes identified include: European sites; Annex I dependent habitats; Surface drinking water supply abstraction source from River Corrib at Jordan's Island; Ecologically sensitive surface water features and catchment systems, fishery streams, fens, flushes etc.; and Flood Risk Areas.
- 11.10.6. It is stated that hydrological impacts fall into two broad categories of quantitative (i.e. changes to flows and levels) and qualitative impacts (i.e. water quality impacts).

Receiving Environment

- 11.10.7. With respect to the **receiving environment**, it is stated that one proposed road drainage outfall from the proposed N59 Link Road North discharges into the Lough Corrib SPA and SAC. All remaining outfalls are located downstream of the Lough Corrib SPA with two proposed discharging directly into the SAC. The NUIG pitches also indirectly discharge into the SAC. The PRD intercepts several watercourses, principally to the west of the River Corrib, which will require culverting to maintain existing hydraulic connectivity. To the east of the River Corrib, due to the highly karstic nature of the terrain, there is a very sparse network of surface water drainage channels, ditches and stream channels.
- 11.10.8. All of the rivers, streams, drains, lake features and groundwater bodies along the route of the PRD eventually outfall into Galway Bay via the River Corrib Estuary or directly and indirectly to coastal and transitional waters via the coastal watercourses or via groundwater flow through both diffuse and preferential karst conduit flow pathways. The study area falls within the Western River Basin District (WRBD), which has classified the transitional coastal waters as good status, the coastal waters as moderate status and Lough Corrib as moderate lake quality (previously classified as poor). The majority of the watercourses and lakes within the study area do not have their status assigned. The only watercourses that have been classified are the Terryland River which has a water quality status of poor, the River Corrib which has a status of good and the lower reach of the Bearna Stream which was

previously given a pass classification and is currently unassigned. The applicant states that the design approach to waterbodies is to maintain or improve the hydrological regime and that this aligns with the objectives of the Water Framework Directive and the Western River Basin Management Plan to achieve Good status for all of its surface watercourses.

11.10.9. There are five principal hydrological drainage catchments and their sub-catchments intercepted/potentially impacted by the proposal. These are: Sruthán Na Libeirtí Stream; Trusky Stream; Bearna Stream; Knocknacarra Stream; and the Corrib Catchment, including River Corrib, Coolagh Lakes, Terryland River and Ballindooley Lough System. Each catchment is described both in terms of catchment, ecological status, surface water quality and water supply source.

11.10.10. The Galway City Water Treatment Works at Terryland currently abstracts water from the River Corrib via an intake channel at Jordan's Island and supplies up to 55,000m³ per day. The regional Galway County Water Supply abstraction is from Lough Corrib at Luimnagh which is 15km upstream of the PRD and stated to be not within the zone of influence of the PRD.

11.10.11. Excluding the River Corrib, there are a total of 17 No. stream road crossing sites that will require culverting. 16 No. of these are in the western section and 1 No. is in the eastern section. Table 11.19 of the EIAR lists the proposed watercourse crossing locations and Table 11.20 sets out the sizes of the proposed culverts. It is stated that Section 50 approval has been obtained from the OPW for these culverts.

11.10.12. The River Corrib bridge is stated as being a cantilevered structure spanning over the river banks and provides a clear span between support piers of 153m. This clear span is sufficient to allow the support piers to be set back from the channel bank and thereby reduce encroachment of the river channel and its flood banks. This is stated to meet IFI Fisheries requirements.

11.10.13. All culverts and the River Corrib bridge are designed to prevent impact to watercourse morphology and to prevent impoundment or alteration of surface water flow hydrodynamics.

11.10.14. There are 16 proposed mainline surface water outfalls discharging directly to surface watercourses, located primarily in the western section. The remaining surface water outfalls will be discharged to groundwater or existing public storm and

foul sewer systems in the absence of surface water drainage features. The two tunnels will discharge to the public foul sewer via pumping, with impounding sumps provided for each tunnel to collect accidental spillages.

- 11.10.15. No major river realignment work will be necessary. Some minor stream and ditch realignment is required as listed in Table 11.25.
- 11.10.16. The proposed pollution control features are set out in Table 11.26 and include combined filter drains, detention ponds, grassed surface water channels, petrol and oil interceptors, wetlands and infiltration basins. The use of filter drains and grassed surface water channels are proposed in non-sensitive groundwater areas (granite bedrock areas west of N59 Moycullen Road) and closed (sealed) drainage systems are proposed in the highly vulnerable Karst Aquifer region east of the N59 Moycullen Road. A Treatment wetland will also be provided upstream or in combination with the attenuation pond at all proposed surface outfalls from the proposed mainline and new link road catchments and upstream of all infiltration basins to provide primary treatment of road runoff.
- 11.10.17. A total of 33¹⁶ site areas have been identified as potential Material Deposition Areas (MDAs) for the excess soft and unacceptable material along the route of the PRD. The locations of the MDAs and their capacity is set out in Table 11.27 (refer to corrected version submitted in the Corrigenda document at the oral hearing).

Potential Impacts

- 11.10.18. It is stated that the principal **potential hydrological impacts** are associated with the proposed crossing points and the potential for sediment loading and associated road drainage pollutants entering such watercourses during construction and operation. There is also potential for impacts to surface water hydrology from other sources. Table 11.28 provides an impact assessment of proposed watercourse culvert crossings at construction phase and operational stage. The River Corrib bridge construction avoids work within the river channel (with the exception of drainage outfalls 18A and 18B). Extensive earthworks will be associated with the development of the NUIG pitches at Dangan¹⁷ and the potential for partial flood

¹⁶ Incorrectly identified as 40 in the EIAR.

¹⁷ As noted earlier, during the Oral Hearing it was confirmed that this work is no longer being carried out as a mitigation measure.

inundation at the 100-year flood for construction runoff pollution exists. The construction of watercourse crossings will necessitate in some cases the localised diversion/realignment of existing watercourses. There are a number of potential impacts associated with this, particularly during construction phase with the potential for soil erosion and contamination. The operational impact of the realignments will be very localised to morphology changes in the stream channel during large floods which are noted as stabilising over time.

11.10.19. During operation the storm outfalls have a potential to adversely impact water quality in the receiving watercourse and groundwater. Water quality and ecological status are also potentially threatened by contamination arising from large liquid spillages.

11.10.20. Potential pollutants due to routine road runoff are considered in detail in Section 11.5.4.2. A Highways Agency Water Risk Assessment Tool (HAWRAT) assessment has been carried out for all mainline drainage outfalls directly discharging to surface watercourses. This assessment was undertaken in the absence of the proposed drainage design measures including petrol interceptors, water quality treatment ponds etc. and as such is stated to be a worst-case assessment.

11.10.21. Table 11.38 presents the Water Quality Impact Assessment.

11.10.22. Detailed assessments of the River Corrib, Coolagh Lakes and Ballindooley Lough are provided using the results of the HAWRAT assessment, including dispersion modelling of the discharges to the River Corrib.

11.10.23. With regard to the impact of routine road drainage run-off on the water quality of the Terryland water supply abstraction point, this is stated to be imperceptible. The outfall spillage risk assessment indicates very low potential for serious accidental spillage and by the provision of outfall control facilities, the potential impact from the operational impact is rated as slight. The construction impact is rated as a potential slight to moderate temporary impact. It is stated that a serious spillage has significant consequences and mitigation measures to prevent construction based activities polluting the River Corrib are necessary.

- 11.10.24. **A Flood Risk Assessment (FRA)** of the PRD was also carried out. The assessment investigated the potential flood risk to the road itself and the potential flood impact arising from the PRD.
- 11.10.25. The vertical alignment has been found to be sufficiently clear of flooding under both present day and future climate change scenarios. The River Corrib bridge is considered not to present a residual flood risk as the structure completely spans the floodplain width. There is minor encroachment by the embankment of the road near the Coolagh Lakes but this is considered to represent a very minor encroachment and will not result in a perceptible impact on flooding. The proposed redevelopment of the NUIG pitches at Dangan represent a slight encroachment of the River Corrib's 100 year and 1000-year flood zones but the potential loss of floodplain storage is considered miniscule in comparison to the available flood storage. A slight encroachment on the Ballindooley Lough flood zone by the embankment is predicted and the effect is assessed as minor and the impact as a slight permanent impact. The potential risk of flooding in the Lackagh quarry has been reduced to slight by design through raising the minimum road level at the tunnel portal entrance by 1m above the historical worst flooding event.
- 11.10.26. Near the N83 Tuam Road at Twomileditch a large pluvial flood risk area is encroached. The area has significant flood risk with up to seven dwellings and the carriageway of the N83 currently at high risk of flooding and it is stated that the Local Authority regularly deploy pumps to clear flooding. Without suitable mitigation the PRD has the potential to remove flood storage and worsen the flood risk at this location, resulting in a significant permanent impact on flood risk.
- 11.10.27. The potential impact on European sites and water dependent habitats outside of a European site are considered. Table 11.42 identifies the potential impacts on Lough Corrib SAC and SPA. It is noted that the River Corrib bridge crossing will not involve any in-stream works but piers are to be located on either bank which can give rise to site runoff entering the river during works. Two bank side drainage outfalls are to be constructed which given their proximity the river flow makes it difficult to prevent local disturbance of sediments. Good dilution significantly lessens the potential impact on receiving waters. During operation, as noted above there is encroachment of the floodplains. Table 11.43 identifies the potential impacts on Galway Bay Complex cSAC and Inner Galway Bay SPA.

Mitigation Measures

11.10.28. **Mitigation measures** are addressed in Section 11.6 of the EIAR where avoidance of the feature has not been possible. During the construction phase the CEMP will be implemented, including an Incident Response Plan, Sediment Erosion and Pollution Control Plan, obtaining necessary consents and consultation with IFI, NPWS and OPW. Various other measures derived from a series of identified guidance documents are also proposed. It is considered that the potential for construction phase impacts on receiving streams and lakes and the River Corrib has been reduced to slight and imperceptible as a result.

11.10.29. **Flood Risk mitigation** is addressed with respect to the operational phase. The flood risk area adjacent to the N83 at Twomileditch was identified as being significantly impacted. Flood relief measures are included, including flood compensation storage, provision of storm drainage on the N83 at this location and a pumping station to discharge to the existing storm sewer.

Residual Impacts

11.10.30. It is stated that the **residual hydrological impacts** associated with the proposal are related to: drainage and flood risk; water quality; channel morphology; and potential impacts on key ecological receptors. It is summarised that potential hydrological impacts from the proposal have been identified and assessed. Appropriate design and mitigation measures have been incorporated to remove any risk of significant hydrological impact on the receiving environment. It is concluded that there are no significant residual hydrological impacts due to the proposal. There are no significant **cumulative impacts** anticipated in combination with other specified projects.

11.10.31. **Assessment**

11.10.32. I consider the potential significant impacts in terms of hydrology relate to:

- Adequacy of drainage proposals.
- Water quality impacts.
- Risk of contamination of Terryland Water supply.
- Flood risk.

- Irish Water Requirements.
- Proposed Parkmore Link Road modification.

11.10.33. It should be noted that there is overlap between this section and other topics which are addressed in sections 11.8, 11.9 and 10.9.

Adequacy of Drainage Proposals

11.10.34. Many observers raised concerns about the drainage proposals and impacts on individual properties and retained lands (where affected by the CPO) and, in particular, that inadequate drainage details had been provided, such as details pertaining to realignments, drains that are severed, culvert details and outfall locations.

11.10.35. Mr Anthony Cawley, the applicant's hydrology specialist, provided a response to this issue in his submission to the oral hearing (Ref. 15). He stated that the drainage system is designed in accordance with TII current design standards and best practice guidance and that it includes climate change allowances and robust design to avoid any unacceptable impacts on flood risk, both to the PRD and to third party lands and to avoid any unacceptable pollution impact on receiving surface waters and groundwaters from the proposed road drainage discharges.

11.10.36. As detailed above, the PRD crosses two very distinct geological regions with different hydrological environments. The area to the west of the N59 Moycullen Road is underlain by granite bedrock and has high surface run-off characteristics and a relatively dense network of drains and watercourses. In contrast, the area to the east of the N59 Moycullen Road is underlain by karst permeable limestone bedrock with low surface run-off characteristics and an almost non-existent surface drain network. The applicant has consequently developed separate drainage proposals for these two discrete receiving environments, with the western section outfalling to watercourses via attenuation ponds and the eastern section requiring infiltration to groundwater via infiltration basins.

11.10.37. The proposed road pavement drainage network is described in detail in the EIAR and illustrated in Figures 11.5.01 – 11.5.02 and 11.5.101 – 11.5.115 as well as in the Design Report included in Appendix A.10.1 of the applicant's RFI Response. These figures show the road drainage network, culvert locations, attenuation ponds,

infiltration basins, outfalls and stream/drain diversions and I am satisfied that there is no substantive lack of clarity or ambiguity regarding the applicant's drainage proposals.

11.10.38. The proposed drainage system will capture rainfall runoff from the mainline carriageway, link roads and all new sections of local and regional roads and will direct it to attenuation ponds/infiltration basins as appropriate, preventing it from discharging directly to the receiving surface waters. The drainage system has been designed in accordance with TII current design standards and is responsive to the differing geology and groundwater vulnerability east and west of the N59 Moycullen Road, with a sealed system proposed on the eastern portion. Accordingly, I consider the proposed drainage system to be acceptable in principle. Potential pollution issues are addressed separately below.

11.10.39. I consider it to be notable that the drainage network for the PRD has been divided into a large number of relatively small drainage catchment areas, with a total of 54 No. outfalls. This relatively small drainage area for each outfall (average of 1.2 ha road pavement area) generally retains water within existing localised catchments and reduces the overall flood risk, in my opinion.

11.10.40. With regard to the proposed culverting of watercourses and drains I note that, under Section 50 of the Arterial Drainage Acts 1945 and 1995, culverting of streams by either new, upgraded or extended culverts/bridges requires approval from the OPW. The applicant has confirmed that Section 50 approval has been obtained from the OPW for these culverts¹⁸. While Inland Fisheries Ireland (IFI) did not make a submission, I note that the applicant consulted with them in the course of preparing the EIAR and has committed to ongoing liaison/consultation in the construction phase. It is stated that construction will comply with various guidance documents regarding fisheries protection, including the IFI 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, 2016'. Various other fisheries protection measures are also outlined in the EIAR and the associated SoEC and are considered to be acceptable.

¹⁸ Copies of the section 50 applications and associated documentation, and the OPW approval are included as Appendices to the Flood Risk Assessment included in Appendix A.11.1 of the EIAR.

11.10.41. Mr Cawley stated that the flows in the watercourses to be culverted have been quantified and that crossings have been designed in accordance with the OPW and TII requirements for such works. All culverts have been designed so as to minimise impact on both upstream and downstream flood conditions and are designed for a flood with a return period of 1 in 100 years plus a climate change allowance and with a minimum of 300mm freeboard clearance. The applicant contends that the potential impact of the proposed culvert and bridge structures on flood water level and flood risk to properties is rated as imperceptible. Considering that the culverts have been designed to the appropriate standards and are correctly sized to provide adequate allowance for climate change, I am satisfied that there will not be any unacceptable impacts associated with this aspect of the project and I consider that adequate details have been provided.

11.10.42. Concerns regarding the proposed infiltration ponds/attenuation basins were raised by a number of parties, including the locations chosen and potential flood risk, as well as the details such as the fencing and screening proposed. The fencing and landscaping of ponds is dealt with in section 11.14, however, I note that all attenuation pond facilities will be securely fenced and planted with appropriate scrubs, hedgerows and/or screen planting to minimise any visual impacts.

11.10.43. At the oral hearing, the applicant stated that the attenuation ponds and flow control measures will restrict the outfall discharge to greenfield runoff rates, thereby avoiding potential significant impacts to channel morphology and flow regime at the local scale. With regard to the siting and sizing of the ponds, the applicant stated that the locations were selected and designed so that the road drainage runoff can gravitate to the ponds, and that they are of a sufficient size and volume to achieve the required attenuation for the 1 in 100-year return period storm event with additional freeboard to provide a factor of safety and an additional 20% allowance for climate change incorporated. The attenuation ponds also need to be sited reasonably close to the main surface water outfall locations to drain each area. With regard to the area to the east of the River Corrib, where discharge will be to ground via infiltration basins, as detailed in Section 11.9 above, the Board's consultant Hydrogeologist is satisfied that the applicant has demonstrated a comprehensive understanding of the underlying geological and hydrogeological characteristics of the study area.

11.10.44. A number of specific queries relating to individual properties and proximity to ponds were also addressed at the oral hearing. Ms Ruth Molloy, in her submission to the oral hearing on 25th February 2020 on behalf of Galway Athletics Board, queried the proposed location of attenuation ponds in the vicinity of the River Corrib and potential contamination of groundwater and the River Corrib. She also contended that freshwater mussels are present in the River at this location and would be affected by water pollution. This issue is addressed in the Biodiversity section of this report. Mr Cawley's response was that the PRD would not encroach on the River and he noted that many roads in the City currently discharge unattenuated and untreated run-off to surface water. In contrast, the design of the PRD will address these matters due to the attenuation and treatment ponds which will allow the primary pollutants (i.e. silt and sediment) to settle out. In response to further questions from Ms Molloy and the Board's consultant Hydrogeologist the applicant confirmed that dewatering of the River Corrib bridge piers during construction had been allowed for, with water discharged to settlement ponds prior to discharge.

11.10.45. Ms Maura O'Connell and Ms Audrey Dineen, in their joint submission to the oral hearing on 3rd March 2020, contended that the attenuation ponds in the vicinity of their houses in Troscaigh West, Bearna would result in flood risk, and queried who would be legally responsible if flooding occurred and queried the details of the maintenance programme for the ponds. Mr Cawley responded that the ponds were appropriately sized with regard to climate change and run-off and noted that an overflow spillway to a watercourse is proposed which, in the event of a blockage to the flow control outlet, will take excess water to control flood risk to nearby properties. He noted that residential developments often included similar attenuation ponds and stated that they are suitably engineered and will not change the flood risk status of the houses. With regard to maintenance, he stated that the Council would be responsible for the ponds. The objectors stated that the response given by Mr Cawley contradicted information previously given to them by the applicant. Notwithstanding this, I consider Mr Cawley's response to be consistent with the information contained in the EIAR and associated documentation.

11.10.46. Galway Property Management, in their written submission, sought that the proposed attenuation ponds at the S17A outfall (At N59 Link Road South and Ragoon Road Junction) be replaced with underground tanks to minimise the visual

impact at this location. Mr Cawley's response at the oral hearing was that the open ponds were sized to enable the capture of first-flush runoff and to provide the necessary attenuation storage to achieve greenfield runoff rates. The design approach of providing ponds as opposed to tanks is due to the need to provide a biological function for water quality improvement, for ease of inspection/maintenance and for timely identification of potential harmful hydrocarbon and chemical spillages. The use of ponds, rather than tanks, is typical for such roads, and subject to appropriate landscaping planting and fencing, as proposed, I consider the principle of providing ponds to be preferable from an environmental protection perspective.

11.10.47. With regard to land drainage, concerns regarding the drainage of retained lands were raised by many parties. This issue is also addressed in respect of agricultural lands in Section 11.16 of this report, which relates to Material Assets – Agriculture.

11.10.48. Detailed drawings of the proposed land drainage proposals are provided on Drawings GCOB-500-D-101 to GCOB-500-D-132, contained in the Design Report which was submitted as part of the RFI Response. This illustrates the proposed pre-earthworks drains/interceptor ditches which will intercept the overland flow from adjoining lands flowing towards the PRD, both during construction and the operational phases. The ditches have been sized to cater for a 1 in 75-year return period with climate change allowance. Cross-drains are proposed in certain locations to cross the PRD and maintain the existing flow paths of the surrounding surface water drainage.

11.10.49. Where drainage outfalls are temporarily altered or land drains blocked or damaged during the construction phase, adequate drainage outfalls will be maintained and land drains will be repaired. With the implementation of these mitigation measures, I am satisfied that the PRD will not have significant impacts on the drainage of adjacent lands.

11.10.50. Having regard to the information contained in the EIAR and the Design Report, and the design of the drainage system in compliance with TII and OPW requirements for drainage of national roads and culverting of watercourses, respectively, I am satisfied that adequate drainage details have been provided and

that the proposed drainage network is appropriate for the particular geological, hydrogeological and hydrological characteristics of the receiving environment.

Water Quality Impacts

- 11.10.51. A number of parties raised concerns in relation to general pollution of streams and watercourses during both construction and operation. Potential contaminants include hydrocarbons, tyre wear, heavy metals, chemicals and silt/soil.
- 11.10.52. As detailed in the EIAR and repeated in Mr Cawley's submission at the oral hearing, a Water Quality Impact analysis using HAWRAT as per TII Guidance was carried out on all proposed drainage outfalls to surface waters. The analysis confirmed that the pollution control measures proposed, upstream of the storm outfalls, are acceptable and ensure there would be no significant impact on any receiving watercourse.
- 11.10.53. Given the ecological sensitivity of the River Corrib and its role as a water supply source, the applicant undertook both HAWRAT analysis and 2-dimensional transport dispersion modelling. I have addressed the potential impacts on the water supply separately below, however, I am satisfied that the assessment undertaken has demonstrated that the high water quality status of the River Corrib will not be affected by the PRD drainage discharges.
- 11.10.54. In addition to routine drainage discharge, impacts to water quality could also arise from chemical spillages, such as from a road traffic accident involving a HGV transporting fuel or other chemicals. Risk analysis utilising TII methodology identified a low overall probability of a serious HGV spillage entering a watercourse (less than 1 in 1000 chance of an occurrence in any given year). For the specific outfalls to the River Corrib, the risk is rated as an extremely low probability event (1 in 2,380). Notwithstanding the predicted very low risk, Mr Cawley outlined the mitigation and containment measures for spillage control, including the provision of: 25 m³ spillage containment areas at all pollution control facilities upstream of the outfall, oil and petrol interceptors; and a shut-off penstock at each outfall.
- 11.10.55. Given the predicted very low risk of a serious spillage event occurring and the various proposed mitigation and containment measures, I am satisfied that there is not likely to be significant contamination of watercourses as a result of a serious road accident spillage event.

11.10.56. With regard to potential construction phase impacts on water quality, these would primarily be associated with potential release of sediments, due to disturbance of the channel bed/bank or uncontrolled site runoff. Mr Stephen Dowds, in his appearance at the oral hearing on 24th February 2020 on behalf of the Galway N6 Action Group, queried the potential for accidental diesel or other spillages from construction machinery to enter the Corrib and the impact this may have on the River. Mr Cawley noted the approach of avoidance, minimisation and protection, which would be followed and again drew attention to the mitigation measures contained in the CEMP and Incident Response Plan (IRP) to prevent discharges entering the Corrib or other watercourses. Mr Cawley stated that, in the unlikely event that fuel entered the Corrib, the flow rate of the River Corrib at low flow is c. 14 m³ per second of water and any small spillage during construction would not have major implications. He reiterated that there was no means of direct access for pollution to watercourses.

11.10.57. In my opinion, construction of the proposed River Corrib Bridge represents perhaps one of the greatest construction phase risks to water quality. The bridge is, however, a clear spanning structure with no piers located within the Corrib, and with its abutment setbacks in excess of 5m from the river's edges. These design features significantly reduce the potential for disturbance of sediments. I also note the River Corrib Constructability Examination Report contained in Appendix A.7.1 of the EIAR, which outlines the construction methodology and which for the main span over the River will be a balanced cantilever construction with travelling formwork and netting to prevent material falling into the River. Given the ecological sensitivity of the River Corrib and its role as a major source of drinking water for the City, robust construction site management and pollution control measures are clearly required.

11.10.58. Mr Cawley addressed these issues in Section 4.3 of his submission to the oral hearing with reference to the measures contained in the CEMP and its associated Sediment Erosion and Pollution Control Plan (SEPCP) and IRP. Having reviewed these documents, I consider them to be robust and comprehensive, I also note that they are intended to be working documents, which will be added to and updated prior to commencement of works on site.

11.10.59. With regard to the requirements of the Water Framework Directive in terms of maintaining, protecting and enhancing the water quality status of the receiving

watercourses and groundwater, I am satisfied that the design of the PRD satisfies these requirements through the provision of comprehensive and robust storm water collection and treatment measures, with controlled discharge at the proposed road drainage outfalls. The PRD is also likely to indirectly enhance water quality to a degree, due to removing road traffic from existing roads where uncontrolled road runoff enters adjacent watercourses and groundwater aquifers.

11.10.60. Having reviewed the information submitted and considered the submission of all parties, I am satisfied that the CEMP, and the associated SEPCP and IRP which document the environmental management and mitigation approach that will be adopted and implemented during the construction phase, is suitably robust and will avoid significant impacts on water quality during construction phase. In this regard I consider that the PRD complies with the Water Framework Directive and the River Management Plan Objectives.

Risk of Contamination of Terryland Water Supply

11.10.61. Irish Water (IW) made submissions at both application stage and following the receipt of further information. They state that they support the proposed development and have no objection in principle, subject to certain matters being addressed. IW noted the assessment contained in the EIAR for potential impacts on the existing water intake for Terryland Water Treatment Plant located at Jordan's Cut/Terryland. They stated that they were about to submit a planning application to relocate the water intake from this current location, which is somewhat off the main River Corrib, to a point to the south of the Quincentennial Bridge, which they consider to be at greater risk of contamination or spillages into the River Corrib. Because the PRD will cross the River Corrib upstream of both the existing and new intakes to Terryland WTP, IW contends that it poses a significant risk to the quality of intake water from chemical or other spillages into the River Corrib. The IW submission states that the operational stage measures to contain spillages are considered acceptable and that appropriate best practice measures should be employed during construction to mitigate/eliminate risks of spillages into the watercourse. IW also state that they should be consulted in the preparation of Incident Response Plans for both the construction and operational phases. IW's second submission reiterated their desire that the applicant engage in ongoing liaison and consultation with them. The Board should note that Irish Water did not appear at the oral hearing and that their planning

application for a new intake (Reg. Ref. 19/107) was subsequently granted by Galway City Council.

- 11.10.62. Potential impacts on the City water supply were also raised by other parties, including the submission of James and Cathleen Barrett on behalf of the Residents of Menlo-Coolough-Ballinfoile-Ballindooley and by Mr Patrick McDonagh at the oral hearing on 24th February 2020.
- 11.10.63. Mr Cawley responded to this issue in Section 4.3.1 of his submission to the oral hearing and, as noted above, both HAWRAT analysis and dispersion modelling was carried out on the storm discharges to the River Corrib system. The conclusion reached by the applicant is that the water quality impact of routine stormwater discharge from the PRD on the River Corrib, including first flush rainfall events (i.e. where the potential pollutant concentration is greatest) represents a slight impact local to the outfalls, reducing to imperceptible further downstream. This is due to the high dilution factor and assimilative capacity of the River. The dispersion analysis shows only trace pollutant concentrations reaching the existing Terryland water supply intake from the Jordan's Island channel and very low concentrations at the proposed new water supply intake downstream of Quincentenary Bridge.
- 11.10.64. The applicant subsequently submitted an updated Schedule of Environmental Commitments at the oral hearing which includes a number of additional commitments in relation to Irish Water, including:
- All construction works will be carried out in accordance with best practice construction guidance and as such will eliminate the risk of spillage to the River Corrib. (Item 11.1).
 - Irish Water will be consulted in the updating of the CEMP and, specifically, the incident response plan (IRP) for construction and operation stages. (Item 11.1).
 - Provision will be made for Irish Water Staff to visit the construction site if deemed necessary by Irish Water. (Item 11.1).
 - Ongoing liaison with Irish Water will be provided at construction stage and procedures for regular project dates will be established during the construction stage in a timely manner so as to enable Irish Water to assess potential

increased risk to the water quality of their potable water supply source. (Item 11.1).

- Throughout the project construction and operation phases Galway County Council will continue to consult and inform Irish Water in respect to water quality and pollution risk to their potable water supply source. (Item 11.10).

11.10.65. Having regard to the design of the drainage system, including the various mitigation measures incorporated, the results of the HAWRAT analysis and dispersion modelling, and the additional commitments made at the oral hearing, I am satisfied that there is no significant risk of contamination to the existing or proposed drinking water supply intake locations due to drainage discharges from the PRD.

Flood Risk

11.10.66. A number of individual concerns were raised in relation to Flood Risk. I am satisfied that a detailed Flood Risk Assessment (FRA) has been carried out for the PRD which has informed the drainage design in terms of drainage requirements, attenuation pond sizes, permissible greenfield runoff rates, culvert and channel sizes, outfall locations, engineered infiltration basins for discharge to groundwater, land interceptor drains and specific flood mitigation measures and will not result in any unacceptable flood risk impact to third party lands and properties.

11.10.67. Flood risk at Lackagh Quarry was raised by McHugh Property Holdings and Mr Patrick McDonagh. The applicant responded stating that the quarry has a limited contributing catchment area of 17.4ha and is enclosed on all sides. It does not represent a flood risk to adjoining lands or dwelling houses. The quarry drains to groundwater only with no surface outflow. Flood levels in the quarry recede reasonably quickly through groundwater infiltration, as established through monitoring. In the flood analysis, the proposed infilling of the quarry has been accounted for in terms of loss of flood storage and design flood levels have been set accordingly. I am satisfied that the PRD will not result in any increase in flood risk at or in the vicinity of the quarry. Groundwater-related issues at the quarry are also addressed in the hydrogeology section of this report (Section 11.9).

11.10.68. The proposed flood mitigation measures in the vicinity of the proposed N83 Junction, where there is a recurring flooding issue, are shown on Figure 11.6.001 of the EIAR. Having reviewed the FRA and the proposed mitigation measures, I am of

the view that the applicant has satisfactorily dealt with this issue and that the existing flooding issue in this area, which results in several houses and the national road being flooded, will be addressed by the suite of mitigation measures proposed. I concur with the assessment that there will be a positive residual impact on flood risk at this location, which I would rate as moderate.

- 11.10.69. With regard to potential impacts on flood risk at the River Corrib, I note that the design of the River Corrib bridge incorporates mitigation through design, as it crosses the river in a single span, has a soffit to flood level clearance of over 10m and has its piers outside of the flood plains associated with the river. Drainage discharge to the river will also be at greenfield run-off rates, as detailed above. Section 50 approval has also been granted by the OPW, who are the competent authority in respect of flood risk management for such watercourses. I do not consider that the PRD will affect flood risk at the River Corrib.
- 11.10.70. The issue of existing recurring road flooding on Cappagh Road was also raised by Shane Kelly and Kevin Kelly in their written submissions and by their representative Peadar Ó Maolain BL at the oral hearing on a number of occasions, including a detailed submission on 3rd March 2020. This included photographs of the flooding. Mr Ó Maolain stated that the flooding would flow down Cappagh Road onto the PRD if not addressed. Mr Kevin Gill also raised the issue of flooding on Cappagh Road in his submission to the oral hearing, again on 3rd March 2020.
- 11.10.71. Mr Cawley's response in his initial submission at the oral hearing was that the source and location of this recurring local flooding is outside of the proposed works area and the PRD boundary area. He stated that the PRD, including its proposed drainage treatment, will not impact upon the existing flooding at this location nor will it alter the source of the flooding. In response to Mr Ó Maolain's oral submission, Mr Cawley stated that the flooding was associated with a localised dip in the road to which some local land drains. The section of realigned Cappagh Road within the PRD area would have drains with an interceptor drain on the PRD to capture water flowing towards it. He also stated that traffic levels on the Cappagh Road to the north of the PRD would be reduced as a result of the development, with less potential for pollution and that resolving the localised flooding at the Kelly property would require re-grading works to the Cappagh Road, outside of the PRD boundary, to remove the dip. With regard to proposed Access Road AR 4/05, which Mr Ó Maolain contended

could exacerbate flooding, I note that it will have an unbound surface and grass verges, and I do not consider that it will contribute to flooding in this area.

11.10.72. Having reviewed the information submitted by the Kelly family and the applicant, it is clear that portions of Cappagh Road are subject to flooding on occasion, which is understandably an issue of concern to the Kelly family. However, noting that the location where the flooding arises is outside of the PRD boundary and its drainage network and having reviewed the alignment and levels of the PRD in this area, I do not consider that the PRD is likely to increase the frequency, depth or extent of flooding at this location.

11.10.73. Concerns regarding flood issues were also raised at the oral hearing by Gerard O'Donnell on behalf of Padraig and Imelda Burke, the owners of Plot 135 on Forai Maola Road. Mr O'Donnell queried whether there would be water storage on Plot 144, to the rear of his clients' property, which it is proposed to acquire, and whether a flood risk would consequently arise. Mr Cawley responded that the acquired lands were to be used for Dry Heath habitat formation, and as such would be free-draining with no associated flood risk. I would concur with this conclusion.

11.10.74. The Aughnacurra Residents Association also raised concern regarding flooding and impacts on septic tanks at the Aughnacurra Estate. The issue of septic tanks is addressed in the hydrogeology section of this report. With regard to flood risk, I note that road drainage runoff in this area will discharge to an existing drainage channel, at outfall S14B at greenfield runoff rates, and flow eastward to the River Corrib. Mr Cawley stated at the oral hearing that this receiving drainage channel has sufficient capacity to accommodate the discharge without causing flooding. Drainage runoff from the mainline immediately adjacent to the estate will be collected and conveyed north eastward, again discharging to the River Corrib at outfall S18A. I am satisfied that the proposed road drainage will not negatively impact the existing drainage in the estate or cause flooding.

Irish Water Requirements

11.10.75. In addition to the issue regarding the intake to Terryland Water Treatment Plant, Irish Water raised a number of additional issues, while asserting that they had no objection in principle to the PRD. These included the requirement for diversion/build over and connection agreements, future proofing sleeves at Ardaun

to be agreed and that works potentially impacting Irish Water assets should be carried out in accordance with their Standards and Specifications.

11.10.76. The applicant responded to the IW issues in Section 4.2.4.12 of Mr Cawley's submission to the oral hearing and committed to carrying out all works in accordance with IW Standards and Specifications, in line with standard processes and procedures for obtaining connection consent and build over agreements with the utility provider. Mr Cawley stated that future proofing sleeves in the vicinity of Ardaun can be easily accommodated and their location will be agreed with IW prior to commencement of construction. This was included as an additional commitment in the final Schedule of Environmental Commitments and is appropriate given the importance of the land bank at Ardaun to the future growth of Galway.

Proposed Parkmore Link Road modification.

11.10.77. The implications of the proposed Parkmore Link Road modification for the hydrology assessment were addressed by Mr Cawley in Section 3.17 of his submission to the oral hearing. He stated that Table 11.23 of the EIAR has been updated to reflect the drainage catchment areas associated with the proposed modification and that it will have no effect on the hydrology assessment results or conclusions contained in the EIAR, NIS and RFI response documents.

Conclusion on Land, Soil, Water, Air and Climate – Hydrology

11.10.78. I have considered all of the written and oral submissions made in relation to hydrology matters, in addition to those specifically identified in this section of the report. I am satisfied that potential impacts would be avoided, managed and mitigated by the measures which form part of the proposed scheme, the proposed mitigation measures and through suitable conditions. I am, therefore, satisfied that the proposed development would not have any unacceptable direct, indirect or cumulative impacts on hydrology.

11.11. Land, Soil, Water, Air and Climate – Air Quality and Climate

11.11.1. Air Quality and Climate are addressed in Chapter 16 of the EIAR. The series of Figures 16.1.01 – 16.1.07 contained in Volume 3 of the EIAR indicate the locations of air quality receptors, while Appendix A.16.1 contained in Volume 4 of the EIAR provides information on the ambient air quality in Galway City in February – May

2017. The Schedule of Environmental Commitments, which was updated at numerous stages over the course of the oral hearing, also sets out commitments in relation to air quality and climate.

- 11.11.2. The changes to traffic forecasts as a result of the consideration of the National Transport Authority/Galway City and County Councils National Planning Framework scenarios for Galway ('NPF Scenarios'), as requested by the Board (see Section 4.7), has potential implications for air quality and climate. This is addressed in Section 8.2.2.5 of the RFI response report, and the associated Appendix A.8.3 'NPF Traffic Forecast – Air Sensitivity Analysis'.
- 11.11.3. Subsequently, at the oral hearing, the applicant submitted a 'Corrigendum' document (Ref. 15). Section 4.4 of the Corrigendum states that the data presented in Appendix A.8.3 of the RFI Response did not follow the same methodology as the EIAR as it took account of a potential improvement in air quality arising from an improvement in the vehicle fleet. In addition, additional receptors were included which did not meet the criteria of demonstrating an increase of 5% in AADT, an approach that was applied in the EIAR. The Corrigendum includes modelling results utilising the same approach as the EIAR, for the stated purpose of sensitivity testing the NPF scenario.
- 11.11.4. A submission responding to the air quality and climate-related written submissions/objections was given at the oral hearing on 20th February 2020 by Sinéad Whyte of Arup on behalf of the applicant. A number of parties subsequently made further air quality and climate-related submissions over the course of the oral hearing, including questioning of, and further submissions by, Ms Whyte. These matters are addressed, where necessary, below. The potential impacts of air quality on human and animal health are addressed separately in Sections 11.6 and 11.17, respectively.

Relevant Guidance

- 11.11.5. The applicant considers that the key relevant guidance documents are the 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (TII; 2011) and the various EPA guidance documents relating to EIS/EIAR. The chapter is also stated to have utilised information gathered during the earlier constraints and route selection studies. The applicant states that the impact of the proposed road on air quality is assessed for both the construction

and operational phases by considering the pollutant background concentrations, emissions from road traffic and potential for construction dust and emissions from construction traffic. Predicted concentrations are compared to relevant limit values, while carbon emissions are considered in terms of Ireland's obligations to reduce its carbon emissions under the European Union (EU) Climate Change and Renewable Energy Package.

Air Quality

- 11.11.6. The Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011), which transposed EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe (the Air Quality Directive) into Irish law, sets out limit values and alert thresholds for concentrations of certain pollutants, including NO₂, NO_x, PM₁₀, PM_{2.5}, CO and Benzene (see Table 16.1 of EIAR).
- 11.11.7. Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants also specifies national-level reductions for nitrogen oxides, particulate matter and non-methane Volatile Organic Compounds for the period from 2020 to 2019 and from 2030 onward, compared with 2005 levels (see Table 16.3 of EIAR).
- 11.11.8. Guideline limit values for various pollutants are also provided in the World Health Organisation (WHO) 'Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide, Global update 2005'. While the WHO guidelines for NO₂ are the same as the AQS, the WHO guidelines for PM₁₀ and PM_{2.5} are substantially lower than the AQS (see Table 16.2 of EIAR). The EIAR notes that the AQS are the statutory limits that apply in Ireland, and that baseline and predicted values are therefore compared to these levels. Notwithstanding this, an assessment of compliance with the WHO guideline values is also included.
- 11.11.9. Sulphur dioxide is not considered in detail within the EIAR on the basis that the UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Annex F, 2007) states that road transport represents a negligible source (less than 1%) of UK sulphur dioxide emissions. Elevated concentrations at heavily trafficked roadside locations in the past have been reduced due to the maximum permitted sulphur content of road fuels being periodically reduced.

- 11.11.10. Ultrafine particles (i.e. airborne particulate matter < 0.1 micrometres) are stated as likely to have adverse health effects, however, no air quality standard has been set, as yet. The WHO guidelines conclude that “while there is considerable toxicological evidence of potential detrimental effects of ultrafine particles on human health, the existing body of epidemiological evidence is insufficient to reach a conclusion on the exposure-response relationship to ultrafine particles”. No limit value for ultrafine particles is therefore provided in the WHO Guidelines.
- 11.11.11. With regard to dust deposition, there are no national or EU limits. The EIAR notes the German ‘Technical Instructions on Air Quality Control’ (TA Luft, 2002), which provides a guideline for the rate of dust deposition of 350 mg/m²/day averaged over one year. This value is also used by the EPA, although applied as a 30-day average, in its document ‘Environmental Management in the Extractive Industry (Non-Scheduled Minerals)’ (EPA, 2006).
- 11.11.12. Finally, the impact of nitrogen deposition on ecologically sensitive areas is considered in light of the TII Guidelines, which quote the United Nations Economic Commission for Europe (UNECE) Critical Loads for Nitrogen. The most stringent of these is for inland and surface water habitats (5-10kg(N)/ha/yr) and this is used in the EIAR assessment.
- 11.11.13. The study area utilised in the EIAR comprises properties located within 200m of the proposed road, which is in line with DMRB guidance. Three months of air quality monitoring was carried out and the TII Guidelines provide a methodology to calculate the annual mean from short-term monitoring. The DMRB Screening Method spreadsheet was also used, in accordance with the TII guidelines. This computes concentrations of pollutants at a local and regional level and was used to assess the potential local and regional air quality impacts and potential climate impacts.
- 11.11.14. Scenarios modelled include the ‘Do-Minimum’ (i.e. PRD is not constructed) and ‘Do-Something’ (i.e. PRD is constructed) with traffic scenarios for 2024 (Opening Year) and 2039 (Design Year). Potential air quality impacts at all sensitive receptors are considered as well as designated ecological areas.

11.11.15. The ADMS-Roads¹⁹ atmospheric dispersion model has also been used to predict the NO_x, PM₁₀ and PM_{2.5} concentrations. This modelling has been carried out with and without noise barriers to determine their potential to change air quality at the receptor. Worst-case receptors were selected as part of the DMRB and ADMS assessments, such as those close to junctions as well as at tunnel portals. In addition, concentrations of NO_x along four 200m transects near Lough Corrib SAC were modelled.

11.11.16. In terms of the receiving environment, the EPA carry out air quality monitoring at the Bodkin Junction where PM₁₀ and heavy metal levels were shown to comply with air quality standards in 2017. Galway is considered to be in Zone C under the Air Quality Standards (AQS) Regulations zoning system adopted in Ireland, and all current baseline concentrations are in compliance with the AQS.

Potential Impacts

11.11.17. The potential **construction phase impacts** on air quality are generally related to dust emissions from activities such as earthworks, windblow from stockpiles, handling and hauling of materials, demolitions, crushing, landscaping etc.

11.11.18. For analysis purposes the EIAR splits the road into six sections, all of which are considered to be locations where works of a 'major scale' will be undertaken. The number of sensitive receptors is identified for each section, being those located within 100m where there is potential for significant soiling effects and those within 25m where there is potential for significant PM₁₀ and vegetation effects. For the potential site compounds, the EIAR identifies sensitive receptors within 50m where there is potential for significant soiling effects and those within 15m where there is potential for significant PM₁₀ and vegetation effects. In terms of construction traffic, impacts are assessed when traffic generated of greater than 10% is predicted to occur. Only 3 No. links are predicted to generate traffic volumes greater than 10% during construction (R336 Bearnna Moycullen Road, Cappagh Road and Menlough Road). Table 16.20 of the EIAR sets out the predicted pollutant concentrations at the worst-case receptor for each road link. The impact ratings for NO₂, PM₁₀ and PM_{2.5} are negligible.

¹⁹ Cambridge Environmental Research Consultants Air Dispersion Modelling Software.

11.11.19. The potential impacts on air quality for the Opening Year (2024) and Design Year (2039) were assessed using the DMRB model. For both scenarios the highest concentration of pollutants is predicted at Receptor R17 (located in Ard an Locha in the Upper Dangan area). However, all annual concentrations comply with Air Quality Standards limit values. Tables 16.21 and 16.22 of the EIAR sets out the predicted pollutant concentrations for the identified receptors in the Opening and Design Years, respectively, and the changes in concentrations of all pollutants are rated as negligible or imperceptible for all receptors with the exception of R16 (Castlegar) and R17 (Upper Dangan), where a slight adverse impact is predicted for NO₂. The predicted concentrations comply with the WHO PM₁₀ guideline values at all locations, however the WHO PM_{2.5} guideline value is exceeded at a number of receptors in both the 'Do Minimum' and 'Do Something' scenarios.

11.11.20. No significant air quality impacts are envisaged at the nearest sensitive receptors to the tunnel entrances due to the separation distances, which range from 80m to 480m.

11.11.21. Ecologically sensitive sites were assessed for potential pollution from nitrogen compounds, VOC, metals/dust and ammonia at Lough Corrib SAC, the River Corrib bridge, Menlough and Lackagh tunnel. The predicted concentrations of these pollutants remain in compliance with the AQS for the protection of vegetation.

11.11.22. Table 16.26 of the EIAR provides NO_x concentrations for the section of the proposed road between the N83 Tuam Road and the N84 Headford Road, as this section is predicted to have the highest traffic volumes. Annual average NO_x concentration at this location complies with the limit value, albeit it reaches 92% of the limit value in the 2039 Do-Something scenario. This is considered to be a slight adverse impact. It is stated that lesser concentration and deposition values would be expected at all other sections where lesser traffic volumes are predicted. It is further noted that the reduction in traffic on certain links as a result of the proposed development will result in localised improvements of air quality. These locations are set out in Table 16.28 of the EIAR.

11.11.23. As noted above, the ADMS model was also used to predict NO_x, PM₁₀ and PM_{2.5} at the various receptors for the Opening Year and Design Year, with and without noise barriers. The results for this assessment are set out in Tables 16.29 to

16.36 of the EIAR. As with the DMRB model, all pollutant concentrations comply with AQS limit values. The maximum predicted impact using the ADMS model was at receptor R16, followed by R17 and R20 (Letteragh), where a slight adverse impact is predicted for NO₂ in the 2039 Design Year. Negligible impacts are predicted for all other receptors and for PM₁₀ and PM_{2.5} and no significant adverse impacts are envisaged. While the AQS limit value for PM_{2.5} is complied with, the WHO PM_{2.5} guideline level is exceeded at all receptor points, excluding R05 and R26 in 2024 and R05 in 2039 which is stated to be due to the contribution of background concentrations.

11.11.24. The concentration of NO_x where the PRD crosses the Lough Corrib SAC have also been predicted with the ADMS model for the future years with and without noise barriers (see Tables 16.35 and 16.36). Predicted annual mean NO_x concentrations are all below the limit value with no significant effects predicted.

11.11.25. As noted above, the applicant, in responding to the Board's Request for Further Information, reassessed air quality impacts during the operational phase on the basis of the higher traffic forecasts for the NTA/GCC NPF Scenarios. This is set out in Appendix A.8.3 to the RFI Response, and in Section 8.2.2.5 of the RFI Response document, the applicant concluded that there are no adverse impacts on air quality as a result of the NTA/GCC NPF Scenarios, and that all air quality predictions are within the standards. On foot of the NPF Scenarios, Receptor R22 (located adjacent to proposed junction of N6 GCRR and Ballymoneen Road) becomes the receptor with the predicted highest concentration of pollutants, although they remain in compliance with the AQS limit values. Predicted PM_{2.5} concentrations, while compliant with AQS limit values, again exceed WHO guideline values at a number of receptors, with background concentrations alone being close to the recommended guideline value. As noted above, a Corrigendum document was submitted at the oral hearing which noted that the RFI Response data, unlike the EIAR, took account of potential improvements to air quality arising from an improvement in the vehicle fleet. The Corrigendum provides modelling results utilising the same approach as the EIAR and states that the conclusions of the air quality impact assessment remain as set out in the EIAR.

11.11.26. The potential for Nitrogen compound pollution, VOCs and metals/dust to affect the Lough Corrib SAC under the NTA/GCC NPF Scenarios was also