IN THE MATTER OF AN APPLICATION TO

AN BORD PLEANÁLA

FOR APPROVAL OF (I) THE N6 GALWAY CITY RING ROAD PURSUANT TO SECTION 51 OF THE ROADS ACT 1993 (AS AMENDED); (II) THE N6 GALWAY CITY RING ROAD MOTORWAY SCHEME 2018; and (III) THE N6 GALWAY CITY RING ROAD PROTECTED ROAD SCHEME 2018

ABP Ref. ABP-302848-18 and ABP-302885-18

ORAL HEARING

Statement of Evidence

Responses to Hydrology

Objection/Submissions

by

Anthony Cawley

B.E. (Civil) M.Eng.Sc (Hydrology) .C.Eng. M.I.E.I.

assisted by

Hazel King, B.E., C. Eng, M.I.E.I, Arup

19 February 2020

1 Qualifications and Experience

1.1 Lead Witness

1.1.1 My name is Anthony Cawley, I am managing director of Hydro Environmental Ltd. I qualified with an honours degree in Civil Engineering and a post graduate master's degree in Engineering Hydrology from NUI Galway. I am a Chartered Civil Engineer with 29 years professional consulting experience in the water engineering field, in a wide variety of activities relating to hydrology, hydrogeology, flooding and hydrodynamic and water quality assessments. Over that period, I have carried out in excess of 100 flood risk assessment studies which included groundwater, rivers, estuarine and coastal flooding throughout Ireland and also in the UK. I have over the past twenty years been involved in preparing the Hydrological Impact assessments for over 20 major road schemes throughout Ireland.

1.1.2 I have been an expert witness in the area of hydrology and flooding related issues at numerous Oral Hearings for major Infrastructure projects (such as the M6, M20/M21, N23, Landsdowne Stadium redevelopment, Galway Harbour Development,).

1.2 Support Witness

1.2.1 I was assisted in the Hydrological Assessment for the EIAR and NIS by Hazel King, a Senior Engineer working in the Infrastructure Group in the Arup Galway Office. She qualified with a first class honours degree in Civil Engineering from NUI Galway and is a Chartered Engineer. Hazel has 12 years experience as a consultant engineer, working in the areas of highways, wet services and flood risk. Hazel has been working as part of the core project team since 2014 working through the constraints, option selection, design and the environmental assessment stages of the N6 Galway City Ring Road project. Hazel was responsible for the delivery of the drainage design including network drainage, flow control and attenuation, pond storage and treatment wetland design, pre-earthworks drainage design, and preparation of Section 50 applications.

2 Role in Proposed Road Development

2.1 My role on the project was to carry out the hydrology assessment for the proposed road development and input to the constraints, option assessment, EIAR and the NIS. I have been working on the project since 2014.

2.2 The evidence I am presenting covers impacts of the proposed road development on Hydrology, as it relates to surface water bodies: lakes, rivers, streams and urban drainage networks and its interaction with hydrogeology and ecology.

2.3 Full details of the above assessments are presented in the hydrology sections of each report as follows:

- Hydrology impact assessment of the proposed road development for the EIAR, Chapter 11 of the EIAR, including the Flood Risk Assessment (Appendix A,11.1 of the EIAR) and water quality monitoring (Appendix A.11.2 of the EIAR)
- Hydrology assessment to inform the appropriate assessment in the Natura Impact Statement (NIS) which is included in Appendix B of the NIS

3 Key issues in relation to Hydrology

3.1 Chapter 11 of the EIAR and Appendix B of the NIS is to be taken as read in its entirety and is not replicated here. To assist the Board in its consideration of this application for approval, for the convenience of all participants at this hearing, and to set the context for responding to the objections and submissions, the key items pertaining to the hydrological assessment of the proposed road development detailed in Chapter 11 of the EIAR and Appendix B of the NIS are summarised briefly below.

3.2 The proposed road development crosses the Lough Corrib cSAC and Lough Corrib SPA and is adjacent to the Galway Bay Complex cSAC and Inner Galway Bay SPA. The potential hydrological impacts of the proposed road development, both direct and indirect impacts on these European sites have been assessed in the NIS (NIS – Hydrological Assessment in Appendix B of the NIS). All other European sites are outside the hydrological zone of influence of the proposed road development as there is no hydrological connection between them and the proposed road development and will not be impacted.

3.3 The proposed road development, passes through three hydrometric areas – Galway Bay Southeast, Corrib and Galway Bay North – along its 17.4km length. Within the study area there are two distinct regions of hydrological response: (1) the area west of the N59 Moycullen Road, which is associated with the granite bedrock that produces high surface run-off and limited groundwater infiltration; and (2) the area is to the east of the N59 Moycullen Road associated with the limestone bedrock having low surface run-off and generally high infiltration. The proposed road development traverses only one major watercourse which is the River Corrib near

Menlo Castle. The River Corrib Bridge crossing will be a clear span bridge with 5m setback of abutments from the river edge.

3.4 The key ecological receptors sensitive to hydrological impacts are Ballindooley Lough, Lough Corrib cSAC including Coolagh Lakes and the River Corrib channel, the various salmonid streams (including the downstream reaches of the Bearna, Trusky and Knocknacarra Streams) and the coastal and transitional waters of the Galway Bay Complex cSAC. The key water dependent wetland habitats within the study area sensitive to surface hydrology include Turloughs, Blanket bogs, Transitional mires, wet heath, rich fen and flush and Molina Meadows. The rating of these receptors varies from locally high (e.g. salmonid watercourses) to extremely high (e.g. Lough Corrib cSAC).

3.5 There are 17 no. proposed stream culvert crossings under the alignment of the proposed road development which are associated with small streams and drains that have a potential, if not appropriately designed, to act as a barrier to flow with the potential for localised flooding and impact to fishery passage. The construction of such culverts can potentially cause the release of sediments into the stream floor and can also result in morphological changes to the stream channel from erosion and deposition during establishment.

3.6 The drainage system for the proposed road development will include 54 storm drainage outfalls:

- 25 to surface watercourses at new storm outfalls
- 9 to groundwater via new infiltration basins
- 17 to the existing public surface water sewers
- 2 from tunnel sections pumped to the public foul sewer
- 1 to the existing N6 infiltration basin

These proposed road drainage outfalls have the potential to cause localised flood impacts, morphological changes to the watercourse and water quality impacts both during construction and operation phases. These proposed road outfalls act as potential point sources of pollution to surface waters and groundwater from routine road drainage discharges and from potential accidental spillage events.

3.7 I confirm that the protection of the receiving surface water environment from pollution, the protection of watercourses from morphological impacts and the protection against flow regime change and flood impacts have all been considered in the design of the proposed road development through the inclusion of appropriate drainage design measures.

3.8 The proposed drainage system has been designed to incorporate a range of pollution control features, which include: primary treatment of road drainage waters in water quality detention ponds and in wetlands and infiltration basins, provision in sensitive aquifers of sealed drainage otherwise provision of filter drains and grassed surface water channels, the provision of oil and petrol

interceptors and shut-off and pollution containment facilities upstream of surface outfalls.

3.9 All culverts are designed with inlet and outlet structures that include headwalls and wing walls and a buried concrete apron or armour stone embedded to a depth of 300mm below the finish bed level and back filled with natural bed sediments. This design provides for fishery passage and habitat and to resist local contraction scour of the stream bed in the vicinity of the culvert. Channel transitions are required to and from the culvert structure and this may require slight realignments to achieve a small transition thereby avoiding the potential for local erosion and deposition sites at the culvert and in the downstream reach.

3.10 All proposed stream culverts have obtained Section 50 approval from the OPW, under the Arterial Drainage Act, 1945 and Arterial Drainage (Amendment) Act, 1995. Such approval ensures that the proposed culverts are hydraulically sufficiently sized as to be able to convey a 100-year design flood with climate change allowance and appropriate factors of safety under the proposed road development without causing adverse local or upstream flood impacts.

3.11 Attenuation storage and flow control have been provided upstream of the proposed outfalls and designed so that the flood discharge from the proposed road development is limited to the natural greenfield flood run-off rate of the receiving stream. This prevents potential impacts to morphology and the flow hydraulics in the receiving streams.

3.12 As a consequence of the proposed drainage design, the potential hydrological impacts have been reduced generally to slight permanent impacts and only moderate local impact in case of very minor tributaries and drains which have low dilution during dry flow periods.

3.13 The potential construction impacts, in the absence of mitigation, through the potential release of sediments by disturbance of the stream channels and banks represent short-term local moderate to significant impacts on water quality and bed sediment deposition rates that could impact fishery habitat potential in the downstream reach as a result of the works.

3.14 To manage and mitigate potential construction stage impacts, a Construction Environmental Management Plan (CEMP) will be implemented (the principal measures of which are detailed in Appendix A.7.5 of the EIAR). As part of the CEMP, a Sediment Erosion and Pollution Control Plan (as outlined in Section 8 of the CEMP) will be implemented, which sets out detailed site-specific measures to avoid, control and minimise the release of sediments to receiving watercourses during construction works. It also sets out measures to minimise the risk from accidental spillages of concrete, chemicals and hydrocarbons to watercourses.

3.15 Specific flood mitigation is proposed for the N83 Tuam Road at Twomileditch, to mitigate a potential significant flood impact from the proposed road development that, if constructed without mitigation, would encroach on an existing flood risk area causing a potential loss of 21% of the available flood storage causing potentially increased flooding locally.

The specific flood mitigation measures proposed are devised to eliminate the flood impact from the proposed road development and will beneficially reduce the existing flood risk currently experienced in this area, and involve:

- Upgrade and provide a storm drainage network along the existing N83 Tuam Road at Twomileditch so as to capture and prevent surface water runoff from the adjacent steep hill spilling uncontrolled across the existing N83 and into the properties along the western side of the road
- Compensate the flood storage loss by providing compensation storage of c. 8,000m3 in the form of an excavated engineered storage pond
- Provide a permanent surface water pumping station and rising mains to discharge to the existing storm sewer at Castlegar, providing a pumping capacity of 250l/s

This proposed flood mitigation will produce an overall positive impact on flood risk in the area including the N83 Tuam Road and surrounding properties.

3.16 The current NUIG planning permission application (Ref 19/373) to construct additional playing pitches and the two proposed strategic housing development applications (Ob_229 and Ob_469 and S_003) do not change the conclusions of the cumulative impact assessment on Hydrology contained in the EIAR and NIS.

3.17 Table 11.23 of the EIAR has been updated to reflect the drainage catchment areas associated with the modification to the Parkmore Link Road. The proposed modification to the Parkmore Link Road will have no effect on the hydrology assessment results or conclusions contained in the EIAR, NIS and RFI response documents.

Table 1: Proposed Road Development Drainage Outfalls to Infiltration Basins

Drainage Network Ref. No.	Approx. Chainage	Total Drainage Area (ha)	Pavement Area (ha)
S22C2	14+400	1.42	1.66

3.18 The EIAR concludes that the proposed road development will have no significant residual impact on hydrology in respect to:

- drainage and flood risk
- water quality
- stream and river morphology
- key water dependent ecological receptors

3.19 The Hydrological Assessment for the NIS (contained in Appendix B of the NIS) concludes that there will be no significant hydrological impacts, either direct or indirect on any European Site.

4 Responses to Issues raised in Submissions/Objections

4.1 Overview

4.1.1 81 of the 296 submissions made to An Bórd Pleanála (ABP) in respect of the N6 Galway City Ring Road (GCRR) Environmental Impact Assessment Report (EIAR), Natura Impact Statement (NIS), Motorway Scheme (MS) and Protected Road Scheme (PRS) include observations relevant to hydrology. Two of the 17 submissions made to ABP in respect to the Request for Further Information (RFI) Response submitted August 2019 also include observations relevant to hydrology. The items raised in these submissions are:

- general issues in relation to the adequacy of drainage details and implications for flooding of properties
- general pollution concerns in respect to the proposed road development and potential impact to key ecological receptors
- the risk of contamination to the Galway City water supply at Terryland from accidental spillage on the proposed road at both the existing and new proposed abstraction points and these will be dealt with further under the two headings Drainage and Flooding; and Water Quality in the proceeding sections.

4.2 Drainage and Flooding

4.2.1 Drainage details

Issues

4.2.1.1 The submissions/objections raised the following issues:

Inadequate drainage details have been provided to the property owners along the proposed road development: such as details pertaining to realignments, drains that are severed, culvert details and outfall locations. The property owners are seeking a commitment that the proposed road development will not flood their property: Ob_103; Ob_108_125; Ob_117; Ob_145.1; Ob_145.2; Ob_145.3; Ob_147; Ob_152; Ob_159; Ob_195; Ob_197.1; Ob_207; Ob_213; Ob_226; Ob_230; Ob_233_234_235; Ob_238; Ob_239; Ob_246; Ob_250_466; Ob_251; Ob_252; Ob_254; Ob_255-256; Ob_249_467; Ob_259_463; Ob_273-461; Ob_272_462; Ob_296; Ob_311; Ob_313; Ob_457.2; Ob_468-501; Ob_485; Ob_488; Ob_498; Ob_512.1 Ob_626; Ob_628-702; Ob_629; Ob_631; Ob_634; Ob_O_635; Ob_639; Ob_O_651.1; Ob_684.

4.2.1.2 Health and safety concerns regarding drainage features: Ob_134; S_004; S_031; S_056; S_057; S_065.

4.2.1.3 Concerns regarding loss of natural drinking water supply for agriculture: Ob_505; Ob_507; Ob_553_561

Response

Road Pavement Drainage

4.2.1.4 The drainage system for the proposed road development is designed in accordance with Transport Infrastructure Ireland (TII) current design standards, TII publications and the Manual of Contract Documents for Road Works (MCRW) which incorporate best practice, including climate change allowance, and robust design to avoid any unacceptable impacts on flood risk, both to the development and to third party lands and to avoid any unacceptable pollution impact on receiving surface waters and groundwaters from the proposed road drainage discharges.

4.2.1.5 Full details of the drainage provision for the proposed road development have been provided in the Design Report in the Appendix A.10.1, Volume 4 of the RFI Response submitted to An Bord Pleanála August 2019. The proposed drainage details are presented in Drawings No. GCOB-500-D101 to 132 and also in Chapter 11 of the EIAR and Figures 11.5.01 – 11.5.02 and 11.5.101 – 11.5.105 of the EIAR. These figures show the road drainage, network, culvert locations, attenuation ponds, and infiltration basins and outfalls and stream/drain diversions.

4.2.1.6 A drainage system for the proposed road development has been designed for the mainline carriageway, link roads and all new sections of local and regional roads. All rainfall runoff from the road pavement will be prevented from discharging directly to the receiving surface waters by the drainage system. As noted earlier, the road drainage system has been designed in accordance with TII current design standards. Accordingly, more than adequate road drainage details have been provided to the property owners along the alignment of proposed road development which show clearly the drainage provisions for the road pavement and type of drain.

Culverts

4.2.1.7 The proposed road development traverses a number of existing streams and rivers along its route. The streams and rivers will be conveyed across the proposed road development using culverts and/or bridge structures. River and stream flows have been quantified and the crossings have been designed in accordance with the OPW requirements for crossing of streams and rivers and the requirements of TII publications documents: DN-DNG-03064 (HD 106) – Drainage of Runoff from Natural Catchments, DN-DNG-03071(HD 107) – Design of Outfall and Culvert Details and DN-DNG-03065 (HD 45) – Road Drainage and the Water Environment for minor watercourses. All culverts have been designed so as to minimise impact on both upstream and downstream flood conditions. The hydraulic structures are discussed in detail in Section 11.5.3.1 of Chapter 11 of the EIAR.

4.2.1.8 All new culverts have been designed for a flood with a return period of 1 in 100-years plus climate change allowance and with a minimum of 300mm freeboard clearance between the design water level and the soffit level of the culvert in

accordance with OPW requirements as outlined in Section 11.4.1.1 of Chapter 11 of the EIAR. 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. Section 50 approval has been obtained from the OPW concerning flooding and flood capacity of all proposed culverts. The potential impact of the proposed culvert and bridge structures on flood water level and flood risk to properties is rated as imperceptible. Accordingly, more than adequate culvert details have been provided to the property owners along the alignment of proposed road development.

Land Drainage

4.2.1.9 Interceptor ditches will be located so as to fully intercept the overland flow from the natural catchments adjacent to the proposed road development, 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 as per DN-DNG-03064 (HD 106) Drainage of Runoff from Natural Catchments.

4.2.1.10 Cross-drains are required where interceptor ditches and/or existing land drains are required to cross the proposed road development and accesses to maintain the existing flow paths of the surrounding surface water drainage.

4.2.1.11 Further details of the land drainage and pre-earthworks drainage proposals are provided on Drawings GCOB-500-D-101 to GCOB-500-D-132 in Appendix 10.1 of the Design Report submitted as part of the RFI Response in August 2019. As is apparent from the application documentation, a considerable volume of information in relation to land drainage details has been provided in respect of the proposed road development.

Attenuation

4.2.1.12 The drainage design includes the provision of attenuation/infiltration ponds and flow control to restrict the outfall discharge to a more natural greenfield flood runoff rate, thereby avoiding potential significant impacts to channel morphology and flow regime at the local scale. Attenuation ponds will be provided at all major surface water outfalls along the length of the proposed road development and are designed in accordance with DN-DNG-03063 – (HD 103) - Vegetated Drainage Systems for Road Runoff.

4.2.1.13 The proposed attenuation storage volumes are sized to ensure that there will be no increase to flood risk up to and including the 1 in 100-year storm event as per TII drainage publications Clause 7.5 of DN-DNG-03022 Drainage Systems for National Roads. An additional 20% allowance for climate change is incorporated into the design as per the TII drainage Guidelines DN-DNG-03065. Surface water discharge from attenuation facilities will be released at a rate which will not increase flooding downstream of any discharge point up to the 1 in 100-year return period storm event. Surface water discharge from attenuation facilities will be maintained at the green-field runoff rate with a minimum value of 5l/s. An additional 300mm freeboard in the maximum storage level is included at all attenuation facilities to provide an additional factor of safety. To protect against

uncontrolled overtopping of the attenuation pond in the event of a blockage to the flow control outlet, an engineered overflow with a crest level set at the maximum design flood level in the pond has been included in the outlet structure.

4.2.1.14 The location of the attenuation pond has been selected and designed so that the road drainage runoff can gravitate to it and is of a sufficient size and volume to achieve the required attenuation for the 1 in 100-year return period rain storm event with an allowance for climate change. The attenuation pond needs to be sited reasonably close to the proposed road drainage outfall to drain the require road drainage area.

4.2.1.15 The attenuation pond is an engineered water impoundment structure designed to contain safely the design storm event with freeboard between the designed top water level and the impoundment level as per TII design requirements. An overflow spillway is provided to ensure that the attenuation pond does not exceed the permissible maximum flood level and this spillway discharges flow overland to the outfall.

4.2.1.16 Once again, extensive attenuation details have been provided in the application documentation and to the property owners along the alignment of proposed road development in the RFI Response submitted to ABP in August 2019.

4.2.2 Flood Risk

Issue

4.2.2.1 Flood risk issues in respect to the drainage elements of the road development including the proposed capacity, location and maintenance of drains and attenuation ponds, flood risk to tunnel sections and general drainage issues in respect to adjacent lands to the road embankment. The relevant submissions in respect to the above points are: Ob_135; Ob_194; Ob_216; Ob_261; Ob_480; Ob_481; Ob_484; Ob_496; Ob_571_579_592_600; Ob_584; Ob_688; Ob_691; Ob_716; Ob_751; S_008; S_029; S_040; S_042; S_044; S_059.

Response

4.2.2.2 A detailed Flood Risk Assessment of the proposed road development was undertaken in accordance with the DoEHLG Planning System and Flood Risk Management Guidelines for Planning Authorities. In order to inform the Flood Risk Assessment (FRA) for the proposed road development, the website floodmaps.ie and the pFRA and CFRAM flood mapping were consulted and hydraulic flood modelling was carried out for watercourse crossings to estimate the design flood level and potential impact of the proposed road development on flooding.

4.2.2.3 The flood risk assessment has included the current guidance in respect to climate change allowances, specifically the drainage design. The design of road drainage, land drainage, and sizing of culverts and stormwater attenuation ponds has

increased design flood flows by a factor of 20% which is in keeping with current OPW and TII guidelines.

4.2.2.4 The potential impact of the proposed culvert and bridge structures on flood water level and flood risk to properties was assessed along the entire length of the proposed road development and the impact is rated as imperceptible due to the fact that the proposed culverts and bridge structures are all sized to provide the requisite flow capacity which includes future proofing, details on the culvert design are outlined in Section 11.4.1 of Chapter 11 of the EIAR.

4.2.2.5 The implementation of sustainable drainage systems (SuDS) through the incorporation of engineered wetlands, attenuation ponds, infiltration basins and controlled discharges at all outfalls will control storm runoff rates to greenfield flood runoff rates subject to a minimum discharge rate of 5l/s and in doing so, will not exacerbate flooding and flood risk in the receiving watercourses. The greenfield runoff rates and attenuation sizes for each drainage network that outfall to surface waterbodies and storm sewers are outlined in Table 5.11, 5.12 and 5.13 of Chapter 5 of the EIAR.

4.2.2.6 The disturbance of field drainage systems represents a direct impact to the existing drainage regime. The drainage has been designed in a manner sympathetic to the natural drainage pathways maintaining, where feasible, existing drainage runs by culverting or slightly realigning the local drains across the proposed road development, as stated in Section 11.7.1 of Chapter 11 of the EIAR. The new proposed ditches have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 (HD 106) Drainage of Runoff from Natural Catchments which includes the 20% climate change allowance. The overall impact on surface drainage along the proposed road development is a slight to imperceptible residual impact.

4.2.2.7 Detailed Flood Risk Assessment has been carried out for the proposed road development 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. The proposed road development and its drainage design meet, in full, the requirements of the Flood Risk Management Planning Guidelines (2009) and will not result in any unacceptable flood risk impact to third party lands and properties.

Issue

4.2.2.8 Submissions/objections S_042 and Ob_216 raised issues regarding recurring flooding of a local road on the Cappagh Road to the north of the proposed road development near Ch. 4+450 and the failure of the proposed road development to include any works to resolve this flooding.

Response

4.2.2.9 The source and location of this recurring local flooding is outside of the proposed works area and the proposed development boundary area. The proposed road development, including its proposed drainage treatment, will not impact upon the existing flooding at this location nor will it alter the source of the flooding.

Issue

4.2.2.10 Submission/objection S_008 raised an issue in respect to potential damage to the existing drainage system (septic tanks) in the estate that could cause flooding.

Response

4.2.2.11 The proposed road drainage design in the vicinity of Aughnacurra Estate (Ch. 8+250 to Ch. 8+650) will be to discharge road drainage runoff to an existing drainage channel, at outfall S14B, which flows eastward to the River Corrib. The discharge at S14B will be attenuated to greenfield runoff rates with the attenuation storage provided in a large attenuation pond facility on the east side of the proposed road development and conveyed to the existing drainage channel via a new carrier drain. At the proposed greenfield runoff rate, the receiving drainage channel running to the west of the Aughnacurra Estate has sufficient capacity to accommodate the discharge without causing flooding. The mainline road pavement, immediately adjacent to the estate from Ch. 8+650 onwards, will be collected and conveyed northeastwards away from the estate to discharge to the River Corrib at outfall S18A. The proposed road drainage will not damage the existing drainage in the estate nor will it cause flooding and this is outlined in detail in drawings GCOB-500-D-111 and GCOB-500-D-112 in Appendix 10.1 of the RFI response for further drainage details.

4.2.3 Location of Attenuation Ponds

Issue

4.2.3.1 A total of 7 submissions/objections, Ob_151; S_004; S_029; S_031; S_056; S_059; S_065 have raised issues in respect to the placement of attenuation ponds close to their homes.

Response

4.2.3.2 The selection of the locations of attenuation ponds took a number of factors into consideration including: the vertical alignment of the proposed road development, drainage runs and the proximity to drainage outfall. The provision of attenuation ponds for treatment of urban storm drainage is required to protect against water quality impact and flooding and represents the most suitable option for this location. All attenuation pond facilities will be securely fenced and planted with appropriate scrubs, hedgerows and/or screen planting to minimize any visual impacts. These facilities will be maintained by the local authority.

Issue

4.2.3.3 Submission/objection S_029 raised an issue in respect to the proposed attenuation ponds at the S17A outfall (At N59 Link Road South and Rahoon Road Junction). The submission references landscape treatment and expresses a preference for underground tanks, as opposed to ponds to minimize visual impact at this location.

Response

4.2.3.4 The provision for the attenuation and water quality treatment of road drainage runoff from the proposed road development is through the provision of open ponds sized to enable the capture of first flush runoff and to provide the necessary attenuation storage to achieve greenfield runoff rates. The general design approach is to provide ponds as opposed to tanks from a water quality treatment function and from maintenance and inspection of facilities perspective. At the Rahoon Road Junction, such ponds have been engineered within the proposed development boundary and provide the optimum solution as they provide a biological function for water quality improvement, ease of inspection and timely identification of potential harmful hydrocarbon and chemical spillages.

Issue

4.2.3.5 Submission/objection Ob_484 has requested that the proposed attenuation pond basin serving catchment S16A be relocated from the residential zoned lands further west into zoned agricultural lands.

Response

4.2.3.6 The proposed attenuation pond was selected at its optimum point in respect to drainage runs and its proximity to the proposed storm outfall with the receiving watercourse. The location is influenced by the vertical alignment of the road, ensuring gravity drainage into the pond and gravity drainage from the pond to the water course via its storm outfall. Therefore the relocation of the proposed attenuation pond at this location cannot be facilitated.

4.2.4 Specific Requests

Issue

4.2.4.1 Submission/objection, S_018.2, asserts that the incorporation of mammal ledges has not been included for in the proposals.

Response

4.2.4.2 Mammals (i.e. Otters) have been catered for in the design of culverts. Mammal ledges have been included on culverted streams and rivers where applicable and required by the ecological assessment. This is outlined in detail Drawing GCOB-500-D-520 of Appendix 10.1 of the Design Report in Volume 4 of the RFI

Response which details both of the locations where specific otter passage is required.

Issue

4.2.4.3 Submission/objection, S_018.2, raises queries in relation to the likely effects on European sites specifically "*SAC-Hydrology*" and likely effects on the Environment NHA-Hydrology and requests clarity in relation to changes in the hydrological regime.

Response

4.2.4.4 Please note that the queries referred to under hydrology and hydrological impacts in this submissions/objection refer to groundwater and as such are fully dealt with in Dr Les Brown's statement of evidence on Hydrogeology and hydrogeological impacts. As noted above, the hydrological assessment for the NIS is contained in Appendix B of the NIS and concludes that there will be no significant hydrological impacts, either direct or indirect on any European Site. The conclusions of this hydrological assessment have informed the ecological assessment as it relates to Appropriate Assessment (AA) and addressed in Section 4.4.3 of Aebhin Cawley's statement of evidence on AA.

Issue

4.2.4.5 Submission/objection, Ob_134, has requested piped drains in place of open drains adjacent to their respective property.

Response

4.2.4.6 The pre-earthwork drains will generally be open drains, with the exception of where traversing beneath an access track. This is standard construction practice for land drainage. The open drain in the vicinity of property 134 will be located inside the proposed development boundary. It is a relatively shallow drain designed to convey overland flow and should not represent a significant health and safety risk, particularly as it will be located inside the proposed development boundary and will be secured via fencing to prevent unauthorized access from the general public.

Issue

4.2.4.7 Submission/objection, Ob_219 noted that provision for a new connection to a public foul sewer in the vicinity has not been provided and suggests that this has a serious effect on their client due to the extra work to accommodate a connection from their lands.

Response

4.2.4.8 It is not within the remit of this project to provide foul sewer connections to private dwellings in the vicinity of the project that are currently operating on a septic tank

system. However, if an existing connection to either a public water supply or foul systems is affected by the proposed works, it will be reconnected.

Issue

4.2.4.9 Submission/objection S_036 requests that drainage networks F19 and F24 should include a grit trap to reduce the level of suspended solids entering the wastewater network.

Response

4.2.4.10 Catchpit manholes are specified throughout the length of both the proposed tunnel drainage networks. Therefore, grit traps have already been specified thus minimising the risk for suspended solids entering the wastewater network. This is outlined in detail in drawings GCOB-500-D-115 and GCOB-500-D-119 in combination with the associated drainage schedules in Appendix A.8.5 of the Design Report in Volume 4 of the RFI Response.

Issue

4.2.4.11 Submission/objection S_036 from Irish Water asserts that it has no objection in principle to the proposed development subject to provision of diversion/build over agreements, future proofing sleeves at Ardaun to be agreed prior to construction, provision of connection agreements where connections to their networks are required and employing best practise measures during construction to eliminate the risk of spillages to the River Corrib. It also states that any works potentially impacting Irish Water assets should be carried out in accordance with Irish Water Standards and Specifications S_036.2 and requests compliance with various legislation.

Response

4.2.4.12 All construction works will be carried out in accordance with best practice construction guidance and as such will eliminate the risk of spillage to the River Corrib. All works will also be carried out in accordance with Irish Water Standards and Specifications, in line with standard processes and procedures for obtaining connection consent and build over agreements with the utility provider. Future proofing sleeves in the vicinity of Ardaun can be easily accommodated and their location will be agreed with Irish Water prior to commencement of construction.

Issue

4.2.4.13 Submission Ob_691 requests further details in relation to the impounding sump serving the Galway Racecourse Tunnel and whether the public sewer has the capacity to accept the tunnel runoff.

Response

4.2.4.14 Full details of the proposed pump stations are provided Section 8.5.6.1 of the Design Report in Appendix 10.1 of the RFI Response in and calculations are provided in Appendix A.8.4 of the Design Report. A pre-connection application enquiry was submitted to Irish Water in relation to the location for tunnel discharge points and their locations and discharge rates were agreed, and this is outlined in further detail in Section 8.5.6 of the Design Report. This process confirms that the sewer has capacity to accept the drainage from the proposed road development at the agreed connection locations.

4.3 Water Quality

4.3.1 General water quality

Issues

4.3.1.1 Submissions/objections Ob_584; Ob_691; S_006; S_017; S_074; and S_036 raised the following issues in respect to surface water pollution:

- it is asserted that the proposed road development would result in continued undesirable polluting surface discharge from tyre and hydro carbon pollution into the surface streams and watercourses
- it is asserted that the proposed road development would result in the contamination of receiving watercourses, Coolagh Lakes and River Corrib
- it is asserted that the potential impacts to the new proposed Galway City Terryland Intake from the River Corrib was not assessed and should be no more significant than it would be at the current intake
- it is asserted that the proposed road development would result in contamination of the Galway City Water Supply and increase the risk of contamination from accidental spillages at both the existing and future proposed abstraction intakes due to siting of permanent attenuation tanks/ponds/sumps located within Lackagh Quarry
- queried whether the public foul sewer capacity to accommodate pumped discharge from the Tunnel section and the implications of flooding on water quality has been assessed

Response

Routine Road Drainage Runoff

4.3.1.2 Runoff from the proposed road will be collected in a drainage system and discharged to watercourses. This will result in the potential for localised water quality impacts, at the outfall site and in the downstream channel reach, from pollutants generally associated with suspended solids and associated trace amounts of heavy metals (Cu, Zn) and hydrocarbons in the drainage waters. A water quality

impact analysis using HAWRAT as per TII Guidance document *Road Drainage and the Water Environment - DN-DNG-03065* was carried out on all proposed new road drainage outfalls to surface waters. This analysis identified whether the outfall passed or failed and the required mitigation in terms of percentage reduction in soluble pollutants and sediment deposition, as summarised in Table 11.33 of Chapter 11 of the EIAR. 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.

4.3.1.3 At all surface water outfalls the potential water quality significant impact from routine road drainage discharges will be prevented by utilising sustainable drainage systems. At all proposed surface drainage outfalls, water quality treatment of the sediment load is provided for in the form of filtering and primary settlement through retention, which will reduce local impacts from sediment deposition accumulation and toxicity levels in the receiving stream/drain channel close to the outfall. This impact will be further reduced by utilising the source control treatment provided by filter drains and grass surface water channels in the runoff conveyance systems where permitted (i.e. in the low vulnerability poor aquifers in the granite bedrock west of the River Corrib). In the regionally important limestone bedrock catchment to the east of the River Corrib vegetated lined wetlands and groundwater infiltration basins are provided with discharges to groundwater in the absence of watercourses.

4.3.1.4 Given the sensitivity of the River Corrib as part of the Lough Corrib cSAC and as a major downstream water supply source, both HAWRAT analysis and 2-dimensional transport dispersion modelling was carried out on the storm discharges to the River Corrib system. The simulations modelling the primary heavy metal pollutants in road drainage waters of copper and zinc were carried out for combined outfalls discharge (outfalls 14A, 14B, 15 and 18A) on the western side of the River Corrib at Dangan and combined with outfall 18B on the eastern bank near Menlo Castle. These analyses and results are reported in Section 11.5.4 of Chapter 11 of the EIAR and Section 4.2.2 of Appendix B of the NIS.

4.3.1.5 The conclusion reached is that the water quality impact of the proposed routine stormwater discharge from the proposed road development, including first flush rainfall events on the River Corrib, given its high dilution and assimilative capacity, represents a slight impact to water quality, immediately local to the outfalls (i.e. at the point of discharge) and a slight to imperceptible impact in the medium to far field downstream extents. The high water quality status of the River Corrib will not be affected by the proposed road development drainage discharges. The dispersion analyses show only trace pollutant concentrations reaching the existing Terryland Galway City water supply intake from the Jordan's Island channel. Interrogation of the dispersion results show very low concentrations of dissolved copper and zinc (< 0.05µg/l Cu and < 0.1µg/l Zn) in the River Corrib at 95-percentile river low flow at the proposed new Terryland Galway City water supply intake to be located in the main River Corrib channel a short distance downstream of Quincentenary Bridge and therefore the water quality at the proposed new intake will not be impacted by the proposed road drainage discharges.

4.3.1.6 It is clear from the hydrological assessment and dispersion modelling that the routine road drainage discharge to the River Corrib via the proposed drainage outfalls will not impact the drinking water quality at either the existing or proposed Galway City supply intake. Therefore the proposed development will not result in undesirable polluting surface discharge from tyre or hydro-carbon pollution into the surface streams and watercourses.

Accidental Spillages Road Drainage Runoff

4.3.1.7 A significant impact to the water quality of a receiving watercourse can arise from a serious chemical spillage arising from a road traffic accident involving a HGV transporting fuel or other such chemicals. This is a worst-case scenario and a risk based assessment was performed in respect to the likelihood of an accident involving a HGV resulting in a serious spillage occurring. The risk analysis used the recommended method presented in the TII Guidance Document Road Drainage and the water environment – DN-DNG-03065. The overall combined probability of a serious HGV spillage entering a watercourse from the proposed road development along its entire road length was found to be low risk at 0.09% (which is slightly less than 1 in 1000 chance of an occurrence in any given year). For the specific River Corrib outfalls 14A, 14B, 15, 18A and 18B) the risk is lower at 0.042% (1 in 2380), which is an extremely low probability event.

4.3.1.8 As a "Belt and Braces Approach", and notwithstanding the predicted very low risk of such a spillage event occurring, it is proposed to mitigate the risk along the mainline and link roads even further by providing all pollution control facilities upstream of the outfall (both groundwater and surface water outfalls) with a separate 25m^3 spillage containment area, an oil and petrol interceptor and a shut-off penstock or similar restriction (shut-off valve) at the outfall, for containment purposes should a spillage occur.

4.3.1.9 A shut-off facility upstream of each outfall allows, in the event of a serious accidental spillage as part of the local authority emergency response, the pond to be closed off manually, thereby containing the spillage within the lined pond. From there it can be removed and treated appropriately and hereby limiting the impact on the downstream watercourse.

4.3.1.10 It can be concluded given the predicted very low risk of a serious spillage event occurring at an outfall and the additional mitigation of spillage containment upstream of the drainage outfalls that the proposed road development will not result in the contamination of watercourses, including the River Corrib and the Galway City water supply through a serious road accident spillage event.

Potential Construction Impacts on Water Quality

4.3.1.11 The potential construction impacts, without mitigation, through potential release of sediments by disturbance of the channel bed and bank and uncontrolled site runoff represent a short term local moderate to significant impact on water quality and bed sediment deposition rates that could impact the fishery habitat potential of the downstream watercourse reaches.

4.3.1.12 The River Corrib Bridge is a free clear spanning structure with its abutment setback in excess of 5m from the river's edge which reduces the potential for disturbance of sediments associated with the bridge construction. However, given the sensitivity of the River Corrib as part of the Lough Corrib cSAC and a major drinking water source, all construction activities in the vicinity of the River Corrib require careful management and pollution control measures.

4.3.1.13 The specific mitigation is set out in Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the EIAR and Appendix C of the NIS and contains the Sediment Erosion and pollution control plan (SEPCP) (as outlined in Section 8 of the CEMP) for protecting sensitive watercourses which include the River Corrib and the Bearna Stream. The CEMP documents the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed road development. Its purpose is to demonstrate how the proposed construction works will be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase. The CEMP and the SEPCP are both working documents and will be added to and updated prior to commencing works on site.

4.3.1.14 The principle objectives of the SEPCP are:

- Plan sediment, erosion and pollution control at the design stage, as far as practicable, so that pollution control requirements are built into the design and land requirements for the proposed road development
- Minimise erosion and potential for soiled and contaminated water to be generated by minimising construction runoff
- Install drainage and runoff controls before starting site clearance and earthworks
- Minimise the area and duration of exposed ground
- Prevent natural clean runoff entering the works area/site
- Provide appropriate control and containment measures on site
- Monitor and maintain sediment, erosion and pollution controls throughout the proposed road development
- Establish vegetation as soon as practicable on all areas that have been exposed

4.3.1.15 An Incident Response Plan (IRP) detailing the procedures to be undertaken in the unlikely event of a spill of chemical, hydrocarbons or other hazardous substances is also included in the CEMP. Staff will be trained in the implementation of the IRP. Further details of the IRP are outlined in Section 10 of the CEMP.

4.3.1.16 At a minimum, details provided in the Sediment Erosion and Pollution Control Plan (SEPCP) will be included for in the method statements for these works.

4.3.1.17 By providing all of the proposed mitigation measures outlined in the CEMP, SEPCP and IRP, and by employing best practice construction methodologies the potential to impact water quality during the course of construction is minimised.

4.3.2 Water quality in the event of a flood

Issues

4.3.2.1 Submissions Ob_584, S_036.2 and S_017 raised issues in respect to the flood risk at Lackagh Quarry and the potential contamination issues associated with material deposit, construction compound and attenuation ponds within the Quarry site.

Response

4.3.2.2 A flood risk assessment of Lackagh Quarry identified that the historical maximum flood level in the quarry reached 15.2m AOD and that the minimum design flood level for the tunnel entrance should be set above 17m AOD – almost 2m higher than the historical maximum. The quarry has a limited contributing catchment area of 17.4ha and is enclosed on all sides and does not represent a flood risk to adjoining lands or dwelling house both existing and proposed cases. 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.

4.3.2.3 To prevent contamination by fine materials, the base of the quarry in the flood zone is to be infilled with clean stone and raised above the 100year flood level of 16.5m OD. In addition, a permeable geotextile membrane is to be placed on top of the clean stone and the deposition material placed on top of the membrane. This membrane allows infiltration but prevents mobilization of fines through the membrane and avoids contamination of groundwater. The material to be placed within the deposition site in the quarry is not contaminated or hazardous material but excess soil material from the road construction. These design measures ensure that there will be no potential contamination of surface and groundwaters from the proposed material deposition area at Lackagh quarry.

4.3.3 Specific Requests

Issues

4.3.3.1 Further commitments from the project team in relation to consultation and liaison with the statutory body was requested in Irish Water Submissions S_036 and S_036.2.

Response

4.3.3.2 The following will be undertaken by the project team.

- Irish Water (IW) will be consulted in the updating of the CEMP and specifically the SEPCP and the incident response plan (IRP) for construction and operation stages S_036
- Provision will be made for Irish Water Staff to visit the construction site if deemed necessary by Irish Water
- Ongoing liaison with Irish Water will be provided at construction stage and procedures for regular project dates will be established during the construction stage in a timely manner so as to enable IW to assess potential increased risk to the water quality of their potable water supply source
- Throughout the project construction and operation phases will continue to consult and inform with Irish Water in respect to water quality and pollution risk to their potable water supply source

Issues

4.3.3.3 Clarity is requested on the means of alarms to identify a chemical/hydrocarbon spill S_036.2.

Response

4.3.3.4 The provision of an alarm system on storm water outfalls discharging to the River Corrib is not considered necessary as it is proposed to provide pollution control facilities upstream of all outfalls (both groundwater and surface water outfalls) with a separate 25m^3 spillage containment area, an oil and petrol interceptor and a shut-off penstock or similar restriction (shut-off valve) at the outfall, for containment purposes should a spillage occur.

Issues

4.3.3.5 A request has been made to put in place appropriate screening measures to prevent debris including plastics entering the watercourse or wetlands, S036.2.

Response

4.3.3.6 All drainage will be collected and discharged through the designed pollution control facilities which will essentially act as a very effective filter removing debris and plastics from entering the watercourses. These ponds, wetlands and containment areas will be inspected and maintained on a regular basis and a build-up of such material can be removed and disposed of appropriately. The proposed drainage system is shown on Drawings GCOB-500-D-101 to 132 in the Design Report in the Appendix A.10.1, Volume 4 of the RFI Response submitted to An Bord Pleanála August 2019.

5 Conclusion

5.1 All measures, both in terms of the drainage design and proposed mitigation, have been carefully considered and will effectively limit the hydrological impact of the proposed road development on flood risk, on hydrological regime change in sensitive ecological receptors and on the water quality of receiving surface waters and their downstream reaches.

5.2 Based on the water quality assessments set out in Chapter 11 of the EIAR and Appendix B of the NIS it can be concluded that the proposed road development as designed complies with the Water Framework Directive and the River Management Plan Objectives and will not impact the water quality status of receiving waters including the River Corrib either during construction or operational phases of the proposed road development. Specifically there will be no changes to the hydrological regime of the Lough Corrib cSAC or in the downstream Galway Bay Complex cSAC.

5.3 I have carefully considered the hydrological issues raised in the submissions and objections made on the application and, as set out above, I conclude that:

- Extensive drainage details have been provided in the application documentation, including details pertaining to realignments, drains that are severed, culvert details and outfall locations
- The proposed road development will not increase flood risk to properties
- There are no health and safety concerns regarding drainage features
- The proposed location of the attenuation ponds are suitable
- The proposed road development within the Lackagh Quarry catchment including the proposed material deposit area, construction compound area, proposed tunnel entrance and approach road and proposed attenuation ponds are designed to be above the design flood and will not impact flood risk elsewhere
- the proposed road development will not result in the contamination of watercourses, including the Coolagh Lakes, Ballindooley Lough, Lough Corrib and the River Corrib
- the proposed road development will not result in contamination of the Galway City water supply
- there is no increased risk to the Galway City water supply source at Terryland from accidental spillage at both the existing and proposed new abstraction locations
- the potential impact to the new proposed Galway City water supply intake at Terryland from the River Corrib was assessed and is no more significant than it would be at the current intake

5.4 No significant hydrological impacts will arise from the proposed road development either during the construction or operation phases.

5.5 I have considered and dealt with each and every submission/objection made in respect to hydrology, water quality, drainage and flood risk. Nothing raised in these submissions/objections have caused me to change my opinion and conclusions as set out in Chapter 11 of the EIAR and Appendix B of the NIS. The conclusions of this hydrological assessment have informed the ecological assessment as it relates to Appropriate Assessment (AA) and addressed in Section 4.4.3 of Aebhin Cawley's statement of evidence on AA.

5.6 In conclusion there will be no significant hydrological impact from the proposed road development on drainage and flood risk, on surface water quality, on stream and river morphology and on hydrological regime change in any of the key water dependent ecological receptors. In respect to European Sites there will be no significant hydrological impacts, either direct or indirect arising from the proposed road development.