

21 Summary of Mitigation Measures and Residual Impacts

21.1 Introduction

Mitigation describes the measures proposed in order to avoid, reduce and where practicable, remedy significant adverse effects. It is also a means by which decisions about a proposed scheme are modified to avoid, reduce or remedy the adverse environmental effects that are identified.

Mitigation measures have been incorporated into the design of the proposed scheme and will be applied during the construction and operation of the M7 Osberstown Interchange and R407 Sallins Bypass.

This chapter of the EIS is a summary of the mitigation measures (Section 21.2) and residual impacts (Section 21.3) of the proposed M7 Osberstown Interchange and R407 Sallins Bypass.

21.2 Summary of Mitigation Measures

21.2.1 Transportation

21.2.1.1 Construction Phase

Construction of the proposed scheme will cause temporary short-term traffic impacts on the local road network.

Enforcement of a Construction Management Plan will ensure that construction traffic impacts are minimised through the control of site access / egress routes and site access locations, traffic diversions and any necessary temporary road closure requirements.

21.2.1.2 Operational Phase

A number of specific mitigation measures have been incorporated into the proposed scheme design to ensure that the proposed scheme provides adequate traffic capacity to avoid any local traffic congestion issues arising. No further mitigation measures are required as a part of the proposed scheme.

21.2.2 Agronomy

Mitigation of impacts takes place under two headings:

- General mitigation measures – described below.
- Compensation under the Compulsory Purchase System – compensation to farmers for residual damage is part of the statutory process for compensation.

21.2.2.1 Construction Phase

- Landtake has been minimised so that only lands required for the proposed scheme are taken.
- The landowner will be provided with access to all separated land parcels during the construction of the proposed scheme.
Where existing water and electricity supplies are disrupted during the construction phase an alternative water source or electricity supply will be made available. If permanent access to surface drinking water sources is taken alternative ground water supplies will be provided (or compensation to allow farmer drill his own well).
- Suitable boundary fencing will be erected to delineate the CPO line and prevent disturbance to adjacent land.
- A key contact person will be appointed during the construction phase to facilitate communications between affected landowners and to facilitate the re-organisation of farm enterprises by farmers during critical times.
- Where drainage outfalls are temporarily altered or land drains blocked or damaged an adequate drainage outfall will be maintained and land drains will be repaired.

21.2.2.2 Operational Phase

- Landowners who lose buildings and water sources to the proposed scheme will be compensated. Compensation payments will assist farmers to re-purchase land to replace land lost to the proposed scheme.
- All separated land parcels will be accessible either via the local road network, via accommodation access roads and access tracks or accommodation underpasses.
- Landowners may have to build additional farm facilities (e.g. cattle holding and testing pens) on their separated land. Field boundaries and paddock systems may have to be re-organised to take into account the altered shape of fields. These matters are allowed for in the compensation settlements.
- Water from the proposed scheme will be diverted to attenuation ponds before discharging to watercourses. The drainage design of the proposed scheme will intersect existing field drains and carry the drainage water to suitable outfalls.
- Other injury impacts such as loss of shelter, removal of field boundaries, disruption of farm roads and field paddock systems and the increased potential for trespass on to private land due to the cycle track and footways are taken into account in this assessment. Statutory compensation will be used to compensate land owners for residual effects and to allow the land owners to execute mitigation measures and re-instatement works on their own land.
- Landscaping along the proposed scheme will minimise the visual impact on farms along the route and will over time improve shelter in affected farms.

21.2.3 Human Beings

21.2.3.1 Construction Phase

A number of positive design elements are included in the proposed scheme, which has the capacity to improve the local environment and sustainable transport. By way of mitigation, the following are proposed to maximise the net socio-economic positives of the proposed scheme:

- Provide roadside footpath along R407 Clane Road as far as the roundabout connection with the bypass.
- On-road signage and surfacing on the Osberstown Road is needed to alert drivers to cyclists and pedestrians crossing the road at Ch. 0+400.
- Provide for uncontrolled crossing of proposed Sallins Link Road to Millbank from informal path from Castlesize Estate and football pitch.
- Provide for angler or amenity access along both sides of River Liffey beneath bridge crossings.
- Protect the tow path in immediate vicinity of the canal crossing.

21.2.3.2 Operational Phase

No mitigation measures are proposed for the operational phase.

21.2.4 Archaeology and Cultural Heritage

21.2.4.1 Construction Phase

Archaeology

- A programme of archaeological investigation (which may include geophysical survey and/or testing) will be undertaken in previously undisturbed greenfield areas within the footprint of proposed road development, including AAP 1–3. This work will be undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist. Full provision will be made for the resolution (by means of either excavation or preservation *in-situ*) of any archaeological features/deposits that may be discovered.
- An archaeological wade survey will be undertaken at stream AAP 3 prior to any construction works. This work will be undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist. Full provision will be made for the resolution (by means of either excavation or preservation *in-situ*) of any archaeological features/deposits that may be discovered.

Cultural Heritage

- Archaeological testing will also include an assessment of the section of mill race (CH 5) to be crossed by the proposed scheme. This work will be undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist. Full provision will be made for the resolution (by means of either excavation or preservation *in-situ*) of any archaeological features/deposits that may be discovered.
- Archaeological testing will also include an assessment of the section of 'dead canal' (CH 2) to be impacted by the proposed road development. This will aim to assess and record the construction techniques employed during the late 18th century when this section of the canal was constructed and later abandoned. This work will be undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist.
- A written and photographic record of the section of townland boundary (TB 4) to be impacted by the proposed road development will be undertaken prior to any construction works. This record will be supplemented by archaeological testing undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist.
- Additional planting of trees and hedgerows (as outlined in the landscape and visual chapter) will be installed along the existing planted northern boundary of the R407 Sallins Bypass, where it passes in close proximity to the southern part of Osberstown demesne, in order to mitigate against the indirect visual impact on designed landscape CH 3. Additional hedgerows (as outlined in the landscape and visual chapter) will be installed along the western boundary of the R407 Sallins Bypass, where it passes in close proximity to the eastern part of Osberstown Hill demesne, in order to mitigate against the indirect visual impact on designed landscape CH 4.
- Archaeological testing will also include an assessment of the remains of the former road and post medieval farmstead (CH 8 and 9) in Osberstown. This work will be undertaken by a licence eligible archaeological under Ministerial Directions issued by the DoAHG, in consultation with the National Museum of Ireland and the NRA Project Archaeologist. Full provision will be made for the resolution (by means of either excavation or preservation *in-situ*) of any archaeological features/deposits that may be discovered.

Monitoring

The mitigation measures recommended above would also function as a monitoring system to allow the further assessment of the scale of the predicted impacts and the effectiveness of the recommended mitigation measures.

21.2.4.2 Operational Phase

No mitigation measures are proposed for the operational phase.

21.2.5 Architectural Heritage

It is intended that the primary mitigatory measure of planting of trees and shrubs will address these impacts. However, the design of the landscape will be developed to achieve a non-linear treatment, to more effectively mask the scale of the proposed scheme say by the planting of copses at intervals along the proposed scheme.

Additionally, mitigation of the nocturnal impact, primarily associated with light from the new fixtures at the junction, will be achieved through appropriate shielding of the luminaires themselves.

21.2.6 Landscape and Visual

21.2.6.1 Construction Phase

Consideration was given to avoidance of significant landscape and visual impact during the route selection and design process for the proposed road development. Nevertheless, all road construction projects give rise to some degree of unavoidable landscape and visual impact and as measures are proposed to mitigate such impacts wherever possible.

During the construction stage, an Environmental Operating Plan (EOP) will be drawn up by the main contractor using the NRA's 'Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan'. Adherence to this plan will be a contract requirement and this will ensure good working practices are followed so as to minimise and manage any significant, negative environmental impacts arising from construction.

General mitigation will ensure that the works will have continuous monitoring under the Environmental Operating Plan so as to ensure adequate protection of areas outside of the construction works.

21.2.6.2 Operational Phase

General measures will be applied over the entire proposed road development, depending on the nature of the particular road section. Where feasible such measures shall include for the re-connection of field boundaries with tree-lines and hedgerows established along the CPO line of the proposed road development. Trees within such hedgerows shall be randomly spaced in a visually naturalistic manner.

Proposals will ensure that planting is distributed along the entire proposed road development and the associated local road re-alignments and will vary from typical rural, randomly tree-lined hedgerow reinstatement to wide plantings of landscape and screen planting to the establishment of larger areas of new woodland for integration of the development into the wider landscape. Shrub planting will be used at the edges of the tree planting.

Along the length of the proposed road development, landscape areas within junctions and small areas of severed fields, plots or other property acquired for the construction of the proposed road development will be varyingly treated including being planted in copse like fashion with native or semi-native woodland species.

The detailed lighting design shall be completed in a manner, which will minimise glare and light pollution that in combination with extensive landscaping as proposed at junctions will ensure that light-spill effect is minimised. It is noted that the proposed road development includes for a minimum of roadside illumination, effectively restricted to roundabouts and junctions and along the link to Sallins.

In specific locations barriers and earth bunds will be provided to reduce the impact of noise. Such barriers will also have the effect of providing immediate visual screening of traffic from properties. Such features shall, wherever possible, be integrated within the proposed landscaping measures.

21.2.7 Noise and Vibration

21.2.7.1 Construction Phase

The contractor will take specific noise abatement measures and comply with the recommendations of BS 5228: Part 1 (2009) and the European Communities (*Noise Emission by Equipment for Use Outdoors*) Regulations, 2001. These measures will be employed to minimise the potential for noise disturbance to the surrounding area which will be employed by the contractor to ensure the construction noise criteria are not exceeded

BS 5228 includes guidance on several aspects of construction site practices, including, but not limited to:

- Selection of quiet plant.
- Control of noise sources.
- Screening.
- Hours of work.
- Liaison with the public.
- Monitoring.

Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring. The contractor will be required to conduct construction noise predictions and put in place the most appropriate noise control measures depending on the level of noise reduction required at any one location.

21.2.7.2 Operational Phase

Options for the reduction in traffic noise levels can take the form of a low noise road surface (LNRS), the use of barriers and or bunds or a combination of both. A LNRS surface is assumed to achieve a minimum noise reduction of -2dB when compared to Hot Rolled Asphalt (HRA). Mitigation measures have been considered for the two development scenarios under assessment.

Three barriers are proposed as part of the noise mitigation for the proposed scheme. These are located along the M7 (2 m in height, 500 m in length) and two along the R407 Sallins Bypass (2.5 m in height and 130 m in length; 2 m in height and 130 m in length).

21.2.8 Air Quality

21.2.8.1 Construction Phase

Emissions to air during earthmoving and construction will occur, although the prevailing weather, the size of the site and its distance from sensitive receptors will assist in facilitating the management of any effects. The focus of the control procedures will therefore be to reduce the generation of airborne material.

The assessment of construction impacts contained in Section 12.4 includes for the implementation of 'standard mitigation', as stated in the NRA guidance. This shall include the following measures:

- Spraying of exposed earthwork activities and site haul roads during dry weather.
- Provision of wheelwashes at exit points.
- Control of vehicle speeds and speed restrictions.
- Sweeping of hard surface roads.

In addition, the following measures shall be implemented in the areas outlined in Section 12.4 where major works will occur in proximity to sensitive receptors including at the river crossing points:

- Provision of hoarding of 2m high at a minimum.
- Covering of stockpiles and locating stockpiles away from sensitive receptors.
- Locating plant away from sensitive receptors.

Dust deposition monitoring will be conducted at a number of locations in the vicinity of the proposed road development. These locations will be determined in consultation with the local residents and the roads authority.

At a minimum, monitoring will be carried out at the two nearest sensitive receptors at the interchange construction site, at the nearest sensitive receptors to the bridge crossings and at the crossing of the Grand Canal. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft guidelines. Should an exceedance of the TA Luft limit occur during the construction phase, additional mitigation measures, for example more regular spraying of water, will be implemented.

21.2.8.2 Operational Phase

No mitigation measures are proposed for the operational phase.

21.2.9 Climate

21.2.9.1 Construction Phase

There will be no effect on microclimate as a result of the proposed scheme, therefore no mitigation measures are proposed.

The NRA's Environmental Impact Assessment of National Road Schemes – A Practical Guide notes that climate change issues are largely outside the scope of an EIS for individual road schemes as the issues and mitigation measures are the subject of specific policies and strategies set out by government. The Climate Change Bill, 2013 requires the Minister for the Environment, Community and Local Government to make, and submit to Government, a National Low Carbon Roadmap, incorporating sectoral roadmaps prepared by the relevant Ministers and approved by Government. This Roadmap will specify policy measures required to ensure compliance with climate related obligations.

It should also be noted that the provision of cycle tracks and improved access to park and ride facilities as part of the proposed scheme will encourage a modal shift in line with Smarter Travel - A Sustainable Transport Future, A New Transport Policy for Ireland 2009 – 2020. This shift has the potential to reduce greenhouse gas emissions associated with the proposed development in the future.

21.2.9.2 Operational Phase

No mitigation measures are proposed for the operational phase.

21.2.10 Ecology

21.2.10.1 Construction Phase

21.2.11 Designated Areas

The crossing of Grand Canal pNHA at Ch. 1+555 will be by a clear span structure encompassing the canal and both the tow path and adjacent local road, which is designed to allow for uninterrupted continuity of the linear habitat and associated fauna. The construction area will be minimised to reduce the disturbance to the canal and associated linear features including the treeline along the northern side. The working area will be defined at the outset of works by a robust fence which will allow for the continued unimpeded movement of fauna along the canal.

21.2.12 Habitats

The design of River Liffey bridge structures has been developed to provide a clear span across the river channel at both locations maintaining both river banks intact in order to avoid any instream disturbance and to maintain the riparian zone of the channels. Measures of pollution control for road run-off to the River Liffey during the operation phase of the proposed scheme include provision of vegetated treatment systems which will function as attenuation, treatment systems and containment to accommodate accidental spillage.

The construction work zones along the River Liffey shall be defined at the outset of construction using rigid timber or equivalent robust fencing. Within the site boundary fence, earth bunds shall be constructed to contain surface water run-off and channel it to a silt trap before discharge. This shall entail a mechanism for containment of runoff in the event of accidental spillage to enable clean-up and appropriate disposal through licensed facilities.

The east side of the river at structure S5 can be accessed from the proposed Sallins Link Road while the east side of the river at structure S6 can be accessed from the existing R407. This means that it will only be necessary to construct one temporary crossing which will be a clear-span Bailey Bridge type structure.

Mitigation for Aquatic Habitats

The mitigation measures detailed below will be incorporated in their entirety into the construction contract documentation.

- A suitably qualified project ecologist will be employed as part of the clients representative team to ensure successful implementation of the mitigation measures.
- All design, construction and operation will be carried out in accordance with *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes* (NRA, 2006), *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites* (Murphy, 2007) and *Control of water pollution from construction sites; Guidance for Consultants and Contractors* (SP156) (CIRIA, 2002) in addition to the specified requirements within the EIS.
- Design and construction method statements will be submitted to Inland Fisheries Ireland for approval prior to commencement of construction.
- Sediment traps or settlement ponds will be provided for on all watercourses during construction. Total suspended solid levels in all waters discharging to the River Liffey system shall be in compliance with the Quality of Salmonid Water Regulations (SI 293:1988).
- Where site investigation (including archaeological works) is required in the vicinity of or adjacent to the watercourses within the River Liffey system, these works will be carried out with due sensitivity and appropriate measures employed to minimise siltation.
- Site compounds and soil storage areas will be located at a minimum distance of 50m from the River Liffey. All drainage from these facilities will be directed through adequately sized settlement ponds with appropriate capacity and measures to provide spill containment.
- The contractor will undertake an inspection and maintenance programme of all treatment facilities during the construction phase to ensure compliance with the discharge limits.
- Watercourse crossing and approach road design will incorporate best environmental practice and design in the control of road run-off and accidental spillage. All stormwater discharges will be directed through hydrocarbon interceptors.
- Realignment of the Osberstown Stream will incorporate hydraulic and morphological continuity with the existing channel. Bankside protection if required will utilise natural materials only. All instream works will be completed during the period May to September unless otherwise agreed with IFI.

- Run-off from the road during operation will be channelled through a stilling process to allow suspended solids to settle out (this may be in open ditches, ponds, hydrodynamic separators, etc.) or through some form of spill-containment facility and vegetated treatment system prior to discharge to a watercourse.
- The short-term storage and removal/disposal of excavated material will be planned and managed such that the risk of pollution from these activities is minimised.
- Specific measures for the River Liffey outfalls include provision of vegetated treatment systems which will function as attenuation, treatment systems and containment to accommodate accidental spillage. Discharge from the system will be via a penstock or similar to enable retention of accidental spillages, into a shallow drainage channel excavated towards the river. As the channels will be shallow channels (swales) discharging at the river bank, no headwalls will be required at the river banks, thus avoiding any instream works or requirements for headwalls, scour protection etc. within the river.
- An emergency-operating plan will be established to deal with incidents or accidents during construction that may give rise to pollution within any watercourse. This will include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (including oil booms, soakage pads, etc).
- Landscaping and design in the vicinity of all watercourses will focus on the establishment of naturally occurring habitat types using native species to re-establish the linear corridor of vegetation along watercourses in accordance with *A Guide to Landscape Treatments for National Road Schemes in Ireland* (NRA, 2006).
- Angling access will be maintained along the River Liffey and the Grand Canal.
- Throughout all stages of the construction phase of the project the contractor will ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the freshwater environments and the requirement to avoid pollution of all types.
- The storage of oils, hydraulic fluids, etc., will be in a bunded facility with filling and take-off points within the bunded area in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005). The bunds will be protected against accidental tank rupture and will ensure any spilled oil can be retained for subsequent disposal to an appropriate facility.
- During construction, temporary, contained chemical toilet facilities will be used, which will be taken off site for emptying at a suitably licensed disposal location. Consequently, there will be no discharge of sewage to surface waters.
- Adequate security measures will be put in place to prevent any acts of vandalism that may result spillage or discharge of pollutants.

- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment. As grout/cementous materials are highly toxic to aquatic life all such works must be maintained in complete isolation of all waters and the storm water system. Wash down from delivery and concrete pumping areas will be contained and removed off site for appropriate disposal.
- All machinery operating in the vicinity of watercourses will be steam-cleaned in advance of works and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken on dry land.
- The risk of accidental transfer of non-native invasive species will require adherence to current best practice protocol for avoiding the spread or transfer of all invasive plants and animals in accordance with the NRA National Roads Authority *Guidelines on the Management of Noxious Weeds and Non-native plant species on National Road Schemes* (2010) along with any modified or updated approaches to invasive alien species control (www.invasivespeciesireland.com).
- These measures will be enforced during construction to ensure accidental spread does not occur on machinery or materials from / to the site. The developers will also adopt any modified or updated approaches to invasive alien species control.

For terrestrial habitats, the principle mitigation will be the minimisation of impacts during the construction phase coupled with the design of the landscaping associated with the proposed scheme. In the vicinity of trees and other woody vegetation to be retained, protection will be afforded in accordance with BS 5837:2012 (*Trees in relation to design, demolition and construction – Recommendations*). Landscape design will utilise a native suite of trees and shrubs in accordance with *A Guide to Landscape Treatments for National Road Schemes in Ireland* (NRA, 2006).

Fauna

Otter

Mitigation requirements for otter require the provision of safe passage along all watercourse crossed by the proposed scheme. This will be achieved by the incorporation of a suitable mammal passage facility in conjunction with otter-proof fencing along the road network to prevent animals from accessing the carriageway. The specification for otter passage and fencing design will be in accordance with the *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA, 2007).

Freshwater Crayfish and Brook Lamprey

Mitigation requirements for freshwater crayfish and brook lamprey similarly entail maintenance of good water quality as detailed in Section 14.5.2 above. Marginal aquatic vegetation is of particular importance to crayfish and the requirement for the maintenance and development of this habitat listed above equally applies.

Provision for the salvage of crayfish and lamprey from the Osberstown Stream and attenuation pond edge at Osberstown where impacted, should be made at the outset of works. This task should be undertaken by appropriately experienced personnel under license from the NPWS.

Badger

As the mammal survey for the EIS was undertaken in mid-summer, vegetation growth precluded a comprehensive search for setts and other signs of mammal activity. While there are no setts apparently within the line of the proposed scheme, in order to identify the extent of the badger territories in the vicinity of the proposed scheme and confirm locations for mammal passage facilities and associated fencing, a follow-up survey is proposed during the appropriate time of the year (November 2013 to April 2014).

The provision of otter passage along all watercourses may also facilitate badger movement across the proposed scheme. However, the detailed design of measures should be in accordance with the specifications as outlined Guidelines for the *Treatment of Badgers Prior to the Construction of a National Road Scheme* (NRA, Rev.2006).

Other mammals

Measures detailed for otter, bats and badger above will serve to mitigate against impacts for other mammals species also.

Bats

Felling of all trees on site which may be potential bat roosts will be scheduled for the autumn months of September/October when bats are less likely to be using trees. Prior to any works commencing, an assessment of the tree will be conducted by a suitably qualified bat specialist who will advise on the appropriate felling methodology.

To avoid disturbance to bats feeding in the vicinity of the watercourses lighting in the vicinity of the Grand Canal, River Liffey crossings and Osberstown Pond should be cowled to prevent spread onto the pond and associated wet grassland area and the adjacent treelines.

Birds

To avoid impacting on breeding birds, no vegetation clearance will be carried out in relation to the proposed scheme within the period March 1st to August 31st in accordance with the Wildlife (Amendment) Act 2000.

Works in the vicinity of the River Liffey crossing at Ch. 2+000 will be confined in the vicinity of the identified kingfisher nest site located 100m downstream of the Ch.2+000 crossing and demarcated by robust fencing to avoid disturbance.

To compensate for the loss of habitat for other bird species, landscaping proposals will primarily entail the use of native trees and shrubs in accordance with *A Guide to Landscape Treatments for National Road Schemes in Ireland* (NRA, 2006). In addition, the use of pesticides and herbicides will be minimized to avoid reductions in insect populations and potential impacts on bird fertility.

21.2.12.1 Operational Phase

Measures of pollution control for road run-off to the River Liffey during the operation phase of the proposed scheme include provision of vegetated treatment systems which will function as attenuation, treatment systems and containment to accommodate accidental spillage.

21.2.13 Soils and Geology

21.2.13.1 Construction Phase

Effects of Construction Dewatering

Where slopes become unstable due to high groundwater table and inflow during construction, pumping locations shall be constructed in order to drain the water table below the level of the granular material and/or cut level for the duration of the construction, in addition to monitoring the slope stability. This will prevent water flowing from the slope surface causing erosion. Long term gravity drainage measures will be employed to retain the groundwater levels below the road level.

Engineering design solutions will be provided (e.g. gabions, soil nails, structural retention systems, etc.) as required during construction to deal with ground instability.

Excavations in Glacial Till

Seepage from excavations in glacial till shall be mitigated by the use of an appropriate drainage system such as herringbone drains on the slope surface with suitable angle employed to maintain slope stability during construction of the railway crossing.

Excavation Methods

No rock excavation is envisaged during the construction phase of the works.

Earthworks

Importation of materials from outside site will be minimised, in-so-far as possible, by ensuring that materials arising within the site area are used to the greatest extent possible. Where necessary, naturally occurring materials will be processed to reduce moisture content and/or improve grading in order to maximise suitability for use. Inevitably, materials will be encountered which cannot reasonably be processed into unstable fill material. These materials are generally suitable for other activities such as landscaping within the site area. Any surplus material remaining which cannot be incorporated into the works will be disposed of off-site at suitably licenced tips.

If encountered, contaminated soils will be excavated and disposed of off-site in accordance with the Waste Management Acts, 1998–2006, and associated regulations and guidance provided in the NRA's Guidelines for the Management of Waste from National Road Construction projects (National Roads Authority, 2008).

21.2.13.2 Operational Phase

With appropriate design and construction, no specific operational mitigation measures are required.

21.2.14 Hydrogeology

21.2.14.1 - Construction and Operation Phase

Proposed Mitigation for Aquifer Type and Hydraulic Conditions

During the construction phase the groundwater resources are potentially at risk from the dewatering process. In general, when significant dewatering is proposed by a development, groundwater level monitoring is put in place 12 months before construction, during the construction phase and 24 months following construction to enable effects from dewatering to be identified. In the shallow cuts of the proposed scheme there will be minimal dewatering required; nonetheless, a monitoring programme will be in place.

The proposed scheme has been designed to ensure minimal alteration to groundwater flow regimes, cuts are generally above water table and abutments and bridge footings are shallow. The M7 Osberstown Interchange and River Liffey crossings will on bank seated abutments minimising any impact. Proposed mitigation for impacts on domestic wells and springs due to localised effects is addressed below in mitigation for water supply.

Proposed Mitigation for Water Quality

Negative impacts on water quality that occur due to stockpiling of contaminated material and leachate generation will be prevented by not storing contaminated material on site. If any suspected contaminated material is encountered it will be tested and disposed of in an appropriate manner and in line with current water management legislation. If it is not possible to immediately remove contaminated material, then it will be stored on, and covered by, polythene sheeting to prevent rain water infiltrating through the material. The time frame between excavation and removal will be kept to an absolute minimum.

Run-off will be controlled through silt/sediment traps as appropriate to minimise the turbidity of water in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion. There will always be some run-off from excavations / earthworks and it cannot be prevented entirely. Earthworks operations shall be carried out such that surfaces slopes are designed with adequate falls, profiling and drainage to promote safe run-off and prevent ponding and flooding.

Once in operation, sealed drainage will be provided where the Quaternary deposits provide insufficient protection to the underlying groundwater. Run-off pollutants shall be assessed at all outfall locations and appropriate methods of treatment to be applied in accordance with the NRA requirements. SuDs systems should be considered in the first instance and only where there is insufficient space may other conventional methods such as priority systems be used.

Proposed Mitigation for Water Supply

The mitigation measures to ensure the proposed road development has no adverse impact on these local supplies involves monitoring of groundwater level and quality of any private wells located within 100 m of the CPO line on a monthly basis 12 months before construction, during and 24 months after construction.

Where private water supply wells are affected these will be replaced or households connected to mains supply where available. Where wells have to be abandoned as part of the proposed road development they will be sealed and abandoned in general accordance with Well Drilling Guidelines produced by the Institute of Geologists of Ireland (IGI 2007). Any wells that are abandoned because of the proposed scheme will be backfilled using bentonite or cement bentonite grout in accordance with the Specification and Related Documentation for Ground Investigation published by the Institution of Engineers of Ireland.

Proposed Mitigation for Karst Features

No karst features have been identified within 500 m of the CPO line. Any springs that are encountered during construction will need to be incorporated into the drainage network of the route. Sealed drainage will be provided where the Quaternary deposits provide insufficient protection to the underlying karstic aquifer if the alignment is in cut section.

Proposed Mitigation for Groundwater Dependent Ecosystems (GDE)

The primary impact that affects the watercourses is the potential for accidental spillage or collapse of stockpiles during construction of the bridge footings. An Environmental Operating Plan will be implemented for the construction of the bridge footings in the river gravels both for the crossings of the River Liffey and of the Grand Canal. Best construction practice will be outlined and incorporated into the Environmental Management Plan.

Fuels will not be stored within 100 m of the River Liffey. All fuel containers and diesel operated plant must be positioned on flat bunded surfaces as far from the river as is feasible. Stockpiles will be graded and shall not be located within 100 m of the River Liffey. Special care will be taken to ensure that the bank surfaces are stable to minimise erosion. All practical measures will be taken to prevent eroded sediments from entering open watercourses (adequate falls, batted slopes, polythene sheeting etc.).

The other GDE impacted is Osberstown Pond and stream. Run-off will be controlled through silt/sediment traps as appropriate to minimise the turbidity of water in outfall areas.

21.2.15 Hydrology

21.2.15.1 Construction Phase

Prior to construction an Environmental Operating Plan (EOP) will need to be prepared by the Contractor. The following will be implemented as part of the EOP:

- Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of a spill of chemical, fuel or other hazardous wastes, a fire, or non-compliance incident with any permit of license issues. The Plan should also address flood risks.
- Prepare a Water Quality Management Plan (please see below for further details) to ensure compliance with current environmental quality standards (EQSs) specified by legislation.
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water.
- Inform the relevant fisheries board of all in-stream construction work scheduled to take place.

Dewatering and surface water runoff discharges on the site, during construction and prior to completion will be controlled and discharged to the existing surface water network at agreed rates of flow in consultation with Kildare County Council. All necessary facilities will be incorporated (settlement tanks/ponds/oil/grit interceptors) to ensure that only clean surface water is discharged (to meet the relevant standards) to the surface watercourses.

In addition, pollution of aquatic systems during the construction phase will be reduced by the implementation of the following best practice mitigation measures. The following mitigation measures will be prescribed for the construction phase to protect all the catchments, watercourses and ecologically protected areas that the proposed scheme interacts with:

- Use of settlement ponds, silt traps and bunds and minimising construction within watercourses.
- Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.
- Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and surrounding stockpiles with cut-off ditches to contain runoff.
- All land drains and streams that occur in areas of land that will be used for site compound/storage facilities will be fenced off at a minimum distance of 5 m. In addition, measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the watercourse.
- Site compounds and storage facilities will be located at a minimum distance of 50 m from the River Liffey watercourse.

- Surface water flowing onto the construction area will be minimised through the provision of berms and diversion channels.
- Any surface water abstracted from a river for use during construction shall be through a pump fitted with a filter to prevent intake of fish.
- All chemical and fuel fill points and hoses will be contained within banded areas.
- Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution of rivers and local watercourses in accordance with the relevant statutory regulations.
- Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards as laid out by the EPA.
- Routine monitoring of water quality will be carried out at appropriate locations during construction
- The quality of surface water discharge from the site will meet water quality targets specified to protect riparian ecosystems and protected species.
- Riparian vegetation will be fenced off to provide a buffer zone for its protection and will be specified in consultation and agreement with the appropriate Fisheries Board and NPWS.

Particular risks are posed to water quality when construction is taking place over or near surface waters. As previously mentioned, concrete and cementitious compounds have a deleterious effect on water chemistry and aquatic habitats and species. Due to the sensitivity of all of the receiving surface waters in the study area, alternative construction methods shall be investigated if work in or in close proximity to the water is necessary.

For any construction work within or directly adjacent to the water the following mitigation measures will apply:

- Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used, to promote the early set of concrete surface exposed to water. When working in or near the surface water and the application in situ cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be considered.
- Where concrete is to be placed under water it will be designed to provide a cohesive mix to limit segregation and washout of fine material. This will be achieved by having either a higher than normal fines content, a higher cement content or the use of chemical admixtures.
- Underwater concrete will be placed within the confines of a cofferdam or caisson. Normally, the forms of the construction works will be provided by pre-cast sections or sheetpiles. In either case, it is essential to seal joints securely and to engage clutches on sheetpiles properly to prevent fine particles polluting the watercourse.

- Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.
- Any river re-alignment work will be undertaken in consultation and with the agreement of the appropriate regional fisheries board.

Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses. The following construction mitigation measures will be utilised to control concrete and cementitious material wash down water interaction with surface water:

- All batching and mixing activities will be located in areas well away from watercourses and drains.
- Surface water drainage around the batching plant will be controlled via the provision of perimeter bunding with runoff diverted to appropriate treatment facilities.
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials.
- Washout from mixing plant of concrete lorries will be carried out in a designated, contained impermeable area.

21.2.15.2 Operational Phase

All rainfall runoff will be prevented from discharging directly to the receiving surface waters by the proposed road sustainable drainage system. Road runoff will only outfall to receiving surface waters at specified outfall locations.

The proposed drainage attenuation system will be sized to accommodate any potential increase in surface water runoff and accommodate increased rainfall during storm events up to the 30 year return period storm. For ponds designed in flood prone areas this design is increased to cater for storm events up to the 100 year return period storm.

All culverts and bridges are designed to prevent impact to river morphology and to prevent impoundment or alteration of surface water flow hydrodynamics. All culverts and bridges are also designed to allow for both aquatic and mammalian species migration, and to maintain the existing river bed as far as possible culverts and bridges will be sized in accordance with the requirements of the Arterial Drainage Act, Section 50 consent by the OPW. This will allow conveyance of surface water flow and maintain the hydraulic capacity of surface water features.

All watercourse re-alignment work will create new channels that will be designed to achieve maximum ecological benefits and improve on the existing hydrological environment.

There will be no use of persistent herbicides, pesticides or artificial fertilisers in any landscaping or subsequent maintenance within 2 m of a watercourse. Applications of herbicides or pesticides will be in accordance with manufacturer's recommendations and confined to periods when the vegetation is not wet from rainfall or dew within a zone of 10 m from any watercourse.

21.2.16 Resource and Waste Management

21.2.16.1 Construction Phase

Waste from M7 Osberstown Interchange and R407 Sallins Bypass Scheme will be managed in accordance with the principles of the waste hierarchy i.e. prevention, re-use, recycling, energy recovery and disposal.

The contractor will minimise waste disposal so far as is reasonably practicable.

Construction Phase

Proposed mitigation measures for the excavation, construction and demolition phases of the Scheme are as follows:

- **Construction and Demolition Waste Management Plan** Preparation of a Construction and Demolition Waste Management Plan which meets the requirements of the DoEHLG Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects (DoEHLG, 2006a) is recommended.
- **ICE Demolition Protocol:** In addition to the general measures outlined above a demolition audit in accordance with the ICE Demolition Protocol 2008 or similar guidance will be considered at detailed design stage for those structures which will be demolished as part of the proposed development.
- Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material may not be re-used within the proposed works the Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable. The contractor will ensure that any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.
- **Source Segregation:** Waste produced will be segregated. Where possible metal, timber, glass and other recyclable material will be segregated during demolition works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation.
- **Material Management:** 'Just-in-time' delivery will be used so far as is reasonably practicable to minimise material wastage.
- **Supply Chain Partners:** The Contractor will engage with the supply chain to supply products and materials that use minimal packaging, and segregate packaging for reuse.
- **Waste Auditing:** The Contractor will record the quantity in tonnes and types of waste and materials leaving the development site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials from the construction phase are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of.

21.2.16.2 Operational Phase

There are no impacts envisaged during the operational phase of the proposed scheme. Therefore no operational mitigation measures are required.

21.2.17 Non-agricultural Material Assets

21.2.17.1 Construction Phase

Where existing access to property is affected, this will be reinstated or an alternative access provided. Where the infrastructure for service providers is impacted, this will be diverted or reinstated in accordance with service providers requirements prior to construction.

Public water supply and foul water systems affected will be reconnected. All necessary diversions will be carried out in accordance with the local authority requirements. Where private potable water supplies are impacted, a new well or alternative water supply will be provided. Mitigation for interference with septic tanks will be agreed by the valuer at a later stage.

Where part of a property or land surrounding a property is to be acquired, agreement will be reached with the owner of the property on the type of boundary treatment that will be provided. Where an access to a property is affected the access will be reinstated to match the existing.

Compensatory measures for the loss of land, buildings and other injurious affection will form part of the Motorway Order / CPO procedures with property owners affected by the land acquisition for the proposed road development. Assessment of compensation is not part of the Motorway Order / CPO approval procedure and is therefore not considered further.

21.2.17.2 Operational Phase

No mitigation measures are proposed for the operational phase.

21.3 Summary of Residual Impacts

The following is a summary of the Residual Impacts associated with the proposed scheme.

21.3.1 Transportation

The opening of the proposed M7 Osberstown Interchange and R407 Sallins Bypass Scheme will see changes to the Local, Regional and National (M7 Corridor) road network and traffic flows. The modelling work undertaken to assess the traffic impacts of the proposed scheme indicates that there will be an overall significant traffic benefit associated with the proposed scheme. Further, the proposed scheme will provide benefits to existing and new public transport services and walking and cycling routes on the adjoining local and regional road network. In the longer term, the proposed scheme will facilitate regional transport objectives for the establishment of a PTI off the R407 Sallins Bypass adjacent to the Dublin to Cork railway line.

21.3.2 Agronomy

The agriculture area of Co Kildare is 115,058 hectares (CSO 2010) (including 1,293 hectares of commonage). The land required for the proposed scheme will take 0.04% of this area. Five new land segments will be created due to the construction of the proposed scheme. This is 0.06% of the total number of land segments in county Kildare (which is 7,734 – Table 28 of 2010 Census of Agriculture). Therefore the impact on a regional or national level will be imperceptible.

The area of all farms directly affected is approximately 464 hectares. Approximately 35.6 hectares of agricultural land and approximately 9 hectares of lands zoned for non-agricultural use will be required for the proposed scheme. The permanent landtake will be approximately 10% of the total area of farms directly impacted.

Separation will affect 5 farmers and 55 hectares of land will be separated due to construction of the proposed scheme – approximately 9% of the affected farms. The overall impact on agriculture (eleven affected farms) along the proposed scheme is moderately adverse.

21.3.3 Human Beings

The proposed scheme will have a significant net positive residual impact on journey characteristics, community severance, journey and general amenity, and the local economy.

There are numerous interactions between each of these impacts. There are also positive cumulative impacts in terms of the sustainability of transport use and local amenity.

Negative impacts will apply to a few businesses on Main Street and Clane Road in Sallins that are currently patronised by drivers passing through Sallins. Although significant for these businesses, the net economic impact at community level is moderate to major positive.

21.3.4 Archaeology

Following the implementation of the mitigation measures outlined above, there will be no residual negative impact on the archaeological and cultural heritage resource.

21.3.5 Architecture and Cultural Heritage

The proposed bypass alignment will not directly impact upon the protected structure of Osberstown House. It will have a 'moderate negative' indirect impact, as assessed in accordance with the NRA guidelines arising from the regional importance of the Protected Structure and the nature of the impact on the setting of the house, which includes the bypass being visible from within the curtilage and/or the attendant lands of the house. Mitigation is to be effected by comprehensively planting the verges.

21.3.6 Landscape and Visual

As with all such developments, the proposed road development, by the means of its very presence will have a permanent effect and therefore some degree of residual impact on the landscape and visual character of its immediate corridor. Nevertheless, it is considered that with the gradual establishment of proposed landscape mitigation measures, the proposed road development will be successfully integrated within its landscape setting in the longer-term.

It is considered that some level of moderate residual impact will remain at Osberstown House, in crossing the Grand Canal and in crossing the River Liffey corridor.

Likewise, after planting and mitigation measures have established and developed residual visual impact will be limited to a small number of properties, including Osberstown House (Property R8); the house at the crossing of Osberstown Local Road (Property R10) and for properties at the crossing of the Grand Canal (Properties R22 to R26). Otherwise the severity and prominence of visual intrusion will be gradually and increasingly mitigated.

21.3.7 Noise and Vibration

21.3.7.1 Construction

The assessment has indicated that construction activities can, for the majority of activities operate within the adopted noise limits for daytime periods at the nearest properties to the works. A small number of potential exceedance are predicted at properties facing directly to site works. Given the linear nature of the works, however, noise emissions related to construction works will be of short term impact at any one area as the works progress along the length of the proposed scheme. The application of the proposed noise limits and restricted hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to within acceptable standards.

21.3.7.2 Operation

The residual noise levels during the operational phase were calculated taking into account the proposed mitigation measures. All properties show compliance with the NRA conditions for noise mitigation and no further measures are required.

21.3.8 Air Quality

The residual impact on air quality as a result of the proposed scheme will not be significant following the implementation of prescribed mitigation measures.

21.3.9 Climate

There will be no residual impact on the microclimate.

In general, construction and operational traffic volumes of CO emissions from are not deemed significant in terms of Ireland's commitment under the EU Climate Change and Renewable Energy Package. Future measures implemented by government as part of the Climate Change Bill 2013 will ensure compliance with climatic obligations

21.3.10 Ecology

The main impacts of the proposed scheme will arise from the construction of crossings for the Grand Canal pNHA and the River Liffey along the proposed R407 Sallins Bypass. The risks are considered temporary in nature as they are associated with the construction phase of the crossings points and works within the immediate catchment with risks of impacting on water quality through siltation and pollution. With adherence to the specified measures described, these risks can be adequately mitigated and will not result in any residual impact. The abutments and piers for the three bridge structures are set sufficiently back from the river banks to avoid any direct impacts on the riparian zone and will not interfere with the ongoing ecological functioning and connectivity of these linear habitats.

The operation phase of the proposed scheme will also have inherent risks of impacting on water quality through road-runoff and accidental spillages resulting from traffic accidents, though the design of the road drainage and associated attenuation spill containment and run-off treatment will provide adequate protection against these risks. As a result the operation of the proposed scheme will not result in any residual impact on water quality.

While the attenuation pond at Osberstown will be resized as a result of the Osberstown interchange the pond will be retained and post construction, the lands around the pond will be re-landscaped and the feature will regain its current ecological functionality over a short period of time.

Elsewhere on the proposed scheme, there will be a loss of habitats associated with the construction and operation of the proposed scheme, with the principle ecological receptors of concern being the treelines and hedgerows that will be dissected by the proposed route with resultant severance of ecological corridors. Over time landscaping for the proposed scheme will compensate for the loss of this habitat and to some extent provide ecological continuity which will be further facilitated through the provision of mammal underpasses.

Overall movement across the proposed scheme for fauna will be facilitated through the combination of the clear span structures over the Grand Canal and the River Liffey, mammal underpasses at strategic locations and the portal frame culvert on the 'dead canal'. The ability of this latter structure to accommodate the movement of kingfisher is however uncertain, though there is no evidence that kingfisher, an Annex I listed species under the EU Birds Directive utilise the 'dead canal' as a connecting corridor between the Grand Canal and the River Liffey. Mortality of kingfisher through vehicle collisions should they attempt to fly over the Sallins Link Road would constitute a significant negative residual impact.

21.3.11 Soils and Geology

In general, the residual impact on soils and geology can be considered imperceptible. However, groundwater seepages may result in erosion and instability of the slope over time. The significance of this residual impact is considered to be slight.

21.3.12 Hydrogeology

The mitigation measures relating to the potential for groundwater contamination will ensure the risk of groundwater contamination is minimised. The predicted residual impacts on hydrogeological features after these mitigation measures are put in place are reduced to imperceptible.

The mitigation measures as described will reduce the predicted impacts with respect to the Aquifer Type and Water Quality for groundwater and for groundwater fed ecosystems to imperceptible. There is the possibility that some local wells will need to be replaced or rebored.

21.3.13 Hydrology

As a consequence of compliance with the construction and operational mitigation there will be negligible permanent impacts across the catchments traversed by the proposed road development.

No negative residual impacts to water quality are anticipated, as all mitigation measures are implemented for the proposed road development. The classification status of the receiving surface waters are likely to remain as they currently are, or demonstrate gradual improvement over time which will comply with the objectives of the draft river basin management plans.

Provided that all mitigation measures described are implemented, negative impacts on flood risk due to increased runoff are not anticipated for design events of up to the 30 year return period event, with the exception of the River Liffey catchment where negative impacts on flood risk due to increased runoff are not anticipated for design events of up to the 100 year return period event.

At some locations, the creation of the proposed road development perpendicular to the natural line of drainage has led to the interception of overland flow into a drainage system that will convey it into the nearest watercourse. This may lead in some cases to diversion of flow that would have flowed into one catchment area into another. There will be a corresponding reduction in flow in one area and increase in the other. The relative percentages of the catchment sizes involved, and the length of reaches affected have led to this effect being overall classified as an imperceptible permanent impact.

21.3.14 Resource and Waste Management

The resulting residual impact of excavation waste will be slight, negative and short term.

The resulting residual impact of construction and demolition waste will be slight, negative and short term.

Based on the scheme description the residual impact of operational waste will be neutral.

There is likely to be significant available capacity within existing Irish waste management infrastructure to manage the excavation, construction and operational waste from the M7 Osberstown Interchange and R407 Sallins Bypass Scheme.

21.3.15 Non-agricultural Material Assets

No significant residual impact on services is envisaged following the implementation of the mitigation measures described..

The residual impact on non-agricultural cannot be assessed as the compensatory measures to be agreed are outside the scope of the Motorway Order / CPO process.