18 SUMMARY OF MITIGATION MEASURES

For ease of reference and clarity, all mitigation measures contained in this EIAR have been summarised below. All measures included below form part of the proposed development and will be implemented in full.

18.1 Population & Human Health

The mitigation measures outlined in the Population and Human Health chapter will minimise and/or eliminate the potential for adverse impacts on the local community and amenities.

Construction Phase Measures

In order to minimise impacts during the construction phase, the following mitigation measures will be implemented:

- Advance notice will be given to the occupiers of the adjacent student accommodation developments and adjacent residential development at Roebuck Castle Housing Estate and Owenstown Park before construction starts and in advance of any major planned disruptions.
- A construction management plan will be prepared to minimise impacts on adjacent residents and the operation of the college.
- A construction traffic management plan will be developed to mitigate against potential traffic delays and to facilitate the existing pattern of vehicular movement. A temporary construction access and dedicated contractor parking will be provided from Foster's Avenue.
- Pedestrian and cycle access to the college will be unaffected from both the Owenstown Park entrance or the Roebuck Castle entrance for the duration of the construction phase to prevent significant changes to travel patterns for those accessing the campus.
- Prior notification will be given to campus users and bus operators of any changes to the route during the period of closure of Owenstown Park.
- The mitigation measures in relation to construction, traffic, noise, vibration, water, air and dust quality and landscaping as set out in this EIAR will be carried out in full to minimise impacts on adjacent residents, the university, and human health.

Operational Phase Measures

- Residents of the proposed student accommodation will be required to comply with UCD Residence Rules and Responsibilities as part of their license to reside, including behaviour and respect for neighbouring residents and communities. The student accommodation will be overseen and actively managed to reduce the incidence of noise or other anti-social behaviour by campus residents.
- Occupants of the proposed student accommodation development will be provided with information on Smart Travel options as part of their welcome pack, to further reduce the demand for the use of private car while resident on campus.
- The University will establish a point of contact to address any potential complaints in relation to the operation of the student accommodation scheme. Full contact details for the management office will be circulated to nearby non-student residents prior to the opening of the facility.
- The woodland walkway will be enhanced as part of the scheme to contribute to an improved recreational amenity for university and external users.

- The mitigation measures relating to the operation phase of the development concerning traffic, transport, noise, vibration, water, air and dust quality and landscaping as set out in this EIAR will be carried out in full to minimise impacts on adjacent residents, the university, and human health.

18.2 Soils & Geology

Character of potential impact	Mitigation measure
Construction Phase	
Excavation and removal of topsoil	Stripped soils shall be temporarily stockpiled on site prior to removal. Destination of stripped soils to be agreed with client. Movement of material shall be minimised in order to reduce degradation of soil structure and generation of dust.
Potential for soil erosion and dust generation	Soil handling and placement shall only take place during appropriate weather conditions and when the soils are in optimum condition (moist but friable). Soils shall not be moved when they are too dry or during unusually windy weather conditions. Conversely soils should not be handled when moisture content is so high it results in smearing.
Excavation and removal of subsoils	Excavated subsoils shall be temporarily stockpiled on site prior to removal.
Migration of contaminants from historical activities to subsoils underlying subject site	Previous site activities do not suggest any contamination. Should any unusual staining or odour be noticed, samples of soil/subsoil shall be analysed by an accredited laboratory. A hydrogeologist shall be engaged to oversee such works. If contaminated soil is encountered it will be required to be removed by a licensed contractor. Further trial pitting shall be carried out in vicinity of TP4 prior to construction works in Area 2.
Excavation of weathered bedrock	No bedrock was encountered within 10 m of surface during site investigation works. It is not envisaged that bedrock will be encountered during construction phase.
Potential for contamination of exposed subsoils and/or bedrock as a result of spillages/leakages.	Potentially contaminating substances will be stored in designated areas that are isolated from surface water drains or open waters. Hazardous wastes such as waste oil, chemicals and preservatives will be stored in sealed containers. Fuelling, lubrication and storage areas will be in a designated area, not within 30 m of drainage ditches or surface waters. All waste containers will be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds will be capable of storing 110% of tank capacity, plus a minimum 30 mm

	rainwater allowance where the bund is uncovered. Where more than one tank is stored, the bund must be capable of holding 110% of the largest tank or 25% above the aggregate capacity. Drip trays used for drum storage must be capable of holding at least 25% of the drum capacity. Regular monitoring of water levels within drip trays and bunds due to rainfall will be undertaken to ensure sufficient capacity is maintained at all times. There will be no storage of fuels on site. Refuelling shall be by mobile bunded bowser at a designated area, i.e. site compound, or where possible off-site. An adequate supply of spill kits and hydrocarbon absorbent packs shall be stored in this area.
Potential for contamination of exposed subsoil	All ready-mixed concrete shall be delivered to site by truck. A suitable risk assessment for wet concreting shall be completed prior to works being carried out. Wash down and washout of concrete trucks will take place at an appropriate facility off-site.
Undermining near existing buildings	Should basement construction be envisaged close to existing buildings or roads a retaining wall will be required to support the soils and help to prevent undermining. A traditional sheet pile wall would suffice (IGSL, 2016).
Bank stability	Conventional side slopes will be adopted during basement excavation. Temporary slopes of about 25 degrees in the made ground and 30 degrees in the Dublin boulder clay is recommended (IGSL, 2016). Slopes shall be protected by netting. A narrow exclusion area at the base of the excavation will be installed. Slope stability to be assessed by suitably qualified engineer.
Operational Phase	
Potential for contamination of subsoils as a result of spillages/leakages.	There will be no parking or other activities on non-hardstanding areas that could enable contamination of soils/subsoils. All runoff generated on hardstanding areas will enter a lined attenuation pond prior to being transferred to the storm water drainage network.

18.3 Water: Hydrogeology & Hydrology

Character of Potential Impact	Mitigation Measure
Construction Phase	
Silt-laden runoff from exposed subsoil. The increased silt content in runoff has potential to degrade local surface	Excavations will remain open for as little time as possible before the placement of fill. This will minimise potential for runoff from exposed soil/subsoil. Topsoil stripping be will be restricted to the minimum area required for efficient earthworks operation.

water quality.	Silt traps will be placed in the receiving drainage network to minimise silt loss. Maintain a vegetated margin of at least 10 m around the working area where possible.
Silt-laden runoff from stockpiles. The increased silt content in runoff has potential to degrade local surface water quality.	Maximise distance of stockpiles from gullies and drainage channels. Excavations will remain open for as little time as possible before the placement of fill. This will minimise potential for water ingress into excavations. Silt traps will be placed in the receiving drainage network to minimise silt loss. Weather conditions shall be taken into account when planning construction activities to minimise risk of runoff from the site. Maintain a vegetated margin of at least 10 m around the working area where possible. A manhole between the pond and the Elm Park Stream will serve as a sampling chamber (see Figure 7.4) for the construction phase.
Runoff/recharge during the construction phase may contain hydrocarbons.	Potentially contaminating substances will be stored in designated areas that are isolated from gullies or open channels. Hazardous wastes such as waste oil, chemicals and preservatives will be stored in sealed containers. Fuelling, lubrication and storage areas will be in a designated area, not within 30 m of surface waters. All waste containers will be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds will be capable of storing 110% of tank capacity, plus a minimum 30 mm rainwater allowance where the bund is uncovered. Where more than one tank is stored, the bund must be capable of holding 110% of the largest tank or 25% above the aggregate capacity. Drip trays used for drum storage must be capable of holding at least 25% of the drum capacity. Regular monitoring of water levels within drip trays and bunds due to rainfall will be undertaken to ensure sufficient capacity is maintained at all times. There will be no storage of fuels on site. Refuelling shall be by mobile bunded bowser at a designated area, i.e. site compound, or where possible off-site. An adequate supply of spill kits and hydrocarbon absorbent packs shall be stored in this area.
Runoff during the construction phase may contain cementituous material.	All ready-mixed concrete shall be delivered to site by truck. A suitable risk assessment for wet concreting shall be completed prior to works being carried out. Wash down and washout of concrete trucks, with the exception of the chute, will take place at an appropriate facility off-site. There will be no hosing into surface drains or gullies of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately and runoff prevented from entering the drainage network. Given the significant amount of concrete to be laid on site, if the concrete contractor insists that trucks are washed out on site, then washings from such

	shall pass through a temporary settlement tank with pH correction.
Increase in vulnerability of underlying aqufier	Removal of subsoil to facilitate basement installation may increase vulnerability from Low to Moderate. Given that the excavated area will be covered in hardstanding, which reduces recharge even further, there is no decrease to groundwater protection. Based on site investigation data it is not envisaged that bedrock will be encountered.
Lack of sanitary facilities prior to connection with mains sewer being established	Permanent sanitary facilities, including connection to mains foul sewer, are available.
Contamination of upgradient runoff entering site	Cut-off drains shall be provided to intercept clean runoff water and divert away from the site work areas. Small overflow dams and geotextile silt barriers shall be installed in any perimeter channels within the construction site.
Impact to downgradient groundwater receptors	Site runoff during construction phase will be diverted to surface water drainage network, following treatment. There will be no direct or indirect discharges to ground.
Operational Phase	
Runoff from hardstanding and roofed areas	Sustainable Urban Drainage Systems (SuDS) shall be implemented to control all runoff leaving the site at pre-development greenfield runoff rates. Refer to Section 13 of EIAR for further details.
	There will be no bulk storage of fuels on site. All runoff generated on basement car parks will discharge to the foul sewer.
Suspended solids having a negative impact on riverine habitats	All runoff generated on hardstanding (excluding roofed area) will pass through the on-site pond. The pond provides adequate residence time for settlement of suspended solids.
Increase in groundwater vulnerability	Any areas from which subsoil is removed will be subsequently covered in hardstanding which further reduces recharge. There is no decrease to groundwater protection.
Impact to downgradient groundwater receptors	Hardstanding will prevent diffuse recharge across the site. There will be no direct discharges to ground.

18.4 Noise & Vibration

Whilst the construction phase is not expected to give rise to negative noise impacts at sensitive receptors, the guidance on the control of noise and vibration from demolition and construction activities presented in BS5228 will be followed. The proposed measures include the following:

- Unnecessary revving of engines will be avoided and equipment will be switched off when not required

- Internal haul routes will be well maintained and there will be no steep gradients
- Rubber linings will be used in chutes and dumpers to reduce impact noise
- The drop height of materials will be minimised
- Plant and vehicles will be started sequentially rather than all together.
- In accordance with best practicable means, plant and activities to be employed on site will be reviewed to ensure that they are the quietest available for the required purpose.
- Where required, improved sound reduction methods, e.g. enclosures will be used.
- Site equipment will be located away from noise sensitive areas, as much as is feasible.
- Regular and effective maintenance by trained personnel will be carried out to reduce noise and/or vibration from plant and machinery.
- Noisy construction works will be limited to 8am to 7pm weekdays with Saturday working from 8am to 1pm unless otherwise agreed with the local authority. Relatively quiet construction activities could be carried out outside these hours, subject to controls in place.
- Ongoing contact with local residents will be maintained to ensure any complaints relating to construction phase noise for the project from local residents can be addressed. Also, prior to any particularly noisy activities, local residents will be contacted in order to minimise the perceived noise impact.
- Monitoring of typical levels of noise and vibration will be undertaken during critical periods and at sensitive locations for comparison with limits and background levels.
- The site contractor will be tasked to prepare a Noise and Vibration Management Plan (NVMP) which will deal specifically with onsite activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the construction works. The NVMP will specify the noise and vibration monitoring and reporting that will be carried out.
- The contractor will be tasked to appoint a community relations officer who will deal on a one-to-one basis with local stakeholders and will notify them before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works.
- The community relations officer will also distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

18.5 Air, Dust & Climatic Factors

A Dust Management Plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The principal objective of the Plan is to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the site. The most important features of the Dust Management Plan are summarised as follows:

- A designated Site Agent will be assigned overall responsibility for Dust Management;
- The design of the site and Construction programme considers dust impact management and chooses design approaches to minimise dust emissions;
- An effective training programme for site personnel will be implemented for the duration of the Construction Programme;
- A strategy for ensuring effective communication with the local community will be developed and implemented;
- A programme of dust minimisation and control measures will be implemented and regularly reviewed;

- A monitoring programme will be implemented.

The design of the construction programme and the location and layout of the construction compound and the storage of materials will be carefully planned to ensure that air quality impacts are minimised. The following is a summary of the main mitigation features of the project and the specific mitigation measures which will be employed in order to minimise emissions from the activity and the associated impacts of such emissions.

- Activities with potential for significant emissions will wherever possible be located at a position as far as possible removed from the nearest residential and commercial receptors;
- The areas on site which vehicles will be travelling on will generally be hard-surfaced thus significantly reducing the potential for dust emissions from the vehicles;
- The construction compound area will have hard standing areas to minimize dust generation from windblow.
- In order to minimise the potential for wind-generated emissions from material storage bays, these bays will be oriented away from the dominant wind direction to minimise the effects of wind on release of dust and particulate.
- The relatively coarse particle size (10 – 75µm) associated with the activity means that the particles will generally be deposited close to the emission source and will not travel significant distances away from the site.
- Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and yard surfaces as necessary in dry and/or windy weather.
- A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.

A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the construction phase in order to verify the continued compliance with relevant standards and limits

18.6 Biodiversity

- A replacement roost location is to be provided. This is to be done under the supervision of a bat ecologist and in accordance with a derogation licence from the National Parks and Wildlife Service. In addition, felling of mature trees and the disturbance of the existing roost is to be done under supervision of a qualified bat ecologist. This is also provided for under the derogation licence.
- To avoid damage to trees the developer should follow the guidance from the National Roads Authority in establishing root protection areas (RPA) along hedgerows to be retained.
- The NRA gives the following equation for calculating the root protection area (RPA) (NRA, unknown year):

  RPA(m2) = π(stem diameter mm 12)/1,000) x2

- The RPA gives the area around which there should be no disturbance or compaction of soil. This will be calculated for the largest tree within each hedgerow. Prior to construction this area will be clearly labelled 'sensitive ecological zone', fenced off with durable materials and instruction given to construction

personnel not to disturb this buffer zone. As a rule of thumb this buffer zone should extend at least to the canopy of the trees concerned.

- The removal of vegetation, including tree felling, should not occur during the nesting season. Where this cannot be avoided, removal can only take place where it has been demonstrated that bird nesting is not occurring. The disturbance of birds' nests can only take place under licence from the NPWS. Vegetation must be inspected by a suitably qualified ecologist and, if no nesting is recorded, vegetation can be removed within 48 hours.
- The invasive species management plan will be implemented in full. This will ensure that Japanese Knotweed is eradicated from the site.

18.7 Landscape & Visual Impact Assessment

- Landscape strategy of reinforcing existing shelterbelt and new shelterbelts to assist with microclimate creation, and in particular wind mitigation.
- The shelterbelt strategy also acts as visual mitigation between blocks and to define the landscape compartment of this area of the campus, in particular the western edges and the interface with Roebuck Castle residential area.
- Capitalisation on southern aspects for useable spaces in built form development to assist with microclimate creation.
- Tree planting and built for wind mitigation, in particular for courtyards.
- Implementation of design for biodiversity and sustainability including use of native species, mowing regimes, and new damp habitat in swales.
- Implementation of active recreational streets and main activity space to mitigate the loss of pitches.
- Relocation of existing trees from along the Elm Walk to boundary areas.
- Retention of trees, in particular the large Lime tree, and replanting of new Lime trees.
- New tree planting programme.

18.8 Material Assets: Traffic & Transport

The following summarises the key mitigation measures proposed to manage the travel demand generated by the development during the construction and operational phases.

Construction Phase

A detailed Construction Traffic Management Plan, which will incorporate the relevant traffic management measures included for in the Outline Construction Management Plan, will be finalised for the construction stage of the project by the Contractor. This Plan will include the following transport-related measures:

- Working hours that will avoid any significant staff trips during peak hours;
- Appropriate amount of car parking for construction staff to mitigate any potential car parking overspill onto the surrounding residential areas;

- The separation of construction traffic from general traffic through the provision of a temporary construction vehicle only access off Fosters Avenue;
- The management and marshalling of construction vehicles on-campus by flag men; and
- The Contractor will be required to implement a Mobility Management Plan for its staff, where travel by sustainable modes and car-pooling will be encouraged.

Operational Phase

Travel demand at UCD is currently managed at a campus wide level rather than at a specific development project level at Belfield and in accordance with the UCD Commuting Strategy 2009 to 2015. It is intended that the new Travel Plan for UCD, currently in preparation, will continue to adopt this approach, and in partnership with DLRCC and the NTA.

As set out in Section 12.6.3 the completion of the UCD Student Residences Masterplan will have an overall relatively significant positive impact in terms of dealing with increases in travel demand to and from UCD by sustainable travel modes (i.e. walking, cycling and public transport). Quantitatively, the planned increase in student residential capacity on campus will ensure that planned increase in campus population growth will not have any material impact on external transport networks, including the surrounding road and street network.

18.9 Water: Water Supply & Drainage

Character of potential impact	Mitigation Measure
Construction Phase	
Potential contamination of flow in existing gravity drainage networks due to pollution from construction activities / materials.	Construction management Plan to be Developed by the Contractor and risk assessments carried out regarding potential pollution of pipe networks. Management Plan to be put in Place to ensure the risk is mitigated insofar as possible.
Operational Phase	
Adverse Potential for new impermeable areas reducing groundwater recharge which preserves base flow in receiving watercourses. Also potential for increased discharge to receiving watercourses after minor rainfall	Design will incorporate full SUDS (Sustainable Urban Drainage Systems). Interception storage including extensive and intensive green roofs, rainwater harvesting and permeable pavements will be included throughout the Design thereby preventing any significant discharge for minor rainfall events. The site investigation confirms that the soil is boulder clay and of limited permeability so re-charge of groundwater table opportunities are limited. Full treatment storage is provided by the existing lake which will allow settlement of any suspended solids in the run-off thereby preventing pollution of the receiving watercourse.

events which increases likelihood of pollution of these watercourses. GDSDS Criterion 1	
Adverse Potential for new impermeable areas increasing peak rate of surface water run-off to receiving site and public systems thereby causing scour of receiving watercourses GDSGS Criterion 2	Design will incorporate full SUDS (Sustainable Urban Drainage Systems). The existing lake was originally designed to have enough freeboard to provide the required attenuation volume and the peak outflow rate of discharge from the site, for storms of up to 100 year return period, will be limited to QBAR or the predicted greenfield run off for the mean annual flood. This will ensure that the receiving watercourses suffer no scour greater than that experienced due to the existing greenfield run -off for the mean annual flood.
Adverse Potential for new impermeable areas increasing surface water run-off to site system thereby causing site flooding. GDSDS Criterion 3	Design will incorporate full SUDS (Sustainable Urban Drainage Systems). The design of the new pipework system will be based on it surcharging but not flooding for the 100 year event and that the top water level in the system is never higher than 0.5m below the lowest floor level of any adjacent building thereby ensuring that the site will not flood.
Adverse Potential for new impermeable areas increasing volume of surface water run-off to receiving public system and potential flooding of that system's receiving watercourses. GDSDS Criterion 4	Design will incorporate full SUDS (Sustainable Urban Drainage Systems). In addition to the pipe system not flooding the discharge from the site for the 100 year storm will be restricted to QBAR without any growth factors applied as required by the GDSDS when long term storage is not provided on site. This will ensure that the rate of discharge to the receiving watercourse is restricted to a level where flooding downstream will not occur due to the development.
Adverse potential for creating increased water supply demand due to provision of 3006 new bed spaces on site and the associated increased in water demand from day students converting to residential students. Potential capacity issues with site and	The increase in Water demand is mitigated by the fact that there will be no increase in the student population and therefor the increase in consumption is only of the order of 100l/head/day less that provided by rainwater harvesting or 280cubic meters additional flow for the total development. An application has been made to Irish water and they have issued their Pre- Connection Enquiry Feedback Statement which shows that there is adequate capacity in the public network to accommodate the development.

public infrastructure.	
Adverse potential for creating increased Foul water effluent due to provision of 3006 new bed spaces on site and the associated increase in Foul flows caused by day students converting to residential students. Potential capacity issues with site and public infrastructure.	The increase in Foul Effluent flow is mitigated by the fact that there will be no increase in the student population and therefor the increase in outflow is only of the order of 100l/head/day or 301 cubic meters total which gives an increase in peak foul flow of 21l/s. An application has been made to Irish water and they have issued their Pre- Connection Enquiry Feedback Statement which shows that there is adequate capacity in the public network to accommodate the development. In addition, UCD have undertaken monitoring of the foul outfall from the campus which shows that it is flowing well below capacity and can comfortably accommodate the additional flow.

18.10 Architecture & Cultural Heritage

An architectural record survey will be made of the extant structures and a programme of repair works will be undertaken as part of the ongoing maintenance of the structures. For the protected structures, these should accord with the Section 57 Declaration for the Castle and further Section 5/ Section 57 Declarations. A maintenance programme will be developed for remaining fabric.

The comprehensive landscaping plan and tree planting plan will be incorporated into the proposed development to allow for reinforcing and providing new screening to protect the settings of the existing structures.

18.11 Archaeology & Cultural Heritage

Further archaeological works will be undertaken at this site including:

1. Excavation of test trenches in greenfield areas (the training pitches, the outlying western area adjacent to Belgrove Student Residence, the greenfield area to the east of the site adjacent to the National Institute of Bioprocessing Research).

2. Excavation of test trenches in areas impacted by groundworks in proximity to Roebuck Castle. Should this not be possible due to existing buildings then monitoring of the groundworks during the construction phase.

All investigations and excavations will be carried out under license to the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA).

NOTE: All mitigation measures expressed in respect of Archaeology are subject to the approval of The Department of Arts, Heritage Regional, Rural and Gaeltacht Affairs (DAHRRG) and the relevant local authorities. As the statutory body responsible for the protection of Ireland's archaeological and cultural heritage resource, the DAHRRG may issue alternative or additional recommendations.