5. Construction Activities

5.1 Introduction

This chapter describes the construction activities and sequencing for the proposed Ringaskiddy Resource Recovery Centre and outlines the mitigation measures which will be implemented to ensure the potential impacts of the construction activities on the environment are avoided, prevented or reduced.

It is anticipated that, with the proper implementation and management of the construction activities described in this chapter the construction phase of the development will have no significant or long-term impact.

5.2 Geotechnical Investigation

In order to ascertain the undying ground conditions onsite, preliminary soil and hydrogeological investigations were carried out on the site, which included drilling of boreholes and excavating trial pits. The results of the site investigations are described in more detail in **Chapter 13 *Soils, Geology, Hydrogeology, Hydrology and Coastal Recession*** of this EIS***.***

It seems likely that, in the past, the hillside at the site followed the gentler slope of the surrounding land. Anecdotal evidence suggests that substantial quantities of material were removed from the site and used for reclamation purposes elsewhere in the Ringaskiddy area, thus creating the escarpment now evident on the site.

The topsoil layer is relatively shallow over most of the site. This layer is underlain by soft silty clays, with some fine sands and gravels. Depth to the bedrock varies across the site, from 1.0M below ground level (bgl) at the northern end of the site, where material has been removed in the past, to greater than 9.0m bgl close to the southern boundary.

5.3 Duration and Activities

5.3.1 Overview

The schedule for the construction and commissioning of the Resource Recovery Centre is approximately 31 months.

The road upgrade, associated road drainage and diversions of services will take circa 8 weeks to complete. The diversion to the 220kV underground cables, if required would take circa 4 additional weeks. It is anticipated that the road upgrade, associated road drainage and diversions of services will proceed in advance of the main construction of the Resource Recovery Centre. Refer to Section 5.3.2 below for further details. Of the 12 week duration period, Gobby Beach car park may need to be closed for up to 6 weeks to facilitate the construction works. However, access to the beach will be maintained for the duration of the works.

The placement of the sacrificial beach material (shingle) required for the coastal protection works will take approximately three weeks to complete. Refer to Section 5.4.3 below for further details. It is envisaged that the coastal protection works will be undertaken towards the end of the construction phase.

It is envisaged that the main stages of construction will be as follows:

- Implement Japanese knotweed management plan for construction phase, fence off infestation area along the western boundary of the site and continue with treatment etc. Note, advance knotweed treatment will commence prior to construction from 2016 onwards. (Refer to Section 5.12.7 below for further details).
- Establish the initial contractor site compound, including the construction phase power supply, fencing and securing of the site,
- Construct temporary road to south of existing L2545 road,
- Upgrading the section of the L2545 road at the northern boundary, including upgrading the drainage and diversion of services
- Construction of new entrance,
- Diversion of existing services within the site, including the gas main, which lies close to the southern and eastern boundaries, and overhead power lines,
- Strip topsoil and vegetation,
- Bulk excavations and general site re-grading, including placing of fill in western field,
- Construction of earth retaining structures, which will happen in tandem with bulk excavations and general site re-grading,
- Establish main contractors' compounds and laydown areas,
- Construction of foundations for main process building,
- Construction of bunker, underground holding tanks and drainage/underground services,
- Erection of superstructure of main process building,
- Construction of ground floor slab of main process building,
- External and internal completions and finishes of main process building,
- Installation of plant and equipment, which will be undertaken in tandem with external and internal completions and finishes,
- Construction of substation, administration building and other ancillary buildings,
- Installation of external plant and equipment,
- Construction of internal roads and parking areas,
- Underground services,
- Surface water drainage system,
- Foul drainage system,
- Connection to existing water and foul services,
- Fit-out and commissioning buildings and equipment,

- Erection of site fencing.
- Site landscaping.
- Placing of sacrificial material on the beach at the toe of the glacial till face at the eastern boundary of the site.
- Removal of contractor facilities and site hoarding.

5.3.2 L2545 Upgrade and Drainage Upgrade

Introduction

The proposed upgrade works to a section of the L2545 local road, which adjoins the northern boundary of the site, will consist of raising a section of the road to a maximum elevation of 3.45m OD, installing large diameter pipes to provide storm water storage and upgrading the surface water drainage. The likely duration of the works will be 12 weeks in total. This work will be undertaken in advance of the main construction works. The road and drainage upgrade is fully described in Section 4.5.17 of **Chapter 4** ***Description of the Proposed Development,*** of this EIS. A summary is provided below.

Outline description of L2545 upgrade – increase in road levels

The proposed L2545 upgrade works will include raising a 185m section of the road to a maximum height of 3.45m OD between the car park and the eastern end of the Hammond Lane Metal Company. This is approximately 1.0m above the existing road level. The road will be raised over a length of approximately 185m in order to ensure a smooth transition down to existing road levels, in accordance with road design standards. The recently constructed footpath on the northern side of the road will also be raised to the new road level.

Outline description of L2545 drainage upgrade

The proposed road drainage network upgrade will extend along the entire northern boundary of the Indaver site. The increased storage will be in the form of oversized pipes placed underneath the road. This is described further below.

A 260 metre length of new linear concrete surface water channel will extend from the western boundary (of the western field area) of the Indaver site, running along the southern edge of the L2545 until it meets the entrance to the Hammond Lane Metal Company. This section of the L2545 is currently super-elevated – i.e. the camber on the road falls from north to south, therefore surface water drains to the south. This section of the L2545 will not be raised as the existing levels are already above the predicted 1 in 200 year design tidal level (2.73m OD) and it will be protected to 3.35m OD by the proposed elevated section of road to the east. The new surface water channel will be drained at regular intervals by gullies which will outfall to the existing 450mm diameter surface water sewer beneath the road. Therefore surface water will no longer flow from the road into the Indaver site (western fields) to the south.

The raised section of the L2545 between the car park and the eastern end of the Hammond Lane Metal Company will be drained by a kerb and gully sealed drainage system which will be connected to two new surface water pipes underneath the road. The two 1500mm diameter pipes will be approximately 190m in length and will provide 660m^3 of surface water storage. There will be

three large concrete chambers constructed on the line of the twin surface water pipes at the start middle and end of the run. The first two chambers will be situated in the road and the terminal chamber will be constructed at the entrance to the car park by Gobby Beach. The recently constructed surface water drainage system on the Haulbowline road will be diverted into the terminal chamber. This chamber will be connected to the existing 450mm diameter surface water sewer via a short length of new 450mm diameter pipe, a new Class 1 bypass hydrocarbon interceptor and a new manhole constructed on the line of the existing pipe. This will allow the upgraded surface water drainage system to discharge to sea via the existing 450mm surface water outfall at Gobby Beach.

All of the above works will be within Indaver ownership, apart from a small area in Hammond Lane ownership. Consent has been given by Hammond Lane to undertake these works.

Outline description of existing services along L2545

The known underground services are a 450mm diameter watermain, 220kV electricity cables, 4 bar gas distribution main, public lighting cables, Eircom underground cables, Enet fibre optic cables, private foul sewer and surface water drainage pipes. There is also an overhead electricity cable crossing the road.

Outline description of construction works required for L2545 upgrade

A construction traffic management plan will be implemented by the appointed Contractor in advance of commencing the works on site. Refer to Section 5.13.5 below for further details.

Whilst the construction of the road upgrade and associated drainage upgrade can proceed in parallel with the construction of the waste to energy facility, the raising of the levels of the western field lands would require the road drainage works to be complete. Therefore it is anticipated that the road upgrade and drainage works would be commenced at the beginning of the project and progressed to completion as soon as possible.

The first task of the road upgrade will be to construct a temporary two way road, approximately 250m long, to the south of the existing road to create working space for the construction of the raised section of the road, the upgraded drainage system and the diversion of services. The traffic will be diverted onto the temporary road until the upgrade works have been completed. The construction traffic management plan will incorporate a temporary traffic management plan in accordance with Chapter 8 of the Traffic Signs Manual (Department of Transport 2010). An initial site compound and site offices will be provided within the Indaver site to provide facilities for the workforce for the road upgrade works.

The existing services running along and adjacent to the road will be carefully set out and suitable working methods will be employed to ensure that the existing services are protected during construction.

There is an overhead electricity line crossing the road however only a marginal increase in road level (circa 100mm) is proposed at this location. The public lighting columns at the northern edge of the footpath, on the northern edge of the road, will have to be raised to match the new road level and the associated duct chambers will also be raised to match the new footpath level.

New Eircom ducting is proposed for the northern road verge to allow Eircom cables to be locally diverted within the road. The gas distribution main will also be locally diverted within the road. The existing surface water drainage from the Haulbowline road will be diverted into the new surface water system. The 450mm diameter watermain will also be diverted along the section of road to be raised between the car park and east of Hammond Lane. This work will be undertaken in consultation with Cork County Council, which is acting as an agent for Irish Water. All of the utilities providers have been consulted in relation to the proposed diversions.

The 220kV power lines and corresponding ESB telecoms fibre optics cables beneath the L2545 may need to be raised as a result of the raising of the L2545.The worst case option in terms of potential impacts would involve diverting the cables into new ducts laid at a higher level underneath the raised section of road. Three new joint bays would be required to allow the raised cable to be jointed back to the existing cables at either end and to join the short length of new cable to the recovered length of cable respectively. The joint bays would be located in the existing road.

Diversion works to the remaining services are not envisaged, however some protection measures, such as cover slabs, may need to be employed.

Due to the presence of the existing services, it may not be possible to batter back the excavation for the large drainage pipes and therefore suitable trench supports e.g. sheet piles or large trench boxes may be used.

The 1500mm diameter pipes and the other pipes, road gullies and new underground services, including the new ducts and joint bays for the potential 220kV cable diversion will be installed and the trenches backfilled, and the new road surfacing will be laid using normal construction method and in compliance with the requirements of Cork County Council and Transport Infrastructure Ireland (TII) specifications. A temporary road surface will be provided which will be replaced with the permanent surface once the main construction project has been completed.

Provision for the site connections to the water main, telecommunications infrastructure and surface water and sanitary sewers will be made during road upgrade works.

Materials required

The road upgrade will involve the following quantities of bulk materials:

- Excavation of circa 3,050m^3 unsuitable material including circa 225m^3 bituminous macadam,
- Importation of 1,400m^3 pipe bed and surround material,
- Import 1,400m^3 select granular fill for new road construction,
- Importation of 370m^3 asphalt for new road.
- Importation of 1000m^3 select granular fill for temporary road construction.

The imported granular fill for the construction of the temporary road may be reused for the construction of internal site roads.

Uncontaminated soil and stone materials which are not suitable for re-use will be disposed of to an appropriate site which is permitted under the Waste Management (Collection Permit) Regulations 2007 and 2008 to accept soil and stone. There are 13 such permitted sites within a 40km radius of the proposed Resource Recovery Centre site. The environmental impacts associated with the permitted site have already been assessed by the planning authority under the approval process specified in the Waste Management (Collection Permit) Regulations 2007 and 2008. All traffic movements associated with the export of materials have been included in the construction traffic impact assessment. Refer to **Chapter 7** (***Roads and Traffic***) for further details.

Materials required for the road upgrade will be sourced locally where possible. Materials required from quarries will only be sourced from quarries which are listed on the register maintained by the local authority. The environmental impacts associated with the registered quarry have already been assessed by the local authority under Section 261 of the Planning and Development Act 2000, as amended. All traffic movements associated with the import of materials have been included in the construction traffic impact assessment. Refer to **Chapter 7 *Roads and Traffic*** of this EIS for further details.

5.4 Site Preparation Works

Once the road upgrade has been completed, the site preparation will commence with the establishment of safe access and site roads. A perimeter fence will be erected around the construction site. Re-grading work will be required. Where feasible, excavated material will be retained on site, either in the eastern area or western field, for use as bulk fill or for landscaping, with the surplus being sent to an appropriate site which is permitted under the Waste Management (Collection Permit) Regulations 2007 and 2008 to accept soil and stone. The quantities of materials being moved offsite will be minimised. All traffic movements associated with the export of materials have been included in the construction traffic impact assessment. Refer to **Chapter 7, *Roads and Traffic*** of this EIS for further details.

It is anticipated that the bulk excavation will take approximately six months. The central part of the site for the waste-to-energy facility will require significant earth retaining structures. These will be constructed in tandem with the bulk earthworks and re-grading.

The material to be removed will comprise overburden and rock. Refer to **Chapter 13 *Soils, Geology, Hydrogeology, Hydrology and Coastal Recession*** of this EIS for a description of the soils and geology underlying the site. The bedrock is comprised of sandstone/siltstone and mudstone. The top 0.5m to 1m of the bedrock is weathered and it is expected that it can be removed using a large excavator. It is expected that the remainder can be removed using chisel or hammer-operated rock breakers. It is anticipated that blasting will not be required. Refer to **Chapter 10, *Noise and Vibration*** and **Chapter, 8 *Air Quality*** of this EIS for details on construction noise and dust impacts and mitigation measures.

Rock crushing may be undertaken on site in order to make the excavated rock suitable for re-use as general fill. Crushed stone will need to be imported onto site. Materials required from quarries will only be sourced from quarries which are

listed on the register maintained by the local authority. The environmental impacts associated with the registered quarry have already been assessed by the local authority under Section 261 of the Planning and Development Act 2000, as amended. All traffic movements associated with the import of materials have been included in the construction traffic impact assessment. Refer to **Chapter 7, *Roads and Traffic*** of this EIS for further details.

Site preparation works will also include the facilities for the contractors and the construction management team. These will include the following:

- Setting up of access control to the site.
- Site offices.
- Site facilities (canteen, toilets, drying rooms, etc.).
- Offices for construction management team.
- Secure compound for the storage of all on-site machinery and materials.
- Temporary car parking facilities.
- Permanent and temporary fencing.
- Site Security.

The western field will be used for the construction laydown areas and the construction facilities, following an initial phase of earthworks to raise the ground levels in this area.

5.4.1 Main Construction Works

Once site levels have been established by the initial bulk excavation works and construction of the retaining structures, the construction of the waste-to-energy facility will commence with the construction of the foundations for the building and equipment, the bunker and the tanks and services to be located under the ground floor. The upper floors and main building support structures will then be completed. Installation of plant and equipment will be undertaken in parallel. The contractor will work on the construction of the foundations and superstructure and installation of the equipment in the ancillary buildings, and the installation of the external plant and equipment, once construction of the waste-to-energy facility has progressed.

Site roads, car parks and site fencing will be completed and the landscaping will be undertaken, when the main construction and equipment installation is completed and commissioning is underway.

5.4.2 Construction of Grid Connection

The proposed development includes a grid connection to the boundary of the adjacent ESB Networks Lough Beg substation. The ESB Lough Beg substation is located on the eastern boundary of the Hammond Lane Metal Recycling Company Ltd. The lands over which the entire grid connection will be constructed lie within Indaver's ownership (save for a small section comprising associated works on the adjacent substation owned by ESB Networks). These works will be carried out by ESB Networks and do not form part of the planning application.

The grid connection will be made by running underground cables between the ESB Networks Lough Bed substation and the import/export substation on-site, east of the main site entrance. Underground cables will be laid, using normal construction methods and complying with ESB Networks requirements.

5.4.3 Coastal Defence Works

Approximately 1,100m^3 of imported rounded shingle of appropriate size will be placed, as sacrificial material, at the toe of the glacial till face on Gobby beach which forms the eastern boundary of the site. The works will extend along the beach from near the car park at the northern end of the Indaver site to the southern boundary of the Indaver site. The material will be deposited above the high water mark.

The placement of the sacrificial beach material (shingle) required for the coastal protection works will take approximately three weeks to complete. It is envisaged that the first instalment of the shingle will be undertaken towards the end of the construction phase.

The sacrificial material has been designed to remain on site and help lower the natural erosion rate over a number of years. However, the expected duration of the material cannot be determined since it depends on the occurrence of extreme wave events which are impossible to forecast. Therefore it is anticipated that monitoring of the sacrificial material and the cliff face will take place on an annual basis. Replenishment of the material will be carried out as determined by the monitoring results. It is envisaged that replenishment may be required every two to five years but it depends on the duration of the material remaining on site. The impacts described below for the initial instalment of shingle will be repeated during replenishment.

The shingle, required for the coastal protection works will be sourced from a quarry which is listed on the register maintained by the local authority. The environmental impacts associated with the registered quarry have already been assessed by the local authority under Section 261 of the Planning and Development Act 2000, as amended. The registered quarry will have similar geological properties to the material found on Gobby Beach so that the shingle chosen will match the existing material on Gobby Beach.

All traffic movements associated with the import of the shingle have been included in the construction traffic impact assessment. Refer to **Chapter 7, *Roads and Traffic*** of this EIS for further details.

The imported shingle will be transported by road and temporarily deposited at the car park at Gobby Beach. A bulldozer will be used to spread the imported shingle in the designated area. It is anticipated that access for construction machinery across the beach will be facilitated by laying down temporary tracks.

To ensure the safety of the general public, it is envisaged that the area of the beach, in which the construction works will take place and the area of the car park in which the materials will be stored, and which will be used by the machinery, will be closed to the public for the duration of the proposed works, approximately three weeks. However, access to the rest of the beach will be maintained for the duration of the works.

The traffic movements associated with the coastal protection works have been included in the construction traffic impact assessment. Refer to **Chapter 7**, ***Roads and Traffic*** of this EIS for further details).

5.4.4 Construction Methods

The proposed development will be constructed employing best practice in safety and efficiency.

In-situ reinforced concrete will be used to form foundations. In the parts of the site where the ground levels are raised, or where the bearing strata does not have the required geotechnical properties, foundations will be piled. In-situ reinforced concrete will be used to form ground bearing floor slabs, upper floor suspended slabs and earth retaining structures. Soil nailing or rock anchors may be used for some earth retaining structures, where the rock is suitable. Underground tanks, chambers and process areas will be constructed of in-situ concrete and will be designed as water retaining structures to the relevant codes. Where required these structures will be double contained, using a high density polyethylene or polypropylene liner.

It is likely that all concrete will be brought to site ready-mixed in trucks. The concrete may be placed directly from the trucks, or it may be pumped or be placed by skips hoisted by a crane.

It is envisaged that some of the minor structural elements (e.g. non-load bearing walls) may be constructed in concrete block work.

The superstructures for the buildings will be constructed in structural steel. Steel members will be fabricated off site, in lengths that are safe to transport, and erected on site. Structural steel will also be used to support the process equipment and to provide access platforms.

The buildings will be clad in profiled metal cladding and the roofing will consist of profiled metal cladding or a membrane type system on and metal deck. Depending on the function of the buildings, the cladding and roof will be insulated.

Cranes will be a significant element of the construction plant and it is envisaged that various crane systems will be used for lifting materials in to place.

The construction of the proposed development will require considerable movements of materials to and from the site. Most of the materials leaving the site will consist of spoil from the excavation works. It is estimated that almost 74,664m^3 of surplus material will be removed from the site. This material is expected to be suitable for deposition in a permitted site. Almost 30,261m^3 of engineering fill and crushed stone will be imported onto the site. These figures include an allowance for bulking up of material.

Uncontaminated soil and stone materials which are not suitable for re-use will be disposed of to an appropriate site which is permitted under the Waste Management (Collection Permit) Regulations 2007 and 2008 to accept soil and stone. There are 13 such permitted sites within a 40km radius of the proposed resource recovery centre site. The environmental impacts associated with the permitted site have already been assessed by the planning authority under the approval process specified in the Waste Management (Collection Permit)

Regulations 2007 and 2008. All traffic movements associated with the export of materials have been included in the construction traffic impact assessment. Refer to Chapter 7 (Roads and Traffic) for further details

Materials required for the construction works will be sourced locally where possible. Materials required from quarries will only be sourced from quarries which are listed on the register maintained by the local authority. The environmental impacts associated with the registered quarry have already been assessed by the local authority under Section 261 of the Planning and Development Act 2000, as amended. All traffic movements associated with the import of materials have been included in the construction traffic impact assessment. Refer to Chapter 7 (Roads and Traffic) for further details.

5.5 Material Sources and Transportation

The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. Construction materials will be transported from the suppliers via the national primary route network as far as Ringaskiddy village and will use the L2545 from the Village to the site. Refer to **Chapter 7, *Roads and Traffic*** of this EIS for an assessment of the impact of construction traffic.

5.6 Services and Utilities Requirements for Construction

5.6.1 Electricity

It is anticipated that the construction work will require a peak load of 300kVA. In liaison with the ESB Networks, a temporary transformer served from local supplies will be installed to provide this.

5.6.2 Water Supply

The construction activities that will require water during the construction phase will be relatively small. The initial estimate of demand is approximately 10m^3 per day, primarily based on the demand requirement for the construction workers and the associated support facilities. In agreement with Irish Water, water will be sourced from the existing water main located in the L2545 road to the north of the site where there is ample supply to meet this demand.

5.6.3 Storm Water and Foul Water Disposal

A dedicated holding tank for storage of construction foul effluent will be constructed prior to commencement of the main construction activities. The effluent will be regularly disposed of off-site by tanker by a licensed contractor to an approved licenced facility.

Storm water will be managed carefully during construction. In general, storm water will be infiltrated to ground via silt traps and managed soakaways. The laydown areas will be suitably drained and any areas which will involve the

storage of fuel and refuelling will be paved and bunded and hydrocarbon interceptors will be installed to ensure that no spillages will get into the surface water or groundwater.

5.7 Employment and Welfare

Through the construction phase there will be some variation in the numbers working on site. It is anticipated that a maximum of 320 construction workers will be employed on site at any one time with around 250 workers working a daytime shift and 70 working a night shift.

Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard in accordance with statutory regulations, as a minimum.

The co-ordination of people and materials on-site will be one of the key activities throughout the construction phases. The construction traffic management plan will designate traffic routes, timings and parking arrangements.

The site start time will ensure that construction workers arrive in the Ringaskiddy area prior to the morning peak hour for traffic on the local network. No construction vehicles will arrive or depart the proposed development site during the morning and evening peak periods (07:00-09:00 and 16:00-18:00) during the construction phase. Typical working hours during the construction phase will be:

Start	Finish	
0600	2000	Monday – Friday
0700	1300	Saturday

It will be necessary to work overtime (including at weekends) and night shifts at certain critical stages during the project. Consideration of safety, weather or sub-contractor availability is likely to necessitate working outside normal hours. Over the 31 month construction phase there will be up to 8 weeks of night time working. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Refer to **Chapter 7** ***Roads and Traffic*** of this EIS for further details on construction traffic.

5.8 Commissioning Phase

Following completion of construction and installation of equipment, and before operation of the facility commences, there will be a testing and commissioning phase. This phase will comprise:

- Installation compliance checks
- Commissioning tests
- Performance demonstration tests

5.8.1 Installation Compliance Checks

This will be a process of systematically checking that all systems and equipment have been constructed, assembled, aligned and installed correctly, in accordance with the design specifications and drawings, and that all interconnecting pipe work, cabling and wiring has been installed in compliance with the design specifications and drawings.

5.8.2 Commissioning Tests

The function of each item of equipment and each system will be tested and verified, in a systematic manner, as being in accordance with the design and specifications. All the alarm and control systems and instrumentation will be tested to demonstrate that they are functioning correctly. Following these tests, each system will be checked to ensure that it is ready to be commissioned under operating conditions including using real materials, temperatures, pressures and voltages.

5.8.3 Performance Demonstration Tests

In this commissioning phase, the individual items of equipment and systems will be tested under operating conditions using the materials, temperatures, pressures and voltages to which they will be subjected when in operation. Once the operation of all equipment and systems have been tested and verified individually, they will be integrated and the operation of complete systems will be tested.

The facility's safety and fire prevention systems and the emission monitoring systems will be subject to the same rigorous testing protocols as the other systems in the plant.

5.8.4 Incineration Plant Test Programme

It is likely to be a requirement of the industrial emissions licence that a test programme is undertaken to demonstrate the performance of the waste-to-energy facility, including operations, control and abatement systems, emissions, monitoring equipment and back-up systems. The test programme must be completed and a report submitted to the EPA before normal operations can commence.

5.9 Construction Site Decommissioning

On completion of construction, all construction facilities and equipment such as plant, materials, signage, contractors' offices and laydown areas, etc. will be removed from site. Some contractor facilities will remain until the end of the guarantee time of the incinerator due to guarantee obligations of the contractors.

5.10 Potential Construction Impacts

5.10.1 General

The potential impacts identified in this section represent the “worst case” scenario predicted in the absence of any mitigation.

Potential construction phase impacts include emissions to air such as dust, noise and vibration, construction traffic (including oversized deliveries), surface water runoff from the site, leaks or spills from construction plant and equipment, construction waste, disruption to users of Gobby beach during placement of sacrificial material on the beach, and disruption to road users during the road upgrade. Additional traffic on the road network will be generated by the construction works.

There is also the potential for impacts on existing underground services during construction i.e. the gas distribution main and the 220kV underground cables and other services that run in the vicinity of the site and under the L2545 road. In particular, the 450mm diameter water main in the road is understood to be subject to occasional leaks. This watermain runs along the northern side of the road. There is the potential that this could be damaged along the section of road to be raised. It is not expected that the section of the 450mm water main between the western boundary of the Indaver site and Hammond Lane will be impacted as it is located on the northern side of the road whereas the proposed drainage works in this area will be located along the southern side of the road.

There will be temporary outages and disruption to the services as new connections are made and/or services are relocated.

Potential construction phase impacts are also addressed in other chapters of this EIS. For example, the construction phase impacts on air quality, climate and noise and vibration are evaluated in **Chapters 8 *Air Quality*, 9 *Climate*** and **10 *Noise and Vibration*** of this EIS respectively. Construction traffic is addressed in **Chapter 7 *Roads and Traffic*** of this EIS. There is an evaluation of the construction impacts on flora and fauna in **Chapter 12 *Biodiversity*** of this EIS. The construction impact on the archaeological, architectural and cultural heritage is addressed in **Chapter 14, *Archaeological, Architectural & Cultural Heritage*** of this EIS. Visual impacts and lighting impacts during construction are detailed in **Chapter 11 *Landscape and Visual*** of this EIS. Potential construction phase impacts on Soils, Geology, Hydrogeology and Coastal Recession are addressed in **Chapter 13 *Soils, Geology, Hydrogeology, Hydrology and Coastal Recession*** of this EIS. Specific construction phase mitigation measures are described in the individual chapters and general mitigation measures are described below.

5.10.2 Do Nothing Impacts

If the proposed development did not go ahead, it is likely that the lands would remain the same or would be developed by some other developer for another industrial purpose. The road drainage would not be upgraded and the road levels would not be raised. Consequently, the road would continue to flood following heavy rain and the road would be vulnerable to tidal flooding, particularly following a rise in sea levels due to climate change.

5.11 Predicted Impacts of Decommissioning Phase

The decommissioning activities are described in Section 4.18 of **Chapter 4** ***Description of the Proposed Development*** of this EIS. These include:

- Incineration of all waste on site,
- Removal off-site of all raw materials, other process materials and residues,
- Decontamination, using chemicals and or power washing, and decommissioning of all plant and equipment,
- Removal of sludge from tanks and inceptors,
- Cleaning of all remaining equipment, pipelines etc.,
- Removal of specialist equipment, tanks, and pipelines from site, and
- Retention of buildings, roads, hard-standings and site fencing.

The site surface water drainage system, site fire safety systems and security systems will remain in place until the decontamination and decommissioning activities have been substantially completed. This will ensure that the decontamination and decommissioning activities will not give rise to a significant risk of environmental pollution.

The decommissioning activities are expected to take six months. Environmental monitoring, testing, validation and reporting will be undertaken for a further six to twelve months. Security will be maintained on site until the decommissioning activities and environmental reporting have been completed.

There will be up to 15 staff and contractors' personnel on site during the six months but the average number on site will be less than this. The decommissioning activities will be undertaken within the hours of 08.00 to 18.00 from Monday to Friday.

Circa 5,500 tonnes of materials and wash waters will be removed from site during the decontamination phase. This represents 275 truckloads of material to be removed from the site over a three month period of the decontamination phase, which is an average of approximately 5 trucks a day.

The decommissioning activities will involve substantially fewer site activities, a substantially smaller workforce and substantially less truck and car traffic than the construction phase. Consequently, it is expected that the decommissioning will not have a significant impact on the environment or the nearest residential receptors.

5.12 Construction Mitigation Measures

5.12.1 General

Every effort will be made to ensure that any detrimental environmental effects will be avoided, prevented or reduced during the construction phase of this project.

A construction environmental management plan (CEMP) will be prepared prior to construction commencing. The CEMP will comprise all of the construction

mitigation measures, which are set out in this EIS, and any additional measures which are required by the conditions attached to the Board's decision. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide, 4th Edition* (CIRIA 2015).

Indaver will appoint a construction management team for the duration of the construction phase. The team will supervise the construction of the project, including monitoring the performance of the contractors to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. Indaver will liaise with neighbours and the general community during the construction phase to ensure that any disturbance is kept to a minimum.

5.12.2 Dust

The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of dust produced will be deposited close to the generated source. A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented.

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only apart from the contractor's car park which will be hardcore only.
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Wheel washing facilities will be provided for vehicle exiting site in order to ensure that mud and other wastes are not tracked onto public roads.
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations. Refer also to **Chapter 8 *Air Quality*** of this EIS

5.12.3 Debris

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily inspections will be undertaken to monitor tidiness.
- A regular program of site tidying will be established to ensure a safe and orderly site.
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site.
- Wheel wash facilities will be provided for vehicles exiting the project site. Wheel wash run off will be stored in an onsite storage tank and will be disposed of by permitted waste haulage company at a permitted or licensed facility.
- In the unlikely event that mud is carried from the project site to the public road, it will be cleaned as required and will not be allowed to accumulate.
- Loaded Lorries and skips will be covered if required.
- Surrounding roads used by trucks for access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required.
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

5.12.4 Noise and Vibration

Construction noise will be kept to a minimum in accordance with BS 5228 (2009). Construction-phase noise impacts are addressed in **Chapter 10 *Noise and Vibration*** of this EIS.

The contract documents will specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (NRA 2014).

There will be no significant construction noise or vibration impacts on neighbouring residences.

Prior to the construction works commencing on site, environmental noise and vibration monitors will be installed at the selected monitoring locations. Refer to **Chapter 10 *Noise and Vibration*** of this EIS for further details.

It is anticipated that no significant vibration will be generated during the construction phases of the proposed development. Piling is likely to be required. It will utilise methods that will minimise the risk of vibration generation and will only be undertaken in daytime. Rock breaking, if required will use methods that will minimise noise and vibration.

5.12.5 Existing Services

The existing services running in and adjacent to the site and the road will be carefully located, identified and suitable working methods will be employed to ensure that these services are protected. Diversion or relocation of services will be undertaken in consultation with the owners of the services and will be undertaken in accordance with the relevant standards and codes of practice. Some protection measures such as cover slabs may be used for the services which will be left in place. Pipeline protection slabs will be used for works carried out in the vicinity of the gas transmission line, once it has been diverted. The section of the 450mm water main, which is located in the part of the road where the level is to be raised, will be replaced. This work will be undertaken in consultation with Cork County Council, which is acting as an agent for Irish Water.

Service users will be notified in advance of any temporary disruption or outages necessitated by the construction works. The disruption to services or outages will be carefully planned so the duration are minimised.

5.12.6 Biodiversity

Potential impacts of the construction phase on biodiversity are addressed in **Chapter 12 *Biodiversity*** of this EIS.

5.12.7 Invasive Non-native Plant Species Japanese Knotweed

Japanese knotweed is a highly invasive, non-native species which can out-compete native plant species and which can penetrate through small faults in tarmac and concrete and thus can damage roads, footpaths and structures.

At present, there are no specific legislative provisions that directly govern Japanese knotweed control or removal in Ireland.

Ecological surveys recorded a small stand of Japanese knotweed along the western boundary of the site and also outside the site's north-western boundary. Refer to **Figure 12.3** for location details. The site layout of the proposed development has been designed not to directly impact on the stand of Japanese knotweed. As part of the management of the infestation, the site will be

resurveyed in the spring of 2016 and treatment (spraying) will commence in the summer of 2016.

There is also the potential for Japanese knotweed to be inadvertently brought onsite in imported fill or on the wheels/tracks of construction vehicles. The supplier of fill will be required to provide a guarantee that the fill to be imported does not contain Knotweed. In addition, the fill will be inspected for signs of knotweed, prior to importation to site. The UK Environmental Agency's publication *Managing Japanese knotweed on development sites - The Knotweed Code of Practice* (EA 2013), states that inspection of topsoil brought into the site, should be carried out using the guidance in appendix I-IV of the code BS 3882:2007 *The British Standard Specification for topsoil and requirements for use*. This Standard was replaced subsequently by BS3882:2015 *Specification for Topsoil.* The inspection of fill will be carried out according to this Standard.

The contractor will be required to inspect vehicles before using them on site, and will pay particular attention to caterpillar tracks and where trucks and dumpers are stowed.

Following treatment in 2016, a management plan for the control of Japanese knotweed on the site during construction will be developed with reference to the following codes of practice and guidelines.

- Best Practice Management Guidelines Japanese knotweed Fallopia japonica (2008) - prepared for NIEA and NPWS as part of Invasive Species Ireland.
- NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)
- Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency.

The implementation of the above measures will minimise the risk of Knotweed being spread within the site or outside the site during the construction phase of the proposed development.

5.13 Construction Waste Management

5.13.1 General

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme, which is implemented by the Environmental Protection Agency.

All waste removed from the site will be collected only by contractors with valid waste collection permits, under the Waste Management (Collection Permit) Regulations. All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.

5.13.2 Waste Arising

In general, construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions. The practice of excessive purchase of materials and equipment to allow for anticipated wastage will be avoided.

The excavated material, which is expected to be uncontaminated soil and stone, may be unsuitable, because of its engineering properties, for use as backfill. Typically, this material will be re-used on site as non-structural fill material, or for landscaping and other uses. The excavated material which is not re-used on site may be suitable for use as non-structural fill material, or for landscaping on another site. The excavated material which is not re-used will be disposed of to an appropriate permitted site. This material which would be suitable for disposal [1]at sites, which have permits under the Waste Management (Collection Permit) Regulations 2007 and 2008 to accept soil and stone. There are 13 such sites within a 40km radius of the proposed resource recovery centre site[1]. The environmental impacts associated with the permitted site have already been assessed by the planning authority under the approval process specified in the Waste Management (Collection Permit) Regulations 2007 and 2008.

In the unlikely event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. Any work of this nature would be carried out in consultation with, and with the approval of the Environmental Department of Cork County Council. The material would be transported to a permitted site via the national and regional road network.

Timber from trees, felled as part of the site preparation, will be sold to the timber industry.

5.13.3 Waste Management Plan for the Construction Phase

The contractor will be required to develop, implement and maintain a Waste Management Plan during the construction works. A senior manager will be responsible for the waste management plan. The manager will be competent in waste management, and will receive training, where necessary, such as the CIF Site Waste Management and Environmental Awareness course.

1 http://www.corkcoco.ie/co/web/Cork%20County%20Council/Departments/Environment%20%26%20Waste/Publications?did=739025488&pageUrl=/Cork+County+Council/Departments/Environment+%26+Waste/Publications, accessed August 2015.

The key principles underlying the plan will be to minimise waste generation and to segregate waste at source. The measures to achieve these aims include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy.
- Immediate and careful storage of materials delivered to the site.
- Storing materials which are vulnerable to damage by rain under cover and raised above the ground.
- Careful handling of materials, using appropriate equipment, to avoid undue damage.
- Designation of separate storage areas for different types of waste, in order to maximise the reuse and recycling potential of the waste.

The Waste Management Plan will outline how residual waste will be handled as follows:

- The identification of disposal sites.
- The identification of quantities to be excavated and disposed of and classification of this material.
- The identification of measures to prevent nuisance, etc.
- The identification of the amounts intended to be stored temporarily on site and the location of such storage.
- The contractor's approach to waste management.
- The names, roles, responsibilities, and authority of the key personnel involved in the waste management.

The Waste Management Plan will include documented procedures for dealing with waste management including liaison with third parties, statutory undertakers and other companies.

The Waste Management Plan will meet the requirements of the guidelines prepared by the National Construction and Demolition Waste Council (NCDWC), *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects*, NCDWC 2006.

5.13.4 Soil, Surface Water and Groundwater

There are no watercourses on site. Cork Harbour lies adjacent to the eastern boundary of the site. The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams et al 2001). Additional guidance is provided in the CIRIA technical guidance on *Control of Water Pollution from Linear Construction Projects* (Murnane *et al* 2006).

The guides are written for project promoters, design engineers and site and construction managers. They address the main causes of pollution of soil, groundwater and surface waters from construction sites and describes the

protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied. The guides address developments on green field and potentially contaminated brownfield sites. The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Site activities considered in the guidance include the following:

- excavation
- earthmoving
- concreting operations
- spreading of topsoil
- road surfacing
- site drainage, and the control and discharge of surface water runoff from the site
- oil and fuel delivery and storage
- plant maintenance

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include:

- Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures,
- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land.
- Minimise the use of cleaning chemicals.
- Use trigger-operated spray guns, with automatic water-supply cut-off.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

Best practice, in accordance with relevant codes of practice and guidelines, will be followed to minimise the risk of spreading Japanese knotweed on or off the site (**Section 5.8.1.1 *Japanese Knotweed,*** of this EIS).

The implementation of the above measures will ensure that the risk of pollution of groundwater, soils and surface waters, resulting from the construction activities will be minimised.

5.13.5 Construction Traffic

The impact of the generated traffic on the local road network during the construction of the proposed development is evaluated in **Chapter 7 *Roads and Traffic*** of this EIS***,*** and mitigation measures are proposed where necessary.

The appointed contractor will be required to develop a Construction Stage Traffic Management Plan in advance of commencing the works on site. The plan will be implemented at the commencement of the works. The plan will need to implement all relevant mitigation measures identified in this EIS, together with any additional requirements imposed by conditions attached by An Bord Pleanála to any grant of permission. For example, the Construction Stage Traffic Management Plan will confirm the indicative traffic routes to the site which have been identified in the application documentation. Points of access and egress for the site will be confirmed and management measures identified in the application documentation will be agreed with Cork County Council.

In order to ensure compliance by contractors and suppliers, the requirements of the EIS, and all additional requirements imposed by conditions attached by An Bord Pleanála will be included in all contract tender documents and will be discussed in detail prior to awarding a contract. All traffic movements associated with the import and export of materials have been included in the construction traffic impact assessment. Refer to Chapter 7 (Roads and Traffic) for further details

The plan will be regularly reviewed and updated to take into account the changing patterns of both the existing traffic and the construction traffic, following consultation with Cork County Council. The routing of any exceptional loads will require liaison with Cork County Council and the Garda Siochána.

During the road upgrade works and the coastal protection works, the traffic management plan will ensure that disruption to local traffic will be minimised.

The implementation of this plan will be monitored by the Indaver Site Management team during the course of the project and will also be reviewed at the main site meetings.

5.13.6 Construction Safety

As required by the *Safety, Health and Welfare at Work (Construction) Regulations 2013*, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

Safety on site will be of paramount importance. During the selection of the contractors and subcontractors, their safety records will be investigated. Only contractors with high safety standards will be selected.

Prior to working on site, each individual will receive a full safety briefing and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. 'Toolbox talks' will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

5.14 Potential Cumulative Impacts

The potential for cumulative construction impacts, should the proposed development take place simultaneously with the construction of the proposed projects, which are listed below, was considered.

Proposed projects

- N28 new road
- Haulbowline East Tip and steelworks remediation projects and Spike Island Masterplan
- Port of Cork expansion
- Cork Lower Harbour Main Drainage Scheme sewage treatment plant, Shanbally
- Novartis wind turbine

The potential cumulative impacts arising during the construction phase are addressed in **Chapters *7 Roads and Traffic*, 8 *Air Quality*, 9 *Climate,* 10 *Noise and Vibration, 11 Landscape and Visual,* 12 *Biodiversity,* 13 *Soils, Geology, Hydrogeology, Hydrology and Coastal Recession,* 14 *Archaeological, Architectural and Cultural Heritage,* 15 *Material Assets,* and 16 *Cumulative Impacts, Other Impacts and Interactions*** of this EIS**.**

5.15 Residual Impacts

It is anticipated that, with proper management, the construction phase of the development will not have significant long-term negative impacts.

The residual construction impacts of the construction phase are addressed in **Chapters 7 *Roads and Traffic,* 8 *Air Quality,* 9 *Climate,* 10 *Noise and Vibration,* 11 *Landscape and Visual,* 12 *Biodiversity,* 13 *Soils, Geology, Hydrogeology, Hydrology and Coastal Recession,* 15 *Material Assets,* 14 *Archaeological, Architectural and Cultural Heritage*** and **16 *Cumulative Impacts, Other Impacts and Interactions*** of this EIS**.**

The residual impacts will last for the duration of the construction phase only and will include:

- temporary closure of access the area of Gobby beach where coastal protection works will take place and a section of the car park for the three week duration of the placing of material on the beach. However, access to the rest of the beach will be maintained for the duration of the works
- disruption to road users and use of the temporary road for the twelve week duration of the road upgrade works. During the twelve week period, the car park may be temporarily closed for up to six weeks however access to the beach will be maintained for the duration of the works,
- additional noise from the site for the duration of the construction phase,
- additional traffic on the road network for the duration of the construction phase, and
- very short term disruption and outages to services as new connections are made and/or services are relocated.

The long term residual impacts will include:

- disposal of surplus excavated material from the site to a permitted site,
- consumption of fuel, natural resources and construction materials such as steel, concrete and imported fill.

5.16 References

British Standard BS 5228 – 1 (2009 +A1 2014) (*Code of practice for noise and vibration control on construction and open sites – Noise).*

British Standard BS3882 (2015) *Specification for Topsoil.*

Construction Industry Research and Information Association, (2015) *Environmental Good Practice on Site*, CIRIA, London.

Construction Industry Research and Information Association, (2001) *Control of Water Pollution from Construction Sites, guidance for consultants and contractors*, CIRIA, London.

http://www.corkcoco.ie/co/web/Cork%20County%20Council/Departments/Environment%20%26%20Waste/Publications?did=739025488&pageUrl=/Cork+County+Council/Departments/Environment+%26+Waste/Publications

Department of Transport (2010) – Traffic Signs Manual

Environmental Agency, (2006, updated 2013) *Managing Japanese knotweed on development sites - The Knotweed Code of Practice,* Environmental Agency, Bristol.

Kelly, J., Maguire, C.M. and Cosgrove, P.J. (2008) *Best Practice Management Guidelines Japanese knotweed Fallopia japonica,* Prepared for NIEA and NPWS as part of Invasive Species Ireland.

Murnane E., Heap A., Swain A. (2006) *Control of Water Pollution from Linear Construction Projects CIRIA*, London.

National Construction and Demolition Waste Council (2006*), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects,* NCDWC, Dublin.

National Roads Authority (2014) *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes*, NRA, Dublin.

National Roads Authority (2008) *Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads, NRA,* Dublin.

Safety, Health and Welfare at Work (Construction) Regulations 2013