



Appendix VIII
Construction Environmental
Management Plan (CEMP)

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NIS Appendix VIII: Construction Environmental Management Plan

5.1 Construction Environmental Management Plan

5.1.1 Introduction

This document is the Construction Environmental Management Plan (CEMP) for the Ringsend to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme).

The CEMP will be updated by the National Transport Authority (NTA) (the Employer for the construction works) prior to the commencement of the Construction Phase, so as to include any additional measures required pursuant to conditions attached to any decision to grant approval. The NTA shall set out the Employer's Requirements in the Construction Contract including all applicable mitigation measures identified in this EIAR, as well as additional measures required pursuant to conditions attached to any decision to grant approval.

The CEMP comprises the construction mitigation measures, which are set out in the Environmental Impact Assessment Report (EIAR), and the Natura Impact Statement (NIS), and will be updated to include any additional measures required pursuant to conditions attached to An Bord Pleanála's decision.

The CEMP will need to be altered during the lifecycle of the Construction Phase to take account of monitoring results, permits, legislative changes, outcomes of third-party consultations etc. The appointed contractor will ensure that the CEMP remains up to date for the duration of the Construction Phase. The appointed contractor may propose modifications to the CEMP. However, any such modifications will not give rise to any impacts which are more significant than those already identified and assessed in the EIAR or NIS.

All of the measures set out in this CEMP will be implemented in full by the appointed contractor and its finalisation will not affect the robustness and adequacy of the information presented and relied upon in the EIAR and NIS.

5.1.1.1 Purpose

The purpose of the CEMP is to set out the management framework for the delivery of the proposed construction works and to illustrate how the Proposed Scheme could be delivered in a logical, sensible, and safe sequence with the incorporation of specific Environmental Commitments, as set out in Section 5.1.9.

The CEMP will be used by the appointed contractor, and the appointed contractor personnel, as a guidance document for the Construction Phase of the Proposed Scheme, outlining procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that could arise during the Construction Phase of the Proposed Scheme.

5.1.1.2 Reference Documents

The CEMP has been prepared as part of the EIAR and the NIS, and should be read in conjunction with the following Proposed Scheme specific documents:

- The EIAR, with particular reference to Chapter 5 (Construction) in Volume 2 of this EIAR;
- The NIS;
- The Construction Contract; and
- Copies of An Bord Pleanála's Order, Inspector's Report and associated documentation.

The appointed contractor will need to comply with all relevant environmental legislation and take account of published standards, accepted industry practice, national guidelines, and codes of best practice appropriate to the Proposed Scheme. The CEMP has been prepared in accordance with the following industry best practice guidance:

- Transport Infrastructure Ireland (TII) (formerly the National Roads Authority (NRA)) Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (hereafter referred to as the TII Guidelines) (TII 2007); and
- Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015).

5.1.1.3 Scope

This CEMP defines the approach to environmental management implementation. Compliance with the CEMP, the procedures, work practices and controls will be adhered to by all personnel employed during the Construction Phase of the Proposed Scheme.

Table 5.1 provides the contents of the CEMP, and where details can be found in this document.

Table 5.1: CEMP Contents

Content	Section of CEMP
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5.1.2 Proposed Scheme Details

Information on the Proposed Scheme will be included in this Section of the CEMP. This information will assist those without detailed knowledge of the Proposed Scheme in quickly familiarising themselves with the key elements of the Proposed Scheme and will also assist those who have a need to examine, review or audit the CEMP.

Details will include a description of the key elements of the Proposed Scheme, an overview of the main works required at each section, the construction programme, construction methodology, construction plant and equipment requirements, details on the Construction Compounds, construction traffic management measures, and interfaces with other projects.

[NTA / appointed contractor shall insert Proposed Scheme details].

5.1.3 Planning Consent

If planning permission is granted for the Proposed Scheme, the entire contents of the planning consent will be inserted at this location.

[NTA / appointed contractor shall insert planning consent details].

5.1.4 Contact Sheets

Contact details of relevant personnel are required to ensure the efficient reporting of environmental incidents. It is essential that these contact details be frequently reviewed to ensure they are up to date. Contact details will include the organisation, position title, name, mobile phone number and email address of relevant personnel.

[NTA / appointed contractor shall insert contact details for the relevant personnel].

5.1.5 Roles and Responsibilities

Procurement of the appointed contractor by the NTA (the Employer for the construction works), will involve the determination that the appointed contractor is competent to carry out the works, including the effective implementation of the mitigation measures. The appointed contractor will be required to plan and construct the Proposed Scheme construction works in accordance with the Employer's Requirements, and the NTA will employ an Employer's Representative team with appropriate competence to administer and monitor the Construction Contract for compliance with the Employer's Requirements.

Information on the appointed contractor's organisational structure / duties and responsibilities will be provided in this Section in the CEMP. The assignment and communication of duties and responsibilities to individual named members will help ensure the successful implementation of the CEMP.

The TII Guidelines (TII 2007) outline a typical organisational structure / roles that may be adopted. It is recognised that the actual titles used by the appointed contractor may vary, however, the appointed contractor should assign relevant duties and responsibilities to the appropriate equivalent person.

One of the roles identified in the TII Guidelines is that of an Environmental Manager (EM). The EM, or equivalent, will be suitably qualified, with sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken. The EM will be responsible for co-ordinating the day-to-day management of environmental impacts during the Construction Phase and for assisting and advising the appointed contractor when programming construction activities and devising methodologies, taking cognisance of the Environmental Commitments. The EM will be responsible for performing inspections as deemed necessary. In addition, the EM will deal with licencing and permit issues, keep up to date with relevant environmental best practice and legislative changes, engage in personnel training, manage responses to environmental incidents and engage environmental contractors as and when required.

[NTA / appointed contractor shall insert the appointed contractor's organisational structure / duties and responsibilities].

5.1.6 Communications

The procedures adopted for internal and external communication of information regarding the specific elements of the Proposed Scheme will be agreed between the NTA and the appointed contractor prior to construction as set out in the Construction Contract.

The appointed contractor will put in place a Communications Plan in accordance with the Employer's Requirements. The Communications Plan will provide a mechanism for members of the public to communicate with the NTA and the appointed contractor, and for the NTA and the appointed contractor to communicate important information on various aspects of the Proposed Scheme to the public. The Communications Plan will include procedures to inform members of the community directly affected by the Construction Phase on schedules for any activity of a particularly disruptive nature which is likely to impinge on their property such as boundary works, road closures and diversions, and any mitigating actions that are being taken to minimise such disruption.

5.1.7 Environmental Awareness Training

Copies of the CEMP will be made available to all personnel. All appointed contractor personnel will receive relevant and appropriate training to ensure that they have the appropriate knowledge to successfully implement the CEMP.

Where a specific management plan has been devised for a works activity (e.g. working in an area where invasive species are present), all appointed contractor personnel involved in that activity will be given a toolbox talk outlining the relevant Environmental Commitments.

5.1.8 Compliance and Review

The EM or equivalent, will carry out environmental inspections at appropriate intervals throughout the Construction Phase. The environmental inspections will ensure that the works are undertaken in compliance with the CEMP and all other planning application documents. Where appropriate, and if required, the EM may arrange to be accompanied on these environmental inspections by suitably qualified professionals (e.g. arborist, ecologist, archaeologist). The CEMP will be developed further by the appointed contractor to include further details of inspection procedures.

The Construction Contract documents will require the appointed contractor to further develop the CEMP within 28 days after receiving notice of Commencement of Works from the NTA. The EM, and the NTA will carry out audits of the CEMP at designated intervals, to determine whether the CEMP is effective in ensuring that the appointed contractor meets all the Environmental Commitments. All changes to the CEMP will be made by the EM and approved by the NTA.

5.1.9 Environmental Commitments

The Schedule of Environmental Commitments will comprise the following:

- The Construction Phase mitigation and monitoring measures as outlined in Chapter 6 to Chapter 21 (inclusive) in Volume 2 of this EIAR, summarised in Chapter 22 (Summary of Mitigation & Monitoring Measures) in Volume 2 of this EIAR, and in Table 5.2;
- The Construction Phase and Operational Phase mitigation measures and residual impacts, as outlined in the NIS, summarised in Table 5.3 which identifies the relevant section of the NIS / CEMP;
- Any commitments arising during the statutory planning process up to and including the Oral Hearing;
- Any commitments set out in the Construction Contract documents; and
- Any conditions and / or modifications imposed by An Bord Pleanála, should they grant approval for the Proposed Scheme.

The CEMP will include the Schedule of Environmental Commitments together with the relative specification, evidence, and responsibilities of how each commitment will be met, where necessary. The appointed contractor will be required to comply with all Environmental Commitments, and all applicable legislation, including relevant standards, codes of best practice and guidelines.

5.1.9.1 Mitigation and Monitoring Schedule

Table 5.2 summarises the Construction Phase mitigation (i.e. which the appointed contractor will implement), outlined in the relevant EIAR technical assessment chapters.

Table 5.2 should be read in conjunction with the relevant technical assessment chapter. Where appropriate, the specific location to which the mitigation relates to is identified and where the mitigation measure may be applicable along the extent of the Proposed Scheme, the location is given as 'Throughout (as required)'. Note that in certain instances, a mitigation measure may be relevant to more than one environmental aspect (e.g. Mitigation Number WT1 is also a mitigation measure used in relation of Biodiversity).

Table 5.3 provides the matrix table from the NIS which identifies the relevant European sites, the potential impacts, and references the relevant sections in the NIS or CEMP for the mitigation to be applied.

Table 5.2: Mitigation and Monitoring Measures (Construction Phase)

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
Chapter 6 (Traffic & Transport)	TT1	6.5.1	Throughout (as required)	<p>A Construction Environmental Management Plan (CEMP) has been prepared (i.e. this document) and will be implemented (and developed further as required) by the appointed contractor.</p> <p>A detailed Construction Traffic Management Plan (CTMP) will be prepared (Section 5.2) (and included in the CEMP) and will be implemented by the appointed contractor.</p> <p>The appointed contractor will also prepare (and include in the CEMP) and implement a Construction Stage Mobility Management Plan (CSMMP), to actively encourage personnel to travel to site by sustainable means.</p>
Chapter 7 (Air Quality)	AQ1	7.5.1.1	Construction Compounds and throughout (as required)	<p>A series of mitigation measures will be implemented by the appointed contractor to minimise dust nuisance impacts:</p> <ul style="list-style-type: none"> Public roads affected by the Proposed Scheme works will be regularly inspected for soiling associated with the construction activities and cleaned as necessary; Material handling systems and stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays (or similar dust suppression methods) will be used as required if particularly dusty activities associated with the construction are necessary during dry or windy periods; During movement of dust generating materials both on and off-site, trucks will be covered with tarpaulin, and before entrance onto public roads, trucks will be checked to ensure the tarpaulins are properly in place; The appointed contractor will provide a site hoarding of 2.4m height along noise sensitive boundaries, at a minimum, at the Construction Compounds, which will assist in minimising the potential for dust impacts off-site; and The appointed contractor will keep the effectiveness of the mitigation measures under review and revise them as necessary. In the event of dust nuisance associated with the Proposed Scheme occurring outside the works boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem.
Chapter 8 (Climate)	CL1	8.7.1.1	Throughout (as required)	<p>A series of mitigation measures have been incorporated into the Proposed Scheme with the goal of reducing the embodied carbon associated with the Construction Phase. These mitigation measures include:</p> <ul style="list-style-type: none"> The replacement, where practicable, of concrete containing Portland cement with concrete containing ground granulated blast furnace slag (GGBFS); Where practicable, materials will be reused within the extent of the Proposed Scheme; and Where practicable, materials will be sourced locally to reduce the embodied emissions associated with transport.
Chapter 9 (Noise & Vibration)	NV1	9.5.1.1	Throughout (as required)	<p>The appointed contractor will be required to take specific noise abatement measures to the extent required and comply with the recommendations of BS 5228-1 (BSI 2014) and European Communities Noise Emissions by Equipment for Use Outdoors (Amendment) Regulations 2006 (S.I. No. 241 of 2006).</p> <p>These measures will ensure that:</p> <ul style="list-style-type: none"> During the Construction Phase, the appointed contractor will be required to manage the work to comply with the limits detailed in Section 9.2.4.1 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR using methods outlined in BS 5228-1 (BSI 2014); and The best means practicable, including proper maintenance of plant and equipment, will be employed to minimise the noise produced by on-site operations.
	NV2	9.5.1.1	Throughout (as required)	<p>The appointed contractor will put in place the most appropriate noise control measures depending on the level of noise reduction required at individual working areas i.e. based on the construction threshold values for noise and vibration set</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				out in Tables 9.8 and 9.11 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR. Reference to Table 9.49 and Table 9.50 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR indicates that intrusive works occurring within 25 to 45m of Noise Sensitive Locations (NSLs) will need specific noise control measures to reduce impacts depending on time period over which they will occur, (i.e. daytime or evening).
	NV3	9.5.1.1.1	Throughout (as required)	The potential for any item of plant or equipment to result in exceedance of construction noise thresholds (see Table 9.8 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR) will be assessed prior to the item being brought onto the site. The least noisy item of plant or equipment will be selected wherever practicable (e.g. plant or equipment items with sound attenuation incorporated). Should a particular item of plant or equipment already on the site be found to exceed the construction noise levels, the first action will be to identify whether or not the item can be replaced with a quieter alternative.
	NV4	9.5.1.1.2	Construction Compounds and throughout (as required)	The following measures will be implemented by the appointed contractor to control noise levels at source in order to remain below the threshold values for noise set out in Table 9.7 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR, which relate to specific site considerations: <ul style="list-style-type: none"> For mobile plant items such as dump trucks, planers, excavators and loaders, the installation of an acoustic exhaust, utilizing an acoustic canopy to replace the normal engine cover and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB; For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting mufflers or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed; The Construction Compounds are in close proximity to NSLs (refer to Table 9.34 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR) and will incorporate a strict noise control policy relating to materials handling. Noisy items of plant or equipment will be sited away from noise sensitive boundaries; Where compressors, generators and pumps are located in proximity to NSLs and have potential to exceed the construction noise thresholds, these will be surrounded by acoustic lagging or enclosed enclosures providing air ventilations; and Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds, while other noise nuisance can be controlled by fixing resilient materials in between the surfaces in contact.
	NV5	9.5.1.1.3	Throughout (as required)	Erection of localised demountable enclosures or screens will be used around breakers or drill bits, as required, when in operation in proximity to NSLs boundaries with the potential to exceed the construction noise thresholds. Annex B of BS 5228-1 (BSI 2014) (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials.
	NV6	9.5.1.1.3	Construction Compounds	The appointed contractor will provide a site hoarding of 2.4m height along noise sensitive boundaries, at a minimum, at the Construction Compounds.
	NV7	9.5.1.1.3	Construction Compounds and throughout (as required)	Careful planning of the Construction Compounds including the placement of site buildings and store between the site and NSLs will also be considered by the appointed contractor.
	NV8	9.5.1.1.4	Throughout (as required)	Construction activities will be scheduled in a manner that reflects the location of the site and the nature of neighbouring properties. Construction activities / plant or equipment items will be considered with respect to their potential to exceed construction noise thresholds at NSLs and will be scheduled according to their noise level, proximity to sensitive locations and possible options for noise control. In situations where an activity with potential for exceedance of construction noise

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				threshold is scheduled (e.g. road widening and utility diversions or activities with similar noise levels identified in Table 9.49 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR). Other construction activities associated with the Proposed Scheme will be scheduled to avoid significant cumulative noise levels.
	NV9	9.5.1.1.5	Throughout (as required)	The NTA will establish clear form of communication that will involve the appointed contractor and NSLs in proximity to the works so that residents or building occupants are aware of the likely duration of activities likely to generate noise or vibration that are potentially significant as set out in Table 9.7 and Table 9.10 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR.
	NV10	9.5.1.1.6	Throughout (as required)	During the Construction Phase the appointed contractor will carry out noise monitoring at representative NSLs to evaluate and inform the requirement and / or implementation of noise management measures. Noise monitoring will be conducted in accordance with ISO 1996-1 (ISO 2016) and ISO 1996-2 (ISO 2017). The selection of monitoring locations will be based on the nearest representative NSLs to the working area which will progress along the length of the Proposed Scheme.
	NV11	9.5.1.2	Throughout (as required)	During the Construction Phase the appointed contractor will carry out vibration monitoring at buildings and structures where proposed works have the potential to be at or exceed the vibration limit value in Table 9.11 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR. Vibration from construction activities will be limited to the values set out in Table 9.11 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR to avoid any form of potential cosmetic damage to buildings and structures.
	NV12	9.5.1.2	Throughout (as required)	The appointed contractor will implement the following mitigation measures during the Construction Phase: <ul style="list-style-type: none"> • A clear communication programme will be established by the NTA to inform adjacent building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to result in significant effects as per Table 9.12 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR; • Activities capable of generating significant vibration effects with respect to human response (as per Table 9.11 in Chapter 9 (Noise & Vibration) in Volume 2 of this EIAR) will be restricted to daytime hours, as far as practicable; and • Appropriate vibration isolation (such as resilient mounts to pumps and generators) will be applied to plant and equipment, where required and where feasible.
Chapter 11 (Human Health)	HH1	11.5.1	Throughout (as required)	Mitigation for adverse psychosocial responses to the Construction Phase will include providing the public with sufficient information to enable people to plan their days, journeys and activities around the construction works and take control of their options to some extent. The appointed contractor will put in place a Communications Plan in accordance with the NTA requirements. The Communications Plan will provide a mechanism for members of the public to communicate with the NTA and the appointed contractor, and for the NTA and the appointed contractor to communicate important information on various aspects of the Proposed Scheme to the public. This will include timely communication to the local community on the planned works activities, timings, and traffic management.
Chapter 12 (Biodiversity)	BD1	12.5.1	Throughout (as required)	Where deemed necessary a suitably experienced and qualified ecologist will be employed by the appointed contractor. The ecologist will advise the appointed contractor on ecological matters during construction, communicate all findings in a timely manner to the NTA and statutory authorities, acquire any licenses / consents required to conduct the work, and supervise and direct the ecological measures associated with the Proposed Scheme.
	BD2	12.5.1.2.1	Throughout (as required)	Habitat Loss / Fragmentation Where practicable, areas of vegetation, including habitats of Local Importance (Higher Value), (i.e. mixed broadleaved woodland, scattered trees and parkland, tree line and hedgerow habitat types) which lie within the footprint, or along the

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				boundary of the Proposed Scheme, will be retained. The areas of vegetation to be retained are shown on the Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR. These areas will be protected by the appointed contractor for the duration of construction works and fenced off at an appropriate distance
	BD3	12.5.1.2.1	Throughout (as required)	<p><u>Habitat Loss / Fragmentation</u></p> <p>To mitigate loss of habitat, the proposed planting incorporated into the Proposed Scheme will be implemented by the appointed contractor. This planting is listed below and displayed on the Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR:</p> <ul style="list-style-type: none"> • 133 street trees planted; • 211,22m2 of proposed ornamental planting; and <p>1731,60m2 of proposed amenity grassland planting.</p>
	BD4	12.5.1.2.2	Throughout (as required)	<p><u>Habitat Degradation – Groundwater</u></p> <p>The following mitigation measures will be implemented with regard to pollution of soil and groundwater:</p> <ul style="list-style-type: none"> • The construction management of the site by the appointed contractor will take account of the recommendations of the CIRIA Guidance Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters Williams et al., 2001) to minimize as far as possible the risk of soil groundwater and surface water contamination; and, • Measures to be implemented by the appointment contractor to minimise the risk of spills and contamination of soil and waters include: <ul style="list-style-type: none"> ○ Employing only competent and experiences workforce, and site specific training of site managers, foremen, and workforce, including all sub-contractors, in pollution risks and preventative measures; ○ Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system e.g. by a rill-over bund, raised kerb ramps or stepped access; ○ The location of any fuel storage facilities shall be considered in the design of the Construction Compounds. These are to be designed in accordance with relevant guidelines and codes of best practice and will be fully bunded; ○ Good housekeeping at the site (daily site clean ups, use of disposal bins, etc.) during the entire Construction Phase; ○ Potential pollutants to be adequately secured against vandalism; ○ Provision of proper containment of potential pollutants according to codes of best practice; ○ Thorough control during the ensure Construction Phase to ensure that any spillage is identified at the earliest stage and subsequently effectively contained and managed; and ○ Spill kits will be provided and kept close to the storage area. Staff to be trained on how to use spill kits correctly.
	Refer to WT1 – WT5 in Table 22.9	-	Construction Compounds and throughout (as required)	<p><u>Habitat Degradation – Surface Water Quality</u></p> <p>In terms of mitigation, a Surface Water Management Plan (SWMP) has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme. It will be a condition of the Employer's Requirements that the successful contractor, immediately following appointment, must detail in the SWMP how it is</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>intended to effectively implement all the applicable measures identified in this EIAR and any additional measures required pursuant to conditions imposed by An Bord Pleanála to any grant of approval. At a minimum, all the control and management measures set out in the SWMP will be implemented by the appointed contractor. This includes measures relating to:</p> <ul style="list-style-type: none"> • Construction Compound management including the storage of fuels and materials; • Control of Sediment; • Use of Concrete; • Management of vehicles and plant including refueling and wheel wash facilities (if necessary); and • Monitoring. <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	Refer to AQ1	-	Construction Compounds and throughout (as required)	<p>Habitat Degradation – Air Quality</p> <p>The mitigation measures which will be applied by the appointed contractor to control dust emissions during the Construction Phase are outlined in AQ1.</p>
	BD5	12.5.1.2	Throughout (as required)	<p>Habitat Degradation – Invasive Species</p> <p>The NTA will ensure that a confirmatory pre-construction invasive species survey will be undertaken by a suitably qualified specialist to confirm the absence and/or extent of all Third Schedule invasive species within the footprint of the Proposed Scheme.</p> <p>Where an infestation is confirmed / identified within the footprint of the Proposed Scheme, this will require the implementation of an Invasive Species Management Plan (ISMP) (Section 5.3). Following the confirmatory pre-construction survey, mitigation measures outlined in BD5 and BD6 will be implemented, as required.</p>
	BD6	12.5.1.2	Throughout (as required)	<p>Habitat Degradation – Invasive Species</p> <p>Where a pre-construction invasive species re-survey identifies newly established non-native invasive species within the footprint of the Proposed Scheme, the ISMP produced will provide a detailed description of the infestations (e.g. approximate area of the respective colonies (m2), where feasible; approximate total number of stems, pattern of growth and information on other vegetation present), and where necessary, include calculations of volumes of infested soils to be excavated. The ISMP will be finalised following the pre-construction survey as advised by a suitably qualified specialist, with regard to the Management of Invasive Alien Plant Species on National Roads - Technical Guidance (TII 2020a) and Standard (TII 2020b) and other species-specific guidance documents including those listed in the ISMP, as necessary.</p>
	BD7	12.5.1.2	Throughout (as required)	<p>Habitat Degradation – Invasive Species</p> <p>The NTA will ensure that all control measures specified in the Proposed Scheme ISMP shall be implemented by a suitably qualified and licensed specialist prior to the construction of the Proposed Scheme to control the spread of newly established non-native invasive species within the footprint of the Proposed Scheme. Furthermore, the appointed contractor will adhere to control measures specified within the ISMP throughout the Construction Phase of the Proposed Scheme. The site will be monitored by the appointed contractor after control measures have been implemented. Any re-growth, will be subsequently treated as detailed in the Proposed Scheme ISMP.</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p><u>Rare and Protected Plant Species</u> <u>Habitat Degradation – Surface Water Quality</u> In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme. Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	BD9	12.5.1.4.1.2	Throughout (as required)	<p><u>Bats</u> <u>Habitat Loss & Fragmentation</u> Where possible, habitats of importance to bats such as scattered trees and parkland, tree line and hedgerow habitat types, which lie within the footprint, or along the boundary of the Proposed Scheme, that are not directly impacted by the Proposed Scheme will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Vegetation to be retained is shown on Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR. Planting of tree line and grassland habitats within the Proposed Scheme footprint will be carried out by the appointed contractor, as detailed in the landscape drawings which will provide suitable habitat for the bat species recorded within the study area (refer to the Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR.</p>
	BD10	12.5.1.4.1.2	Construction Compound, and active works areas.	<p><u>Bats</u> <u>Disturbance of Flight Patterns / Foraging Routes as a result of Lighting Impacts</u> The appointed contractor in liaison with the suitably qualified licensed ecologist(s) will ensure that lighting at the Construction Compound, and active work areas in proximity to known bat activity, will be designed to minimise light spill and be cognisant of light-spill onto these areas. Mitigation measures to reduce light spill will include the following:</p> <ul style="list-style-type: none"> • The use of sensor / timer triggered lighting; • LED luminaires to be used where practicable; • Column heights to be considered to minimise light spill; • Accessories such as baffles, hoods, or louvres to be used to reduce light spill and direct it only where needed; and • Where night time works are required, the appointed contractor will liaise with the engaged suitably experienced and qualified ecologist(s) and implement measures to mitigate the impact of such works (especially works carried adjacent to watercourses with known bat activity).
	BD12	12.5.1.4.3	Throughout (as required)	<p><u>Otter</u> <u>Habitat Loss</u> The NTA will ensure that a confirmatory pre-construction check of all suitable otter habitat will be completed within 12 months prior to any construction works commencing. The presence of any new holt/couch or activity at the previously established holt site at MV Cill Airne will be treated and / or protected in accordance with the Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA 2006b).</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Where a new or reactivated holt is encountered, within 150 metres (up and downstream) of the watercourse crossing, the qualified ecologist(s) will consult with the NPWS in conjunction with the NTA and appointed contractor. The qualified ecologist will review method statements; oversee works; provide advice to the appointed contractor(s), deliver toolbox talks and temporarily halt works, if, and as, necessary, having conferred with the NTA.
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p>Otter <u>Habitat Degradation / Reduced Prey Availability- Water Quality</u> A SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme. Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	BD14	12.5.1.4.3.4	Throughout (as required)	<p>Otter <u>Measures to Prevent Disturbance / Displacement</u> Where night time works are required adjacent to the Liffey Estuary Lower appointed contractor will liaise with the engaged suitably experienced and qualified ecologist(s) and implement measures to mitigate the impact of such works. The Construction Compounds proposed to be established at Sir John Rogerson’s Quay and Thorncastle Street will be surrounded by suitable fencing / hoarding fencing to exclude as far as is practical otter ingress into these areas. Where necessary, consideration of mammal-proof fencing as outlined in Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA, 2008c) should be made and as advised by the ECoW after the pre-construction survey.</p>
	BD15	12.5.1.4.3.4	Construction within water course at Custom House Boardwalk and DPTOB	<p>Marine Mammals</p> <ul style="list-style-type: none"> • A qualified and experienced marine mammal observer (MMO) (DAHG, 2014) shall be appointed by the appointed contractor to monitor for marine mammals and to log all relevant events using standardised data forms (NPWS, undated). • Pile driving activity shall not commence if marine mammals are detected within a 1,000m radial distance of the pile driving sound source, i.e. within the Monitored Zone. • Pile driving activities shall only commence in daylight hours where effective visual monitoring, as determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible. • An agreed and clear on-site communication signal must be used between the MMO and the appointed contractor as to whether the relevant activity may or may not proceed, or resume following a break. It shall only proceed on positive confirmation with the MMO. • The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO. • The prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO.

EIA Chapter	Mitigation Number	EIA Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<ul style="list-style-type: none"> In commencing a pile driving or other noise generating operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds 170 dB re: 1µPa @1m an appropriate Ramp-up Procedure (i.e. “soft-start”) must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment, and species therein, and other information. Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e. a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes. The controlled buildup of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period. Where the measures outlined in steps above are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential, and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output. In all cases where a Ramp-Up Procedure is employed the delay between the end of the ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment. Once an appropriate and full Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time (if permitted), nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 1,000m radial distance of the sound source, i.e. within the Monitored Zone. If there is a break in pile driving sound output for a period greater than 30 minutes (e.g. due to equipment failure, shut-down or location change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken. <p>For higher output pile driving operations which have the potential to produce injurious levels of underwater sound as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.</p>
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p><u>Marine Mammals</u> <u>Habitat and Food Resource Degradation – Water Quality</u></p> <p>In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT4 and WT5.</p>
	BD16	12.5.1.7.2	Throughout (as required)	<p><u>Breeding Birds</u> <u>Habitat Loss, Loss of Breeding / Resting Sites</u> <u>Protection of Vegetation</u></p> <p>Where possible, habitats of importance to breeding birds such as scattered trees and parkland, tree line and hedgerow habitat types, which lie within the footprint, or along the boundary of the Proposed Scheme, that are not directly impacted</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Vegetation to be retained is shown on the Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR.</p> <p>Planting of tree line, hedgerow and grassland habitats within the Proposed Scheme footprint will be carried out by the appointed contractor, as detailed in the landscape drawings (Refer to the Landscaping General Arrangement drawings (BCIDC-ROD-ENV_LA-0016_XX_00-DR-LL-9001) in Volume 3 of this EIAR for locations.</p>
	BD17	12.5.1.7.2	DCC Docklands Offices at Custom House Quay Boardwalk, the North Wall Quay Boardwalk, and the quay walls surrounding the Proposed DPTOB.	<p>Breeding Birds <u>Habitat Loss, Loss of Breeding / Resting Sites</u> Nesting Bird Checks</p> <p>Where the proposed DPTOB and proposed boardwalk construction works are undertaken within the breeding bird season (March to June inclusive), a pre-construction check of suitable habitat for nesting birds will be carried out by a suitably qualified ecologist in advance of the breeding season (before 1st March) at the DCC Docklands Offices at Custom House Quay Boardwalk, the North Wall Quay Boardwalk, and the quay walls surrounding the Proposed DPTOB.</p> <p>Where it can be confirmed that there are no nesting birds present, the appointed contractor in liaison with the suitably qualified ecologist will securely attach a protective screening material (in the form of heavy duty closely woven mesh or equivalent) as necessary to areas of the quay walls that may be suitable for nesting sites, prior to the breeding bird season. The protective screening will remain in place until the construction works are completed after which it will be carefully removed by the contractor.</p> <p>Only areas of suitable nesting habitat (e.g. the quay walls above the high water mark) where direct impacts will occur will need to be covered with the screening material. These areas have been identified as:</p> <ul style="list-style-type: none"> Proposed North Wall Quay boardwalk; Suitable habitat either side of the quay walls at the proposed DPTOB site. <p>The area along Custom House Quay at which the proposed DCC Docklands Offices boardwalk is proposed is not deemed to contain suitable nesting habitat due to the high levels of disturbance which are likely to be present there and the narrow body of water between the quay wall and the pontoon associated with The Jeanie Johnston. Therefore, no mitigation is required in relation to the works for this boardwalk.</p> <p>The mesh should be attached from the uppermost area of the quay wall such that it hangs down over the necessary sections. The mesh should be secured at the base to prevent it from blowing up during windy weather.</p> <p>Should it not be feasible to install the protective screening material the following alternative mitigation measure will be implemented by the appointed contractor. The suitably qualified ecologist engaged by the contractor will undertake daily monitoring (3 hour surveys each morning) to confirm that no nests are present and to watch for signs of breeding birds in areas where direct impacts are likely to occur (e.g. quay walls at the locations of proposed new boardwalks and the immediate vicinity of the proposed Dodder Bridge), for the duration of works in these areas. Should any signs of breeding birds be detected within the works area, works in that area will have to cease immediately and will not be able to recommence until either the end of the breeding bird season or until all breeding birds are no longer using the area for breeding purposes (e.g. the young have fledged and have left the nest). Once works are completed the constant watch can be terminated.</p>
	BD18	12.5.1.7.2	Throughout (as required)	<p>Breeding Birds <u>Direct Injury / Mortality</u></p> <p>Prior to the Construction Phase of the Proposed Scheme, where feasible, vegetation (e.g. hedgerows, trees, scrub, bankside vegetation and grassland) will not be removed, between the 01 March and the 31 August, to avoid direct</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>impacts on nesting birds. Where the construction programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist as engaged by the appointed contractor, for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within three days of the nest survey, otherwise repeat surveys will be required. Vegetation clearance will not commence where nests are present, works will resume when birds have fledged and nests are no longer in use, or an agreement is reached with NPWS.</p> <p>During the Construction Phase of the Proposed Scheme, construction machinery, when not in use, such as cranes and cherry pickers will not overhang the aquatic environment.</p> <p>Where the above measure cannot be implemented fully (i.e. due to health and safety issues), UV lighting or UV paint will be used on construction machinery to illuminate extendable parts (such as the arm of cranes) which may overhang the aquatic environment. The objective of this is to make these lattice structures more detectable for birds that may fly at dusk or at night. The UV decoys will be installed prior to the erection of construction machinery at night.</p>
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p>Breeding Birds <u>Habitat and Food Resource Degradation – Water Quality</u></p> <p>In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	BD19	12.5.1.8.1	Throughout (as required)	<p>Wintering Birds <u>Direct Injury / Mortality</u></p> <p>Construction machinery, when not in use, such as cranes and cherry pickers will not overhang the aquatic environment. Where the above measure cannot be implemented fully (i.e. due to health and safety issues), UV lighting or UV paint will be used on construction machinery to illuminate extendable parts (such as the arm of cranes) which may overhang the aquatic environment. The objective of this is to make these lattice structures more detectable for birds that may fly at dusk or at night. The UV decoys will be installed prior to the erection of construction machinery at night.</p>
	BD20	12.5.1.8.1	Throughout (as required)	<p>Wintering Birds <u>Habitat and Food Resource Degradation – Water Quality</u></p> <p>In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	BD21	12.5.1.10.1	Throughout (as required)	<p>Amphibians <u>Habitat Loss, Disturbance and Mortality Risk</u></p> <p>If vegetation clearance works by the appointed contractor are to begin during the season where frogspawn or tadpoles may be present (i.e. February to mid-summer), or where breeding adult newts, their eggs or larvae may be present (i.e.</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>mid-March to September), a pre-construction survey of suitable habitat will be undertaken by a suitably qualified ecologist engaged by the appointed contractor to determine whether breeding amphibians are present. Where amphibians are present, mitigation measures outlined in below will be completed before works recommence.</p> <p>In the case of common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured, under a licence from NPWS and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the Zol of the Proposed Scheme;</p> <p>In the case of smooth newt, individuals will be captured, under a licence from NPWS, and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the Zol of the Proposed Scheme. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating smooth newt;</p> <p>If the size or depth of the habitat feature is such that it cannot be determined by a visual survey whether all amphibians have been captured, the suitably qualified ecologist engaged by the appointed contractor will advise on the appropriate course of action to confirm that no amphibian species remain. If drainage of the habitat feature is deemed to be the appropriate course of action, any mechanical pumps used will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism; and</p> <p>Any capture and translocation works shall be undertaken immediately in advance of site clearance / construction works commencing.</p>
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p>Fish <u>Habitat Degradation – Surface Water Quality</u></p> <p>In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
	BD22	12.5.1.11.2	DPTOB	<p>Fish <u>Direct Injury / Mortality</u></p> <p>There is a risk that fish may become trapped within cofferdams during their construction. In order to prevent the death of fish, they should be removed from the cofferdam during dewatering.</p> <p>Where necessary, any fish that are present behind the coffer dam/sheet piles will be removed by the appointed contractor by the appropriate means in liaison with the suitably qualified ecologist before dewatering is complete. It is assumed any rescuing of fish would be done prior to this and that removal of any fish could be undertaken using, for example, a ‘fish-friendly’ pump would be used to ensure any that any fish that remain are not harmed. A suitably qualified licensed ecologist(s), engaged by the appointed contractor will ensure that this activity is undertaken in accordance with IFI requirements.</p>
	Refer to WT1 – WT5 in Table 22.9	-	Throughout (as required)	<p>Rare and Protected Plant Species <u>Habitat Degradation – Surface Water Quality</u></p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>In terms of mitigation, a SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>Specific mitigation measures which the appointed contractor will implement in relation to surface water quality at the new and relocated bridges at George’s Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03), Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02), DPTOB (Structure Reference: 05), and the Construction Compounds are outlined in WT2, WT3, WT and WT5.</p>
Chapter 13 (Water)	WT1	13.5.2.1	Construction Compounds and throughout (as required)	<p>A SWMP has been prepared (Section 5.4), which details control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase of the Proposed Scheme.</p> <p>It will be a condition of the Employer’s Requirements that the successful contractor, immediately following appointment, must detail in the SWMP how it is intended to effectively implement all the applicable measures identified in this EIAR and any additional measures required pursuant to conditions imposed by An Bord Pleanála to any grant of approval.</p> <p>At a minimum, all the control and management measures set out in the SWMP will be implemented by the appointed contractor. This includes measures relating to:</p> <ul style="list-style-type: none"> • Creation of an Environmental Incident Response Plan (Section 5.6); • Construction Compounds management including the storage of fuels and materials; • Control of Sediment; • Use of Concrete; • Management of vehicles and plant including refueling and wheel wash facilities (if necessary); and • Monitoring.
	WT2	13.5.2.2.1	Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02)	<p>For associated works to the quay wall to secure the boardwalk to the DCC Docklands Offices, sheeting will be attached below the area of works to catch any debris. In-channel and river bank working general principles as set out in the SWMP will apply:</p> <ul style="list-style-type: none"> • The steel piles may be driven from the land if feasible, reducing the need for machinery in the water; • All construction machinery operating within or close to any waterbody will be mechanically sound to avoid leaks; • The area of disturbance of the watercourse bed and bank will be the absolute minimum required for the installation of the piles.
	WT3	13.5.2.2.2	New and Relocated Bridges at the Royal Canal (Structure Reference: 04)	<p>The pouring of concrete will take place in dry weather only. Silt fences or similar will be installed by the appointed contractor to prevent overland flow into the canal or the Liffey Estuary Lower.</p> <p>In-channel and river bank working general principles will apply as set out in the SWMP.</p>
	WT4	13.5.2.2.3	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05)	<p>The coffer dams and area behind the sheet piling will be dewatered via silt-buster tanks (or similar) and discharged directly to the estuary. The appointed contractor will liaise with the suitably qualified ecologist and / or environmental specialist engaged by them to ensure that any required permits / licences are obtained.</p> <p>Any requirement to rescue fish or other fauna during this process will be carried in a manner as specified in Chapter 12 (Biodiversity) in Volume 2 of this EIAR. As the water level approaches the estuary bed, there is a greater risk of disturbing sediments; at this point the rate of emptying will be slowed to allow the silt-buster tanks to continue to operate efficiently.</p> <p>The dynamic nature of the waterbody in this area i.e. estuarine would result in varied levels of suspended solids depending on the time of year and weather conditions. Therefore, the NTA will ensure that monitoring will be carried out</p>

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				monthly for a period of at least six months prior to the commencement of construction at this location, in the manner and of a frequency necessary to inform any applications for permits or licenses to discharge that may be required. The NTA will also ensure that any discharges from the coffer dam will be comply with conditions set out in all relevant permits and licenses.
	WT5	13.5.2.2.3	Construction Compounds	<p>Construction Compound R1 and Construction Compound R2 have limited ability to impact upon nearby water bodies. The general measures for the Construction Compounds as set out in the SWMP are sufficient to control these potential impacts and no additional measures are required.</p> <p>Activities within the Construction Compounds on either side of the DPTOB (Construction Compound R3 and Construction Compound R4) will be largely controlled as set out in general measures in the SWMP. In addition, all surface water drains in the vicinity will be identified and either stopped up or bunded on the side closest to both Construction Compounds. A cutoff drain or equivalent measure and a silt fence will be installed along the estuary side of the Construction Compounds. The appointed contractor will ensure that appropriate spill control equipment is available (e.g. a suitably sized floating boom), to control any spillages to the river should a spillage occur. The CEMP includes an Environmental Incident Response Plan (Section 5.6), which will apply for the management of any incidents that may occur.</p>
Chapter 14 (Land, Soils, Geology & Hydrogeology)	LSGH1	14.5.1	Throughout (as required)	<p><u>Loss or Damage of Topsoil</u></p> <p>Excavated topsoils will be stockpiled by the appointed contractor using appropriate methods to minimise the effects of weathering.</p> <p>Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff.</p>
	LSGH2	14.5.1	Throughout (as required)	<p><u>Loss or Damage of Topsoil</u></p> <p>All topsoil or subsoil shall be assessed for re-use within the Proposed Scheme by the appointed contractor ensuring the appropriate handling, processing, and segregation of the material. Where practical the removal of topsoil from the Proposed Scheme will be avoided.</p> <p>All earthworks will be undertaken in accordance with TII Specification for Road Works (SPW) Series 600 Earthworks (TII 2013a) and project specific earthworks specifications ensuring that all excavated material and imported material is classified using the same methodology so as to allow maximum opportunity for the reuse of materials on site.</p>
	LSGH3	14.5.1.2	Throughout (as required)	<p><u>Excavation of Potentially Contaminated Land</u></p> <p>The appointed contractor will ensure that excavations will be kept to a minimum, using shoring or trench boxes where appropriate.</p> <p>For more extensive excavations, a temporary works designer shall be appointed by the appointed contractor to design excavation support measures in accordance with all relevant guidelines that minimises the excavation of contaminated ground.</p>
	LSGH4	14.5.1.2	Throughout (as required)	<p><u>Excavation of Potentially Contaminated Land</u></p> <p>The appointed contractor will be responsible for regular testing of excavated soils to monitor the suitability of the soil for reuse.</p>
	LSGH5	14.5.1.2	Throughout (as required)	<p><u>Excavation of Potentially Contaminated Land</u></p> <p>Samples of ground suspected of contamination will be tested for contamination by the appointed contractor during the ground investigation and ground excavated from these areas will be disposed of to a suitably licensed or permitted site in accordance with the current Irish waste management legislation.</p>

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	LSGH6	14.5.1.2	Throughout (as required)	<u>Excavation of Potentially Contaminated Land</u> Any dewatering in areas of contaminated ground will be designed by the appointed contractor to minimise the mobilisation of contaminants into the surrounding environment.
	LSGH7	14.5.1.3	Throughout (as required)	<u>Pollution of Soils and Groundwater</u> Good construction management practices, as outlined in the CIRIA guidance, Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (CIRIA 2001), will be employed by the appointed contractor to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater. The construction management of the site will take account of these recommendations to minimise, as far as possible, the risk of soil, groundwater, and surface water contamination.
	LSGH8	14.5.1.3	Throughout (as required)	<u>Pollution of Soil and Groundwater</u> Measures to be implemented by the appointed contractor to minimise the risk of spills and contamination of soils and waters would include: <ul style="list-style-type: none"> • Employing only a competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all sub-contractors, in pollution risks and preventative measures; • Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system (e.g. by a roll-over bund, raised kerb, ramps or stepped access); • The location of any fuel storage facilities shall be considered in the design of the Construction Compounds. These are to be designed in accordance with relevant guidelines and codes of best practice at the time of construction and will be fully bunded; • Good housekeeping at the site (daily site clean-ups, use of disposal bins, etc.) during the entire Construction Phase; • Potential pollutants to be adequately secured against vandalism; • Provision of proper containment of potential pollutants according to codes of best practice; • Thorough control measures during the entire Construction Phase to ensure that any spillage is identified at early stage and subsequently contained and managed effectively; and • Spill kit to be provided and to be kept close to the designated storage area. Staff to be trained on how to use spill kits correctly.
	LSGH9	14.5.1.3	Throughout (as required)	An Environmental Incident Response Plan (EIRP) (Section 5.6), will be implemented by the appointed contractor, which will identify the actions to be taken in the event of a pollution incident. It will address containment measures, emergency discharge routes, a list of appropriate equipment and clean-up materials and notification procedures to inform the relevant environmental protection authority.
	LSGH10	14.5.1.3	Throughout (as required)	Sediment control methods as outlined in the SWMP (Section 5.4) will be implemented by the appointed contractor.
	Chapter 15 (Archaeological & Cultural Heritage)	ACH1	N/A	Throughout (as required)
ACH2		15.5.1.1	Throughout (as required)	The appointed contractor will make provision for archaeological monitoring to be carried out under licence to the Department of Housing, Local Government and Heritage (DHLGH) and the National Museum of Ireland (NMI), and will ensure the full recognition of, and the proper excavation and recording of, all archaeological soils, features, finds and

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				deposits which may be disturbed below the ground surface. All archaeological issues will be resolved to the satisfaction of the DHLGH and the NMI.
	ACH3	15.5.1.1	Throughout (as required)	The appointed contractor will ensure that the archaeologist as described in ACH5 will have the authority to inspect all excavations to formation level for the proposed works and to temporarily halt the excavation work, if and as necessary, having conferred with the NTA. They will be given the authority to ensure the temporary protection of any features of archaeological importance identified having conferred with the NTA. The archaeologist will be afforded sufficient time and resources to record and remove any such features identified in accordance with licensing requirements agreed.
	ACH4	15.5.1.1	Throughout (as required)	The appointed contractor will make provision to allow for, the necessary archaeological monitoring, inspection and excavation works that may arise on the site during the Construction Phase.
	ACH5	15.5.1.1	Throughout (as required)	An experienced and competent licence-eligible archaeologist will be employed by the appointed contractor to advise on archaeological and cultural heritage matters during the Construction Phase to communicate all findings in a timely manner to the NTA and statutory authorities, to acquire any licences / consents required to conduct the work, and to supervise and direct the archaeological measures associated with the Proposed Scheme.
	ACH6	15.5.1.1	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05), Tom Clarke East Link Bridge	In the case of cellars, coal cellars, tunnels, and / or basements, the appointed contractor in consultation with the archaeologist engaged by them will make provision for a geodetic survey and recording of each individual structure which will be subject to impact. This survey and recording will be carried out in advance of any construction works on the cellar, coal cellar, and / or basement.
	ACH7	15.5.1.1.1	Throughout (as required)	Licence applications are made by the licence-eligible archaeologist to the National Monuments Service at the DHLGH. In addition to a detailed method statement, the applications must include a letter from the NTA that confirms the availability of adequate funding. There is a prescribed format for the letter that must be followed. Other consents may include a Dive Survey Licence to conduct archaeological dive work, a Detection Device Licence to use a metal-detector or to carry out a non-invasive geophysical survey.
	ACH8	15.5.1.1.1	Throughout (as required)	The archaeologist will be provided with information on where and when the various elements and ground disturbance will take place.
	ACH9	15.5.1.1.1	Throughout (as required)	Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended in accordance with licensing requirements. If it is not possible for the construction works to avoid the material, full excavation of the archaeologically significant material will be recommended. The extent and duration of excavation will be advised by the archaeologist and will be a matter for discussion between the NTA and the licensing authorities.
	ACH10	15.5.1.1.1	Throughout (as required)	Secure storage for artefacts recovered during the course of the monitoring and related work will be provided by the appointed contractor.
	ACH11	15.5.1.1.1	Throughout (as required)	During construction all construction traffic and the management of materials will be restricted where practicable by the appointed contractor so as to avoid any newly revealed archaeological or cultural heritage sites and their environs, to ensure no damage to a site of archaeological interest.
	ACH12	15.5.1.1.2	Throughout (as required)	Features of cultural heritage interest that are required to be removed on a temporary basis or for a short-term period, will be removed under archaeological supervision and in accordance with a method statement in consultation with the NTA and the relevant statutory authorities.
	ACH13	15.5.1.3.1.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge	The appointed contractor will ensure that archaeological monitoring under licence will take place at the following locations:

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
			(RMP DU018-020, DU018-0020152, DU018-0200564, RMP DU018-020479, RMP DU018-020201)	<ul style="list-style-type: none"> In areas of archaeological potential, namely within the designated Zones of Archaeological Potential (ZAP) for the Historic City of Dublin (RMP DU018-020) which encompasses the recorded archaeological sites DU018-0020152 (glasshouse site of), DU018-0200564 (quay), RMP DU018-020479 (quay) and RMP DU018-020201 (quay) (Figure 15.1, Sheets 1, 2 and 3 of 5 in Volume 3 of this EIAR). <p>It is in these areas that there is a possibility to disturb intact archaeological layers and material and so these areas will require investigation by monitoring.</p>
	ACH14	15.5.1.3.1.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge	Should any subsurface archaeological stratigraphy be encountered, an appropriate ameliorative strategy will be implemented by the appointed contractor in liaison with the archaeologist as described in ACH5. This will entail licensed archaeological excavation, in full or in part, of any identified archaeological remains (preservation by record) or preservation in situ.
	ACH15	15.5.1.3.1.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Custom House Quay and junction of Excise Walk and North Wall Quay)	The appointed contractor will ensure that archaeological monitoring under licence will take place during the preparatory works to the quay walls and when any interventions are planned, this will allow an assessment and full recording of any internal fabric of the quay structures should they be exposed during the course of the proposed works.
	ACH16	15.5.1.3.1.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Scherzer Bridges (RMP DU018-020, DU018-020564))	At the Scherzer Bridges, ground reduction work has the potential to impact on below ground archaeological remains (associated with the history city of Dublin (RMP DU018-020) and the historic quay (DU018-020564) and subsurface features associated with the workings of the Scherzer Bridges). The appointed contractor in liaison with the archaeologist as described in ACH5 will ensure that mitigation in the form of recording and monitoring will take place.
	ACH17	15.5.1.3.1.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Scherzer Bridges (RMP DU018-020, DU018-020564))	The appointed contractor will ensure that a full and complete photographic and detailed industrial heritage record survey will be undertaken (the scope of the record survey will be identified through liaison between the appointed contractor and the archaeologist and architectural heritage specialist engaged by the appointed contractor).
	ACH18	15.5.1.3.1.3	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Non-designated archaeological heritage sites, DCIHR (DCC 2003 to 2009))	<p>The appointed contractor will ensure that archaeological monitoring under licence will take place at the following locations:</p> <ul style="list-style-type: none"> At all undesignated archaeological heritage sites identified from historic mapping and the DCIHR (DCC 2003 to 2009), as listed in Table 15.7 and shown in Figure 15.1, Volume 3 of this EIAR). <p>It is in these areas that there is a possibility to disturb intact archaeological layers and material and so these areas will require investigation my monitoring. Should any subsurface archaeological stratigraphy be encountered, an appropriate ameliorative strategy will be implemented. This will entail licensed archaeological excavation, in full or in part, of any identified archaeological remains (preservation by record) or preservation in situ.</p> <p>Potential impacts will be ameliorated through preservation by record or in situ. Once these strategies are employed, this will result in any archaeological remains being identified, recorded, and excavated out of the ground or being left in situ as a design solution resulting in no potential impacts, post mitigation.</p>
	ACH19	15.5.1.3.1.4	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Areas of Archaeological Potential; CBC0016AH004 and CBC0016AH006)	<p>The appointed contractor will ensure that archaeological monitoring under licence will take place at the following locations:</p> <ul style="list-style-type: none"> At the two areas identified as having an archaeological potential to reveal below ground industrial heritage features and finds as identified previously from historic mapping and investigations at CBC0016AH004 and CBC0016AH006 (as listed in Table 15.7 and Figure 15.1, Volume 3 of this EIAR).

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>It is in these areas that there is a possibility to disturb intact archaeological layers and material and so these areas will require investigation my monitoring. Should any subsurface archaeological stratigraphy be encountered, an appropriate ameliorative strategy will be implemented. This will entail licensed archaeological excavation, in full or in part, of any identified archaeological remains (preservation by record) or preservation in situ.</p> <p>Potential impacts will be ameliorated through preservation by record or in situ. Once these strategies are employed, this will result in any archaeological remains being identified, recorded, and excavated out of the ground or being left in situ as a design solution resulting in no potential impacts, post mitigation.</p>
	ACH20	15.5.1.3.2	Talbot Memorial Bridge to Tom Clarke East Link Bridge (Famine memorial (NIAH Ref. 50010002), the statue of Matt Talbot (CHC0016CH009), the statue of Admiral William Brown (CBC0016CH009))	Sculptures and memorials namely the famine memorial (NIAH Ref. 50010002), the statue of Matt Talbot (CHC0016CH009), the statue of Admiral William Brown (CBC0016CH009), will be protected in accordance with the mitigation measures set out in Chapter 16 (Architectural Heritage) in Volume 2 of this EIAR (i.e. AH3).
	ACH21	15.5.1.4.1.2	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05) (Dublin City (RMP DU018-020), Sir John Rogerson’s Quay (DU018-020201), and sea wall (DU018-066))	<p>The appointed contractor will ensure that archaeological monitoring under licence will take place:</p> <ul style="list-style-type: none"> • Within the ZAP for the historic settlement of Dublin City (RMP DU018-020), the ZAP for Sir John Rogerson’s Quay (DU018-020201) and the ZAP for the sea wall (DU018-066) (Figure 15.1, Sheets 3 and 4 of 5, Volume 3 of this EIAR), to include the full extent of land take for the Proposed Scheme. The monitoring of ground breaking and reduction works, and excavation works across this whole area will be carried out as an archaeological exercise.
	ACH22	15.5.1.4.1.3	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05) (River Dodder (CBC0016AH003); Britain Quay (CBC0016AH001); and Thorncastle Street / York Road (CBC0016AH002))	<p>The appointed contractor will ensure that archaeological monitoring under licence will take place:</p> <ul style="list-style-type: none"> • Within the River Dodder and the area of archaeological potential (CBC0016AH003), archaeological monitoring will take place within the riverine environment for all works on the riverbed, on the quayside of Britain Quay (CBC0016AH001) and in the proposed reclamation area at Thorncastle Street / York Road (CBC0016AH002). Full provision will be made for the resolution of any features and deposits that are revealed as a result of the work (Figure 15.1, Volume 3 of this EIAR).
	ACH23	15.5.1.4.1.3	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05) (Britain Quay (CBC0016AH001), Unnamed quay (CBC0016AH002))	<p>In order to create a record of the features of the quay and quay wall on Britain Quay (CBC0016AH001) and of the unnamed quay – Thorncastle Street / York Road (CBC0016AH002), a photogrammetry survey will be undertaken by the appointed contractor prior to the commencement of construction works.</p> <p>Potential impacts will be ameliorated through preservation by record, design or in situ. Once these strategies are employed, this will result in any archaeological remains being identified, recorded, and excavated out of the ground or being left in situ.</p>
	ACH24	15.5.1.4.2	Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 05) (Maritime memorial (CBC0016CH017) and a decorative buoy (CBC0016CH018))	Sculptures and memorials namely; the maritime memorial (CBC0016CH017) and a decorative buoy (CBC0016CH018) will be protected in accordance with the mitigation measures set out in Chapter 16 (Architectural Heritage) in Volume 2 of this EIAR (i.e. AH3).
	ACH25	15.5.1.5.1.2	Tom Clarke East Link Bridge to Sean Moore Road	The appointed contractor will ensure that archaeological monitoring under licence will take place, where any preparatory ground breaking or ground reduction works are required at the following locations:

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
			(Ringsend (DU018-054), Irishtown (DU018-053), the south wall (DU018-066))	<ul style="list-style-type: none"> Within the ZAP for the settlement clusters for Ringsend (DU018-054) and Irishtown (DU018-053) (Figure 15.1, Sheets 3 and 5 of 5 in Volume 3 of this EIAR) and in the vicinity of the south wall (DU018-066), a recorded monument and linear structure that extends from Ringsend to Poolbeg Light House Figure 15.1 in Volume 3 of this EIAR). <p>It is in this area that there is a possibility to disturb intact archaeological layers and material. Licensed archaeological excavation, in full or in part, of any identified archaeological remains (preservation by record) or preservation in situ will be undertaken.</p>
	ACH26	15.5.1.5.2	Tom Clarke East Link Bridge to Sean Moore Road (CBC0016CH019)	The sculpture (CBC0016CH019) (Figure 15.1 in Volume 3 of this EIAR) will be protected in accordance with the mitigation measures set out in Chapter 16 (Architectural Heritage) in Volume 2 of this EIAR (i.e. AH3).
	ACH27	15.5.1.5.2	Tom Clarke East Link Bridge to Sean Moore Road (Ringsend Park (CBC0016CH021))	At Ringsend Park (CBC0016CH021) (Figure 15.1 in Volume 3 of this EIAR), should any subsurface archaeological stratigraphy associated with a heritage asset be encountered, an appropriate ameliorative strategy will be implemented. This will entail licensed archaeological excavation in full or in part, of any identified archaeological remains (preservation by record). A full measured, written, drawn and photographic survey of any features of a cultural heritage significance will be undertaken prior to removal by the archaeologist engaged by the appointed contractor.
	ACH28	15.5.1.6.1.2	Construction Compounds	The appointed contractor will ensure that a programme of archaeological monitoring under licence will take place at the preconstruction and early stages of construction as appropriate, during the site preparation and earthmoving works, in built-up sites, and where any preparatory ground reduction works are required at the proposed locations of the Construction Compounds. This will be designed in order to establish the presence or absence, as well as the nature and extent, of any archaeological deposits, features or sites that may be present within the Proposed Scheme. It is in this area that there is a possibility to disturb intact archaeological layers and material. Licensed archaeological excavation, in full or in part, of any identified archaeological remains (preservation by record) or preservation in situ will be undertaken.
Chapter 16 (Architectural Heritage)	AH1	16.5.1.1	Throughout (as required) (Custom House Quay (DCC RPS 8829); North Wall Quay (DU018-020564); George’s Quay (DU018-020458); City Quay (DU018-020479); Sir John Rogerson’s Quay (DU018-020201); Britain Quay (DCC RPS 8808); Scherzer Bridges – at George’s Dock (DCC RPS 896); Scherzer Bridges – at the Royal Canal (DCC RPS 912); York Road (DU018-066); CIE Goods Depot, North Wall Quay (DCC RPS 5836); Store / Warehouse, North Wall Quay (DCC RPS 5837); 58-59 North Wall Quay (DCC RPS 5838); 73 North Wall Quay (DCC	Twenty-five protected structures were identified in the study area which are within the site boundary, front onto, or have boundaries along it. The proposed mitigation is the recording, protection and monitoring of the sensitive fabric prior to, and for the duration of the Construction Phase. Recording, overseeing of protective measures and monitoring is to be undertaken by an appropriate architectural heritage specialist engaged by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works Affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
			<p>RPS 5840); 81 North Wall Quay (DCC RPS 5841); 82 North Wall Quay (DCC RPS 5842); 3Arena, North Wall Quay (DCC RPS 5843); 9 City Quay (DCC RPS 1853); 10-12 City Quay (DCC RPS 1854); 21-22 City Quay (DCC RPS 1855-56); 2 Sir John Rogerson's Quay (DCC RPS 7543); 4-5 Sir John Rogerson's Quay (DCC RPS 7544-5); 14-15 Sir John Rogerson's Quay (DCC RPS 7546); 20-24 Sir John Rogerson's Quay (DCC RPS 7547); 30-32 Sir John Rogerson's Quay (DCC RPS 7548); and 35-36 Sir John Rogerson's Quay (DCC RPS 7549-50) (see Appendix A16.2 (Inventory of Architectural Heritage Sites) for further information on these features).</p>	
	AH2	16.5.1.1	<p>George's Dock Scherzer Bridges (DCC RPS 896); Custom House Quay (DCC RPS 8829); North Wall Quay (RMP DU018-020564); the Royal Canal Scherzer Bridges (DCC RPS 912); Embedded rail tracks (CBC0017BTH029; DU018-020564; and CBC0016BTH033 / DU018-020201); Quay Wall (Britain Quay) (DCC RPS 8808); and sea wall (DU018-066)</p>	<p>Seven locations were identified where the Proposed Scheme would directly impact on sensitive fabric associated with a Protected Structure. These are:</p> <ul style="list-style-type: none"> The Scherzer Bridges spanning the George's Dock (DCC RPS 896) will be relocated and a new fixed four-lane road bridge will be constructed by the appointed contractor. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the protection, labelling, safe storage, repair and reinstatement of the bridges, the affected kerbs, winches, and historic masonry. The affected quay walls (DCC RPS 3173) fabric will be made available by the appointed contractor to the Local Authority for salvage or re-use. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR; A pedestrian boardwalk will be added to Custom House Quay (DCC RPS 8829) between Sean O'Casey Bridge and just east of Commons Street by the appointed contractor. The recommended mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the existing masonry in position prior to the works (at low tide) and protection of the surrounding fabric. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR; A boardwalk is proposed to be added to North Wall Quay (DU018-020564), at the junction of North Wall Quay and Excise Walk. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the existing masonry in position prior to the works (at low tide) and protection of the surrounding fabric. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR; The Scherzer bridges (DCC RPS 912) spanning the Royal Canal at Guild Street. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee further pre-construction surveying,

EIA Chapter	Mitigation Number	EIA Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				<p>condition assessments and recording of the structures prior to their careful dismantling and to oversee the protection, labelling, safe storage, repair and reinstatement of the bridges, the affected kerbs (CBC0016BTH030), winches, and historic masonry. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIA;</p> <ul style="list-style-type: none"> • The removal of embedded rail tracks (CBC0017BTH029) at the east end of North Wall Quay (DU018-020564), and on the east end of Sir John Rogerson's Quay (CBC0016BTH033 and DU018-020201) would result in the loss of historic fabric. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the existing fabric in position prior to its careful removal. The rails and any historic paving stones will be made available by the appointed contractor to the Local Authority for possible re-use on the quays; • The quay wall on Britain Quay (DCC RPS 8808) will be altered to accommodate the DPTOB over the mouth of the River Dodder by the appointed contractor. Mitigation has been embedded in the Proposed Scheme design through the proposal to raise the deck of the bridge, minimizing the disruption required to the historic fabric. However, a short section of the quay wall (approximately 19m) will be removed to accommodate the bridge structure. The architectural heritage specialist engaged by the appointed contractor will oversee the recording of the existing masonry in position prior to the works (at low tide) and protection of the surrounding fabric. The affected masonry shall be salvaged for use within the proposed landscaping design by the appointed contractor, where practicable, or offered to the Local Authority. Consolidation or repair of surrounding masonry will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIA; and • A short section of the sea wall (DU018-066), visible at the very end of Thorncastle Street will be incorporated into land reclamation to accommodate the DPTOB by the appointed contractor. A section of wall to the east of the St. Patrick's Rowing Club (SPRC) on York Road will also be removed to accommodate the tying in of existing and proposed cycle and foot paths over the new DPTOB. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the existing masonry in position prior to the works and protection of the surrounding fabric. Sections of sea wall which will be incorporated in the land reclamation will be retained in situ, though buried. Masonry which is removed will be salvaged for re-use in consolidating the retained sea wall. Consolidation or repair of surrounding masonry will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIA.
	AH3	16.5.1.3	Throughout (as required) The famine memorial (NIAH 50010002) (direct impact); The Triumphal Arch (NIAH 50011219); ESB sub-stations (NIAH 50011185) and campshire warehouses (NIAH 50020466)	<p>Four NIAH structures were identified in the study area which are within the Proposed Scheme boundary front onto or have boundaries along it. There is potential for damage to these features during the construction works. The proposed mitigation to offset the risk of damage is as follows:</p> <ul style="list-style-type: none"> • The famine memorial (NIAH 50010002) - The architectural heritage specialist engaged by the appointed contractor will oversee the recording of the feature in position prior to the works, the labelling of the affected fabric prior to its careful dismantling and removal to safe storage, and their reinstatement in their existing positions subsequent to the works. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIA; and • The Triumphal Arch (NIAH 50011219); ESB sub-stations (NIAH 50011185) and campshire warehouses (NIAH 50020466) - The architectural heritage specialist engaged by the appointed contractor will oversee the recording, protection and monitoring of the sensitive fabric prior to, and for the duration of the Construction Phase in

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR.
	AH4	16.5.1.4	Quay Wall, Thorncastle Street (CBC0016BTH038)	One location was identified where there will be a direct impact on the fabric of a Structure of Architectural Heritage Interest during the Construction Phase. Construction of the DPTOB includes land reclamation to the north of the existing quay wall, (CBC0016BTH038), visible at the very end of Thorncastle Street. A short section of quay wall will be incorporated in land reclamation and will be obscured from view. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the existing masonry in position prior to the works (at low tide) and the protection of the fabric for the duration of the construction works. Sections which will be incorporated in the land reclamation will be retained in situ, though buried.
	AH5	16.5.1.4	Ringsend Park (CBC0016BTH025), 1-2 Seaview (CBC0016BTH027), Pembroke Cottages (CBC0016BTH016), 1-44 Pigeon House Road (CBC0016BTH019), 1-4 City Quay (CBC0016BTH013), Mission Hall (CBC0016BTH017), 12 York Road (CBC0016BTH018), 46-51 Pigeon House Road, Bayview Terrace (CBC0016BTH020), and 62-63 Pigeon House Road (CBC0016BTH037)	Nine Structures of Built-Heritage Interest share a boundary with the Proposed Scheme boundary The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording, protection and monitoring of the sensitive fabric prior to, and for the duration of the Construction Phase in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR
	AH6	16.5.1.5.1	Custom House Quay / North Wall Quay (CBC0016LP001)	Two locations were identified where lamp posts of architectural heritage significance may be impacted by the Proposed Scheme: <ul style="list-style-type: none"> Twelve existing lamp-posts along Custom House Quay and North Wall Quay (CBC0016LP001) will be repositioned. The proposed mitigation for these features is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording of the lamp-posts in position prior to the works, the labelling of the affected fabric prior to its careful removal to safe storage, and their reinstatement in new positions by the appointed contractor. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR; and The remaining identified lamp posts will be retained in position. The proposed mitigation for these lamp posts is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording, protection and monitoring prior to, and during the Construction Phase. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A.16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR.
	AH7	16.5.1.5.2	Paving/surface treatments of architectural heritage interest at: Custom House Quay (CBC0016BTH031); City Quay (CBC0016BTH032); and paving in front of 30-32 Sir John	Three locations were identified where paving, or surface treatments of architectural heritage interest may be indirectly impacted by the Proposed Scheme. The proposed mitigation is for an architectural heritage specialist engaged by the appointed contractor to oversee the recording, protection and monitoring prior to, and during the Construction Phase. Works to historic fabric will be carried out by the appointed contractor in accordance with the methodology provided in Appendix A.16.3 (Methodology for Works affecting Sensitive and Historic Fabric) in Volume 4 of this EIAR.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
			Rogerson's Quay (CBC0016BTH034).	
Chapter 17 (Landscape (Townscape) & Visual)	LV1	17.5.1	Throughout (as required)	<p>Mitigation and management measures are proposed to avoid, reduce, or remediate, wherever practicable significant negative landscape (townscape) and visual effects of the Construction Phase of the Proposed Scheme. These mitigation measures (LV1-LV5) will be carried out by the appointed contractor and are to be applied across the Proposed Scheme wherever necessary to avoid disturbance of landscape features or characteristics to be retained.</p> <p>Trees and vegetation to be retained within and adjoining the works area will be protected in accordance with the British Standard Institution (BSI) British Standard (BS) 5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations (BSI 2012). Works are required within the root protection area (RPA) of trees to be retained will follow a project specific arboricultural methodology for such works, prepared / approved by a professional qualified arborist. For details of trees to be retained refer to the Tree Protection Plans for the Proposed Scheme which are contained within the Arboricultural Impact Assessment documents (BCIDD-ROT-PRW_PC-0016_XX_00-DR-CR-0001; Appendix A17.1 in Volume 4 of this EIAR).</p>
	LV2	17.5.1	Throughout (as required) especially Ringsend Stadium and around Irishtown Stadium	<p>Wherever practicable, trees and vegetation will be retained within the Proposed Scheme. This is of particular note where mature trees are a prominent and valuable asset within the urban realm such as within the grounds of Ringsend Park and around Irishtown Stadium. Trees and vegetation identified for removal will be removed in accordance with 'BS 3998: 2010 Tree Work – Recommendations' (BSI 2010) and best arboricultural practices as detailed and monitored by a professional qualified arborist engaged by the appointed contractor.</p> <p>For details of trees and vegetation to be removed refer to the Tree Protection Plans for the Proposed Scheme which are contained within the Arboricultural Impact Assessment documents (BCIDD-ROT-PRW_PC-0016_XX_00-DR-CR-0001; Appendix A17.1 in Volume 4 of this EIAR) and the Landscaping General Arrangement Drawings (BCIDD-ROT-ENV_LA-0016_ML_00-DR-LL-9001) in Volume 3 of this EIAR.</p>
	LV3	17.5.1	Throughout (as required)	The Arboricultural Impact Assessment prepared for the Proposed Scheme will be fully updated at the end of the Construction Phase by the appointed contractor and made available, with any recommendations for on-going monitoring of retained trees during the Operational Phase.
	LV4	17.5.1	Throughout (as required) especially along sections of the campshires and the confluence of the River Dodder and the River Liffey (i.e. SPRC and adjacent jetty), Trinity College Dublin (Stack B Building).	Where properties are subject to permanent and / or temporary acquisition (especially along sections of the campshires and the confluence of the River Dodder and the River Liffey (i.e. SPRC and adjacent jetty), Trinity College Dublin (Stack B Building)) an inventory of boundary details and accesses, planting, paving, and other features that may be disturbed or removed will be prepared by the appointed contractor prior to commencement of construction works.
	LV5	17.5.1	Throughout (as required) especially along sections of the campshires and the confluence of the River Dodder and the River Liffey (i.e. SPRC and adjacent jetty), Trinity College Dublin (Stack B Building).	Where properties are subject to permanent and / or temporary acquisition (especially along sections of the campshires and the confluence of the River Dodder and the River Liffey (i.e. SPRC and adjacent jetty), Trinity College Dublin (Stack B Building)) appropriate measures will be put in place by the appointed contractor to provide for protection of features, trees and vegetation to be retained, for continued access during construction, for adequate security and screening of construction works. All temporary acquisition areas will be fully decommissioned and reinstated at the end of the Construction Phase or at least at the earliest time after the reinstatement works are completed to the satisfaction of the NTA. Where boundary features, gates, railings, archways of heritage importance (and which contribute to landscape value) are to be affected by the works, mitigation measures should follow those outlined in Chapter 16 (Architectural Heritage) in Volume 2 of this EIAR.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	LV6	17.5.1	The campshires, Capital Dock Park, SPRC and adjacent lands, Ringsend Park, and other areas of open space at Irishtown Stadium and Sean Moore Road	Appropriate access to amenities and public open spaces including the campshires, Capital Dock Park, SPRC and adjacent lands, Ringsend Park, and other areas of open space at Irishtown Stadium and Sean Moore Road shall be maintained by the appointed contractor.
Chapter 18 (Waste & Resources)	WR1	18.6.1	Throughout (as required)	A Construction & Demolition Resource and Waste Management Plan (CDRWMP) has been prepared (Section 5.5) and will be implemented (and updated as necessary) by the appointed contractor.
	WR2	18.6.1	Throughout (as required)	<p>The following measures will be implemented during construction, where practicable, by the appointed contractor, to ensure the maximum quantity of material is reused on the Proposed Scheme and to contribute to achieving the objectives set out in the National Waste Action Plan for a Circular Economy as follows:</p> <ul style="list-style-type: none"> • Stockpiling of existing sub-base, capping layer and topsoil material generated on-site for direct reuse in the Proposed Scheme where practicable (subject to material quality testing to ensure it is suitable for its proposed end use); and • Recycled aggregates and reclaimed asphalt will be specified in the Proposed Scheme, where practicable.
	WR3	18.6.1	Throughout (as required)	<p>The following management measures will be implemented by the appointed contractor insofar as is reasonably practicable:</p> <ul style="list-style-type: none"> • Where waste generation cannot be avoided, waste disposal will be minimised; • Opportunities for reuse of materials, by-products and waste will be sought throughout the Construction Phase of the Proposed Scheme; • Possibilities for reuse of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use; • Where excavated material cannot be reused within the Proposed Scheme works, material will be sent for recovery or recycling; • Source segregation: Metal, timber, glass, and other recyclable material will be segregated (and waste stream colour-coding will be used) during construction works and removed off site to a permitted / licensed facility for recycling; • Material management: 'Just-in-time' delivery, where practicable, will be used to minimise material wastage; • General construction waste and by-products will be reused within the Proposed Scheme, where practicable, or appropriately reused (in accordance with Article 27 of the Waste Directive Regulations), recovered, recycled, or disposed of off-site, as arranged by the appointed contractor; • Any hazardous waste arising will be managed by the appointed contractor in accordance with the applicable legislation; and • Waste Auditing: The quantity and types of waste and materials leaving site during the Construction Phase will be recorded by the appointed contractor. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity to each facility. Records will show material, which is recovered, which is recycled, and which is disposed of. <p>Where Article 27 notifications are required in relation to the Proposed Scheme, the appointed contractor will complete and submit these Article 27 notifications to the EPA for by-product reuse.</p>

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Any off-site interim storage or waste management facilities for excavated material will have the appropriate EPA licence, waste facility permit or certificate of registration, as appropriate, in place. The relevant appropriate waste authorisation will be in place for all facilities that wastes are delivered to (i.e. EPA Licence, Waste Facility Permit or Certificate of Registration).
	WR4	18.6.1	Dodder Public Transport Opening Bridge (DPTOB)	Excavation material will be generated as a result of the construction of the Dodder Public Transport Opening Bridge (DPTOB). The appointed contractor will reuse the material generated, if practicable and appropriate, where it meets the required standards and regulations. Where the excavated material cannot be reused within the Proposed Scheme works, it will be sent for reuse, recovery, or recycling, where practicable by the appointed contractor. Where reuse, recycling and recovery are not possible the material will be disposed of to an authorised facility by the appointed contractor. Any hazardous waste arising will be managed by the appointed contractor in accordance with the applicable legislation. Where such material is transported within Ireland this will be undertaken in accordance with the European Communities (Shipments of Hazardous Waste Exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011) to authorised facilities (e.g. EPA licensed facilities), or exported to authorised facilities outside of Ireland in accordance with the Transfrontier Shipment Regulations 2007. Where there are sites with planning permission and required authorisations such as foreshore licences granted and to which the material can be delivered for placement, reuse, recovery, or disposal excavated material may also be delivered to these sites by the appointed contractor.
Chapter 19 (Material Assets)	MA1	19.5.1.1	Throughout (as required)	Where there are interfaces with existing utility infrastructure, the appointed contractor will ensure that protection is in place or diversion as necessary will be carried out to prevent long-term interruption to the provision of the affected services.
	MA2	19.5.1.1	Throughout (as required)	All possible precautions will be taken by the appointed contractor to avoid unplanned interruptions to any services during the Construction Phase of the Proposed Scheme. This will include appropriate investigation by the appointed contractor to identify the precise location of all utility infrastructure within the working areas prior to the commencement of excavations. Where works are required in and around known utility infrastructure, precautions will be implemented by the appointed contractor to protect the infrastructure from damage, in accordance with best practice methodologies and the requirements of the utility companies where practicable. Protection measures during construction will include warning signs and markings indicating the location of utility infrastructure, safe digging techniques in the vicinity of known utilities, and in certain circumstances where possible, isolation of the section of infrastructure during works in the immediate vicinity.
	MA3	19.5.1.1	Throughout (as required)	All utility companies for which diversions are proposed will continue to be consulted with NTA oversight when designing any diversions to ensure that proposed diversions conform to the utility provider's requirements, where practicable and acceptable to the NTA, and to ensure that service disruptions are kept to a minimum.
	MA4	19.5.1.1	Throughout (as required)	Where diversions or modifications are required to utility infrastructure, service interruptions and disturbance to the surrounding residential, commercial and / or community property may be unavoidable. Where this is the case, it will be planned in advance by the appointed contractor. Required service disruptions will only be permitted for a set period of time per day (generally a set number of hours) and interruptions will generally only occur for a set period of time per day (a set number of hours not exceeding eight hours where reasonably practicable) and will generally not be continuous for full days at a time. Prior notification will be given to all impacted properties. This notification will include information on when interruptions and works are scheduled to occur and the duration of such interruption. Any required works will be carefully planned by the appointed contractor to ensure that the duration of interruptions is minimised in so far as practicable.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	MA5	19.5.1.1	Royal Canal Scherzer Bridges	The proposed works at the mouth of the Royal Canal have been designed to minimise the impact on the canal itself as far as possible. Any disruption to the waterway will be planned in consultation with Waterways Ireland, and all Waterways Ireland requirements will be adhered to during the bridge works. Where works are to take place adjacent to and above the canal, precautions will be implemented by the appointed contractor to protect the canal banks, canal locks and the navigation channel itself from damage.
	MA6	19.5.1.2	Throughout (as required)	Consideration will be given by the appointed contractor to the sustainability of material being sourced for the construction of the Proposed Scheme. In so far as is reasonably practicable, materials required for the construction of the Proposed Scheme will be sourced locally in order to reduce the amount of travelling required to get the material to the site. Key issues to be considered when sourcing materials for the Construction Phase will include the source, the material specification, production and transport costs, and the availability of the material. For quarried material sourced within the State, only quarries which are included in local authority quarry registers will be used by the appointed contractor to source any quarried material.
	MA7	19.5.1.2	Throughout (as required)	Construction materials will be managed on-site by the appointed contractor in such a way as to prevent over-ordering and waste. Materials will be stored in appropriate storage areas or receptacles to reduce the potential for damage requiring replacement. 'Just In Time' ordering principles shall be implemented where practicable in order to reduce the potential for over-ordering.
Chapter 21 (Cumulative Impacts & Environmental Interactions)	CI&E11	21.4.2.1	Throughout (as required)	Other major infrastructure projects could directly interface with the construction of the Proposed Scheme. Interface liaison will take place on a case-by-case basis through the NTA, as will be set out in the Construction Contract, to ensure that there is coordination between projects, that construction access locations remain unobstructed by the Proposed Scheme works and that any additional construction traffic mitigation measures required to deal with cumulative impacts are managed appropriately.

Table 5.3: Matrix of Mitigation Measures and Residual Impacts (from NIS)

European Site	Potential Impacts							Any Adverse Effect on the Integrity of European Sites (Post Mitigation)
	Construction							
	Habitat Loss and Fragmentation	Hydrology	Hydrogeology	Invasive Species	Air Quality	Disturbance / Displacement	Direct Injury / Mortality	
North Dublin Bay SAC	X	✓ Section 5.4 (Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.1.4.2 in NIS)	X	X		No
North Dublin Bay SAC	X	✓ Section 5.4 (Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.1.4.2 in NIS)	X	X	X	No

European Site	Potential Impacts							Any Adverse Effect on the Integrity of European Sites (Post Mitigation)
	Construction							
	Habitat Loss and Fragmentation	Hydrology	Hydrogeology	Invasive Species	Air Quality	Disturbance / Displacement	Direct Injury / Mortality	
South Dublin Bay SAC	X	✓ Section 5.4 (Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.1.4.2 in NIS)	X	X	X	No
Howth Head SAC	X	✓ Section 5.4 (Section 7.2.5 / Section 7.1.4.1 in NIS)	X	X	X	X	X	No
Rockabill to Dalkey Island SAC	X	✓ Section 5.4 (Section 7.3.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.3.5.2 in NIS)	X	No
Lambay Island SAC	X	✓ Section 5.4 (Section 7.3.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.3.5.2 in NIS)	X	No
Wicklow Mountains SAC	X	✓ Section 5.4 (Section 7.1.4.1 / Section 7.14.4.1 in NIS)	X	X	X	✓ (Section 7.14.4.2 in NIS)	✓ (Section 7.14.4.2 in NIS)	No
Howth Head Coast SPA	X	✓ Section 5.4 (Section 7.2.5 / Section 7.1.4.1 in NIS)	X	X	X	X		No
Dalkey Islands SPA	X	✓ Section 5.4 (Section 7.4.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.4.5.2 in NIS)	✓ (Section 7.4.5.3 in NIS)	No
Rockabill SPA	X	✓ Section 5.4 (Section 7.4.6 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.4.5.2 in NIS)	✓ (Section 7.4.5.3 in NIS)	No
North Bull Island SPA	X	✓	X	✓	X	✓	✓	No

European Site	Potential Impacts							Any Adverse Effect on the Integrity of European Sites (Post Mitigation)
	Construction							
	Habitat Loss and Fragmentation	Hydrology	Hydrogeology	Invasive Species	Air Quality	Disturbance / Displacement	Direct Injury / Mortality	
		Section 5.4 (Section 7.5.4.1 / Section 7.1.4.1 in NIS)		Section 5.3 (Section 7.5.4.2 / Section 7.1.4.2 in NIS)		(Section 7.5.4.4 / Section 7.4.5.3 in NIS)	(Section 7.5.4.3 / Section 7.4.5.4 in NIS)	
South Dublin Bay and River Tolka Estuary SPA	X	✓ Section 5.4 (Section 7.6.4.1 / Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.6.4.2 / Section 7.1.4.2 in NIS)	X	✓ (Section 7.6.4.4 / Section 7.4.5.3 in NIS)	✓ (Section 7.6.4.3 / Section 7.4.5.4 in NIS)	No
Malahide Estuary SPA	X	✓ Section 5.4 (Section 7.7.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.7.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.7.3.2 / Section 7.4.5.4 in NIS)	No
Baldoyle Bay SPA	X	✓ Section 5.4 (Section 7.8.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.8.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.8.3.2 / Section 7.4.5.4 in NIS)	No
Rogerstown Estuary SPA	X	✓ Section 5.4 (Section 7.9.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.9.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.9.3.2 / Section 7.4.5.4 in NIS)	No
Skerries Islands SPA	X	✓ Section 5.4 (Section 7.10.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.10.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.10.3.2 / Section 7.4.5.4 in NIS)	No
The Murrrough SPA	X	✓ Section 5.4 (Section 7.11.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.11.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.11.3.2 / Section 7.4.5.4 in NIS)	No
Islands Eye SPA	X	✓ Section 5.4 (Section 7.12.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.12.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.12.3.2 / Section 7.4.5.4 in NIS)	No
Lambay Island SPA	X	✓	X	X	X	✓	✓	No

European Site	Potential Impacts							Any Adverse Effect on the Integrity of European Sites (Post Mitigation)
	Construction							
	Habitat Loss and Fragmentation	Hydrology	Hydrogeology	Invasive Species	Air Quality	Disturbance / Displacement	Direct Injury / Mortality	
		Section 5.4 (Section 7.12.3.1 / Section 7.1.4.1 in NIS)				(Section 7.12.3.3 / Section 7.4.5.3 in NIS)	(Section 7.12.3.2 / Section 7.4.5.4 in NIS)	
Wicklow Mountains SPA	X	X	X	X	X	X	✓ (Section 7.13.3.3 / Section 7.4.5.4 in NIS)	No
North Dublin Bay SAC	X	✓ Section 5.4 (Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.1.4.2 in NIS)	X	X	X	No
South Dublin Bay SAC	X	✓ Section 5.4 (Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.1.4.2 in NIS)	X	X	X	No
Howth Head SAC	X	✓ Section 5.4 (Section 7.2.5 / Section 7.1.4.1 in NIS)	X	X	X	X	X	No
Rockabill to Dalkey Island SAC	X	✓ Section 5.4 (Section 7.3.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.3.5.2 in NIS)	X	No
Lambay Island SAC	X	✓ Section 5.4 (Section 7.3.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.3.5.2 in NIS)	X	No
Wicklow Mountains SAC	X	✓ Section 5.4 (Section 7.1.4.1 / Section 7.14.4.1 in NIS)	X	X	X	✓ (Section 7.14.4.2 in NIS)	✓ (Section 7.14.4.2 in NIS)	No
Howth Head Coast SPA	X	✓	X	X	X	X		No

European Site	Potential Impacts							Any Adverse Effect on the Integrity of European Sites (Post Mitigation)
	Construction							
	Habitat Loss and Fragmentation	Hydrology	Hydrogeology	Invasive Species	Air Quality	Disturbance / Displacement	Direct Injury / Mortality	
		Section 5.4 (Section 7.2.5 / Section 7.1.4.1 in NIS)						
Dalkey Islands SPA	X	✓ Section 5.4 (Section 7.4.5.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.4.5.2 in NIS)	✓ (Section 7.4.5.3 in NIS)	No
Rockabill SPA	X	✓ Section 5.4 (Section 7.4.6 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.4.5.2 in NIS)	✓ (Section 7.4.5.3 in NIS)	No
North Bull Island SPA	X	✓ Section 5.4 (Section 7.5.4.1 / Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.5.4.2 / Section 7.1.4.2 in NIS)	X	✓ (Section 7.5.4.4 / Section 7.4.5.3 in NIS)	✓ (Section 7.5.4.3 / Section 7.4.5.4 in NIS)	No
South Dublin Bay and River Tolka Estuary SPA	X	✓ Section 5.4 (Section 7.6.4.1 / Section 7.1.4.1 in NIS)	X	✓ Section 5.3 (Section 7.6.4.2 / Section 7.1.4.2)	X	✓ (Section 7.6.4.4 / Section 7.4.5.3 in NIS)	✓ (Section 7.6.4.3 / Section 7.4.5.4 in NIS)	No
Malahide Estuary SPA	X	✓ Section 5.4 (Section 7.7.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.7.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.7.3.2 / Section 7.4.5.4 in NIS)	No
Baldoyle Bay SPA	X	✓ Section 5.4 (Section 7.8.3.1 / Section 7.1.4.1 in NIS)	X	X	X	✓ (Section 7.8.3.3 / Section 7.4.5.3 in NIS)	✓ (Section 7.8.3.2 / Section 7.4.5.4 in NIS)	No

5.2 Construction Traffic Management Plan

5.2.1 Introduction

The Construction Traffic Management Plan (hereafter referred to as the CTMP) has been prepared to demonstrate the manner in which the interface between the public and construction-related traffic will be managed and how vehicular movement will be controlled.

5.2.1.1 Purpose

The purpose of this CTMP is to demonstrate that the residual impacts to the public road network during the Construction Phase of the Proposed Scheme which have been identified in the application documentation can be minimised and that transport related activities are carried out as safely as possible and with the minimum disruption to other road users. The CTMP has also been prepared for the purpose of identifying feasible, appropriate and safe methods of access for construction traffic to the Proposed Scheme.

5.2.1.2 Objectives

The objectives of the CTMP are to:

- Outline minimum road safety measures to be undertaken, including site access / egress locations, during the works;
- Provide measures that respond to all road user needs including public transport, pedestrians, cyclists and vehicular traffic;
- Ensure disruption is minimised, with access to houses and businesses maintained, as is reasonably practicable in delivering the Proposed Scheme;
- Demonstrate to the NTA, the appointed contractor and suppliers, the need to adhere to the relevant guidance documentation for such works; and
- Identify objectives and measures for inclusion in the management, design and construction of the Proposed Scheme to control the traffic impacts of construction insofar as it may affect the environment, local residents and the public in the vicinity of the construction works.

5.2.1.3 Scope

This CTMP illustrates a traffic management design for the transportation of construction materials, equipment and personnel along the public road network to facilitate the construction of the Proposed Scheme. Light vehicles, such as cars and vans, are used by operatives travelling to and from the works areas. Lorries deliver general construction materials, such as concrete, to, from and around the works areas.

The appointed contractor will develop the CTMP in the event An Bord Pleanála decides to grant approval for the Proposed Scheme. The CTMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by An Bord Pleanála.

The CTMP should be read in conjunction with Chapter 5 (Construction) in Volume 2 of this EIAR.

5.2.2 Proposed Construction Activities

5.2.2.1 Overview

Construction activities to be carried out as part of the Proposed Scheme are illustrated in Chapter 5 (Construction) in Volume 2 of this EIAR. Pavement operations are expected to be a key activity on the Proposed Scheme, and shall include planing, excavation, temporary stockpiling (if required), installing, disposal, import and haulage. The Construction Phase of the Proposed Scheme shall require movements of materials to, from and around the works areas. Most of the materials leaving the works areas will consist of road planings. In addition, the Dodder Public Transport Opening Bridge (DPTOB) forms a part key part of the Proposed Scheme and will require the delivery of concrete, steel and other materials to facilitate its construction.

To facilitate construction, the Proposed Scheme has been divided into three primary sections, with six sub-sections, as described in Section 5.2 in Chapter 5 (Construction) in Volume 2 of this EIA. The location of each section / sub-section along the Proposed Scheme is shown in Image 5.1.

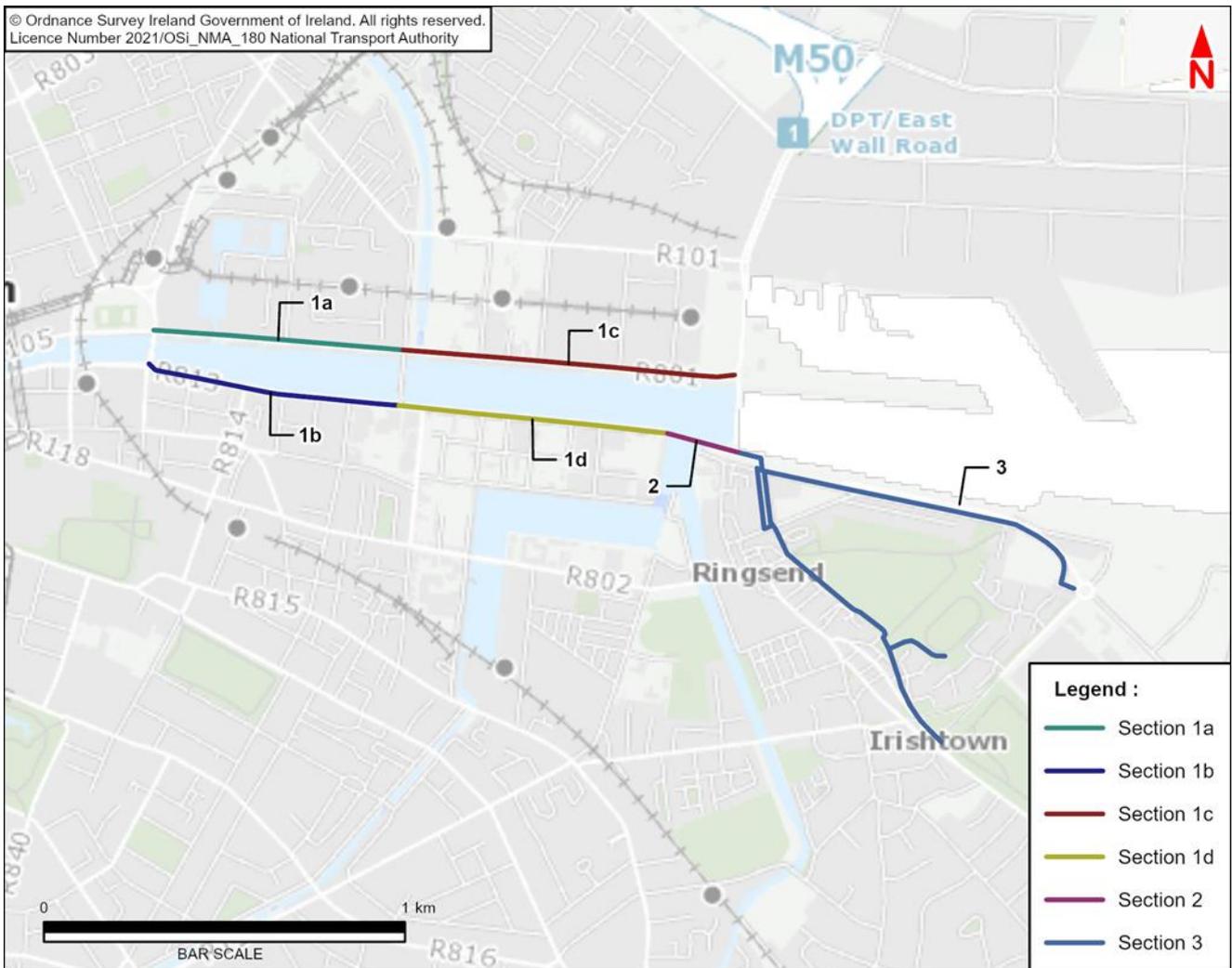


Image 5.1: Location of Each Section / Sub-Section along the Proposed Scheme

5.2.2.2 Construction Programme

A programme for the Proposed Scheme is provided in Section 5.4 in Chapter 5 (Construction) in Volume 2 of this EIA. The total Construction Phase duration for the overall Proposed Scheme is estimated at approximately 30 months. However, construction activities in individual sections will have shorter durations. The programme identifies the approximate duration of works at each section. The appointed contractor will be responsible for determining the final programme.

It is envisaged that the DPTOB will be constructed under a separate Construction Contract from the remainder of the Proposed Scheme, therefore it is possible that the DPTOB construction could be undertaken in a different sequence (e.g. either independently of the other elements or overlapping with them) to that shown in the programme above. However, for the purposes of the EIA assessment the programme assumes that the construction of the DPTOB and the other elements of the Proposed Scheme will be constructed concurrently.

The staging of construction and associated temporary traffic management measures has considered the receiving environment when developing the schedule of works.

5.2.2.3 Temporary Traffic Management Designs

In the event that An Bord Pleanála decides to grant approval for the Proposed Scheme, Temporary Traffic Management designs (drawings and method statements) will be prepared by the appointed contractor in compliance with the former Department of Transport, Tourism and Sport (DTTAS) (now the Department of Transport) Traffic Signs Manual, Chapter 8, Temporary Traffic Measures and Signs for Roadworks (hereafter referred to as the Traffic Signs Manual) (DTTAS 2019a), to facilitate the safe and efficient construction of the Proposed Scheme.

Temporary construction traffic management provisions are provided in Section 5.8 in Chapter 5 (Construction) in Volume 2 of this EIAR. These provisions have been developed using works areas for the purpose of safety, to minimise disruption and to facilitate the smooth operation of construction activities. The roads and streets along the Proposed Scheme will remain open to general traffic, wherever practicable, during the Construction Phase. However, lane closures, road closures and diversions will be necessary to facilitate construction. Traffic management provisions for each section / sub-section are included in Table 5.4.

Table 5.4: Traffic Management Provisions at Each Section / Sub-Section

Section No.	Estimated Construction Duration	Traffic Management Provisions
Section 1a	24 months	<ul style="list-style-type: none"> Works will be managed in short sections to minimise disruption; One lane of traffic will be maintained in each direction with phased lane closures in place as required; General traffic inbound to the City Centre will be diverted from East Wall Road, along Sheriff Street Upper, onto Seville Place and Amiens Street to facilitate inbound public transport priority; General traffic and public transport traffic outbound from the City Centre will be reduced to a shared single lane; and During works at the new and relocated bridges at George's Dock, traffic will be reduced to a single lane shuttle, controlled by a stop / go system of temporary traffic lights for a period of up to 10 months on either side of the carriageway (20 months in total).
Section 1b	9 months	<ul style="list-style-type: none"> Works will be managed in short sections to minimise disruption; Where there are two lanes of traffic in one direction, the works will be carried out on one side of the carriageway, with traffic reduced to a single lane outbound from the City Centre. Short term local diversions may be required along Moss Street and Townsend Street; Where there is one lane of traffic in each direction, the works will be carried out on one side of the carriageway, with the carriageway reduced to a single lane. Traffic will travel in each direction, controlled by temporary traffic lights. At pinch points, short-term local diversions may be required; and Between Lime Street and Samuel Beckett Bridge a temporary diversion will be put in place for a very short period of time.
Section 1c	24 months	<ul style="list-style-type: none"> Works will be managed in short sections to minimise disruption. One lane of traffic will be maintained in each direction with phased lane closures in place as required; General traffic inbound to the City Centre will be diverted from East Wall Road, along Sheriff Street Upper, onto Seville Place and Amiens Street to facilitate inbound public transport priority; General traffic and public transport traffic outbound from the City Centre will be reduced to a shared single lane; and During works at the new and relocated bridges at the Royal Canal, traffic will be reduced to a single lane shuttle, controlled by a stop / go system of temporary traffic lights for a period of up to 10 months on either side of the carriageway (20 months in total).
Section 1d	12 months	<ul style="list-style-type: none"> Works will be managed in short sections to minimise disruption;

Section No.	Estimated Construction Duration	Traffic Management Provisions
		<ul style="list-style-type: none"> Where there are two lanes of traffic in each direction, the works will be carried out on one side of the carriageway, with traffic reduced to a single lane in each direction. Local diversions may be required; and Where there is one lane of traffic in each direction, the works will be carried out on one side of the carriageway, with the carriageway reduced to a single lane. Traffic will travel in each direction, controlled by temporary traffic lights, or short-term local diversions may be required.
Section 2	30 months	<ul style="list-style-type: none"> During junction tie-in works construction traffic management measures will be required. Works will be undertaken out-of-hours and / or with the implementation of road closures.
Section 3	12 months	<ul style="list-style-type: none"> Short term construction traffic management measures will be required for general traffic, pedestrian and cyclists.

5.2.2.4 Envisaged Construction Traffic Generation

Traffic will be generated during the Construction Phase of the Proposed Scheme. Construction traffic can be expected to comprise of trips for the following purposes:

- Journeys by construction personnel to and from the Proposed Scheme; and
- Delivery and removal of materials to and from the Proposed Scheme:
 - Clearance of existing material and waste;
 - Deliveries of construction material; and
 - Removal of construction waste material.

Construction activities associated with the Proposed Scheme typically follow a work sequence that is repeated in smaller works areas. The movement of construction vehicles to and from the Proposed Scheme is determined by this work sequence; materials either being ‘removed from’ or ‘delivered to’ site. There is also stationary dwell time, as material is being unloaded or loaded at either end of a journey. Lorry movements for typical construction activity cycles are shown in Image 5.2 and Image 5.3.

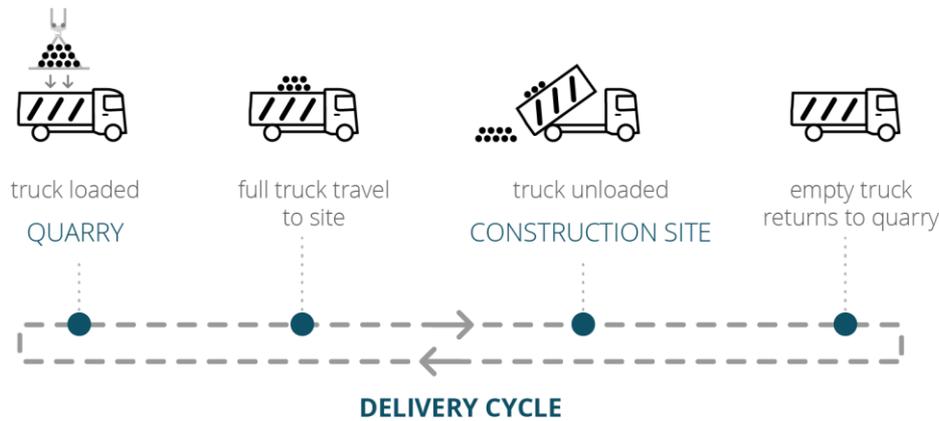


Image 5.2: Lorry Movements for 'Removal' of Materials

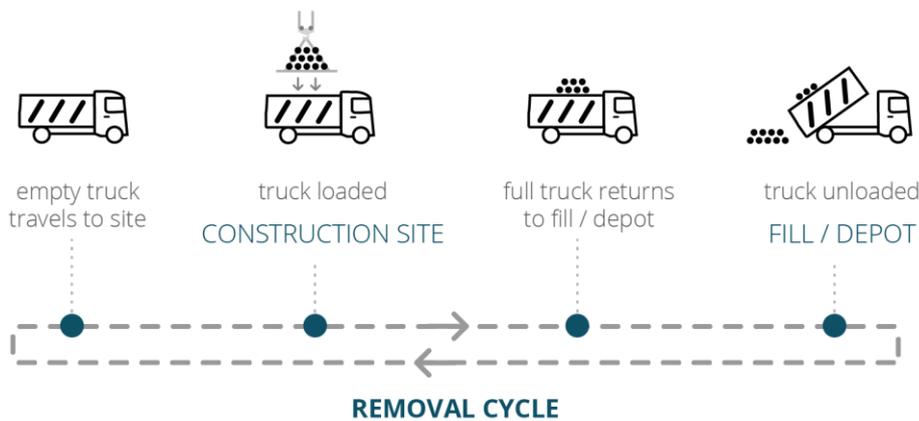


Image 5.3: Lorry Movements for 'Delivery' of Materials

Pavement operations are expected to be a key activity on the Proposed Scheme where this sequence will take place. This activity shall involve some or all of the following steps including planing, excavation, temporary stockpiling (if required), installing, disposal, import and haulage. Other activities such as traffic signal installation, signage and line marking, do not require lorry movements. Lorries are not always required to facilitate construction activities.

Likely traffic generation associated with construction site activities is described further in Section 5.2.2.4.1 and Section 5.2.2.4.2.

5.2.2.4.1 Removal and Delivery of Materials

An estimate of construction plant and equipment that will be necessary to construct the Proposed Scheme is provided in Section 5.6 in Chapter 5 (Construction) in Volume 2 of this EIAR. Of the plant and equipment in operation during construction, lorries will use the public road network for delivery and removal of materials to and from the Proposed Scheme.

Based on construction activities taking place, lorries will typically be in operation 40% of the time. This reflects the varied nature of works; whereby lorry movements are not necessary to execute certain construction activities and dwell time is experienced at either end of journeys. The number of lorries estimated to be in operation across the Proposed Scheme is shown in Table 5.5, as expanded on in Section 5.6 in Chapter 5 (Construction) in Volume 2 of this EIAR.

Table 5.5: Estimated Peak Daily Lorry Numbers Across the Proposed Scheme

Plant / Equipment	Section					
Type	1a	1b	1c	1d	2	3
	4	8	5	6	21	17

The construction period of the programme (as set out in Section 5.4 of Chapter 5 (Construction) in Volume 2 of this EIAR), where the highest number of lorries are expected to be in operation is Year 2: Q2. Works will be ongoing at Sections 1a, Section 1b, Section 1c, Section 1d, Section 2 and Section 3 this period. The maximum number of lorries expected to be in operation is 61 vehicles, as shown in Table 5.6. This represents the peak period for haulage activities on the public road network.

Table 5.6: Estimated Lorry Numbers in Operation During Period of Peak Haulage Activity Along the Proposed Scheme

Plant / Equipment	Section						All Sections
Type	1a	1b	1c	1d	2	3	Total
Lorry	4	8	5	6	21	17	61

In a typical hour during peak haulage activity of the Proposed Scheme, 40% of lorries are anticipated to be in operation on the public road network which equates to approximately 24 lorries. A total of 24 two-way lorry movements are therefore expected in a typical hour during peak haulage activity of the Proposed Scheme.

Lorry movements will be managed during the periods of 07:00hrs to 09:00hrs and 17:00hrs to 19:00hrs to minimise the impact of construction related traffic on peak-hour general traffic.

Construction vehicles will be directed to access work sections via the Proposed Scheme and dedicated routes on the National and Regional Road Network where practicable, to minimise use of the Local Road Network. The routes are outlined in Section 5.2.3.3 of this CTMP.

5.2.2.4.2 Journeys by Construction Personnel To and From the Proposed Scheme

Personnel numbers for the Proposed Scheme are illustrated in Section 5.10 in Chapter 5 (Construction) in Volume 2 of this EIAR. Throughout the Construction Phase there will be some variation in the numbers of personnel working on-site. It is anticipated there will be approximately 20 to 30 personnel directly employed across the Proposed Scheme, rising to 50 personnel at peak construction.

The appointed contractor will prepare a Construction Stage Mobility Management Plan (CSMMP) to actively discourage personnel from using private vehicles to travel to the Proposed Scheme. The CSMMP will promote the use of public transport, cycling and walking by personnel. Private parking at the Construction Compounds will be limited. Vehicle-sharing will be encouraged, subject to public health guidelines, where travel by private vehicle is a necessity (e.g. for transporting heavy equipment).

Typical work hours are envisaged between 07:00hrs and 23:00hrs with personnel working across early and late shifts. The adopted shift patterns help minimise travel by personnel during the peak hour periods of 08:00hrs to 09:00hrs and 17:00hrs to 18:00hrs.

A combination of CSMMP measures, as well as work shift patterns, means that fewer than 10 trips by private vehicle are envisaged to and from site during peak periods.

5.2.3 Construction Traffic Management Plan Contents

The appointed contractor shall be responsible for developing a CTMP to effectively manage traffic and transport during the Construction Phase of the Proposed Scheme. The appointed contractor shall address the following aspects, in addition to any other aspects identified by the appointed contractor during the preparation of the CTMP:

- Access and egress;
- Construction Compounds;
- Routing of construction vehicles;

- Pedestrian (including able-bodied pedestrians, wheel-chair users, mobility impaired pedestrians, pushchair users etc.) and cyclist provisions;
- Public transport provisions;
- Parking and access;
- Lighting;
- CSMMP;
- Traffic management signage;
- Timings of material deliveries;
- Traffic management speed limits;
- Vehicle cleaning;
- Road cleaning;
- Road condition;
- Road closures and diversions;
- Enforcement of Construction Traffic Management Plan;
- Interface with other projects;
- Emergency procedures during construction; and
- Communication.

Further details on issues to be addressed are provided in Section 5.2.3.1 to Section 5.2.3.19.

5.2.3.1 Access and Egress

The appointed contractor shall provide advanced warning signs, in accordance with the Traffic Signs Manual (DTTAS 2019a), on approach to the proposed access locations, and entry and exit points throughout the live working area.

When roads and streets are being upgraded, there will be some temporary disruption / alterations to on-street and off-street parking provision, and access to premises in certain locations along the Proposed Scheme. Local arrangements will be made on a case-by-case basis to maintain continued access to homes and businesses affected by the works, at all times, where practicable. Details regarding temporary access provisions will be discussed with homes and businesses prior to construction starting in the area.

5.2.3.2 Construction Compounds

Construction Compound requirements to facilitate the Construction Phase of the Proposed Scheme are illustrated in Section 5.7 in Chapter 5 (Construction) in Volume 2 of this EIAR. The Construction Compound locations have been selected due to the amount of available space at these location, their location near the majority of the Proposed Scheme major works and access to the National and Regional Road network.

The location of the Construction Compounds in relation to the Proposed Scheme are shown in Image 5.1. Construction Compound R1 will be located along North Wall Quay, at George's Dock, north of the existing Scherzer Bridges, either side of the George's Dock culvert, and across the culvert. Construction Compound R2 will be located along North Wall Quay, at Spencer Dock, north of the existing Scherzer Bridges, either side of the Royal Canal. Construction Compound R3 will be located at the end of Sir John Rogerson's Quay. Construction Compound R3 has been split into two separate construction compounds (Construction Compound R3a and Construction Compound R3b), as it is envisaged that the DPTOB will be constructed under a separate Construction Contract from the remainder of the Proposed Scheme. Construction Compound R3a will be used to complete the works along the south quays; City Quay and Sir John Rogerson's Quay. Construction Compound R3b will be used to complete the works at DPTOB. The Construction Compound R4 layout and boundary will change throughout the DPTOB (Structure Reference: 05) construction programme. Whilst reclamation works, construction of the new SPRC building, and demolition of the old SPRC building are underway, a smaller Construction Compound will be established. Once these works are complete, the Construction Compound size will increase in size.

The appointed contractor's CTMP shall include measures for managing traffic accessing and egressing the Construction Compounds. The Construction Compounds will contain a site office, and welfare facilities for NTA personnel and appointed contractor personnel. Limited car parking will be allowed at the Construction

Compounds, in line with the principles of the CSMMP. Materials such as topsoil, subsoil, concrete, rock etc., will be stored at the Construction Compounds for reuse as necessary. Items of plant and equipment will also be stored within the Construction Compounds.

5.2.3.3 Routing of Construction Vehicles

Access to and egress from the Construction Compounds is envisaged to be along dedicated construction vehicle routes. It is assumed that all national roads and regional roads in the immediate vicinity of the Proposed Scheme would be used by construction vehicles.

The following national roads are expected to be used as Construction Access Routes during the Construction Phase of the Proposed Scheme:

- M1;
- Dublin Port Tunnel; and
- M50 Motorway.

The following regional roads are expected to be used as Construction Access Routes during the Construction Phase of the Proposed Scheme:

- R101;
- R105;
- R118;
- R131;
- R801;
- R802;
- R813; and
- R814.

Assumed Construction Access Routes for the Proposed Scheme are shown in Image 5.4.

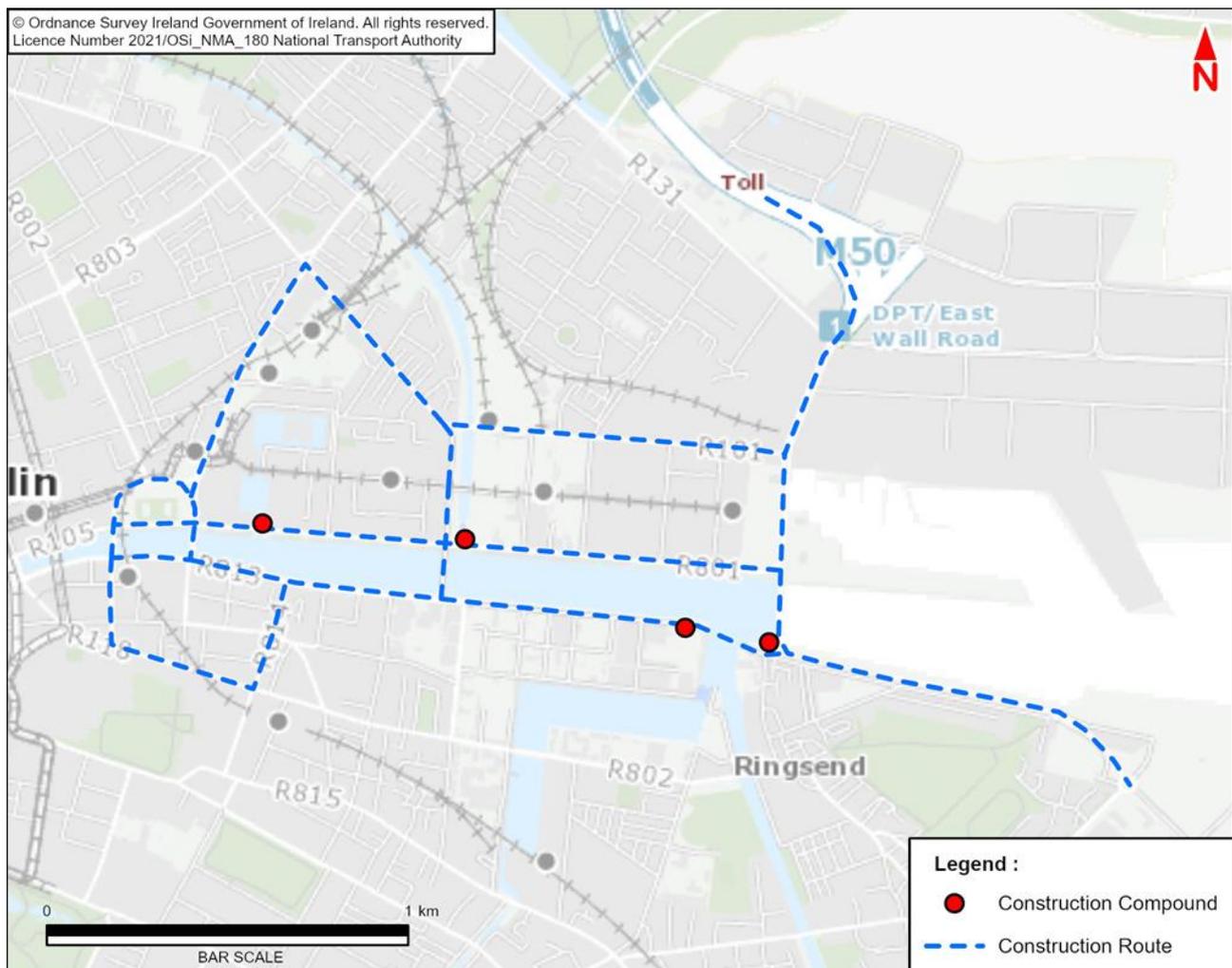


Image 5.4: Construction Access Routes

5.2.3.4 Pedestrian and Cyclist Provisions

The measures set out in Section 8.2.8 of the Traffic Signs Manual (DTTAS 2019a) will be implemented, wherever practicable, to ensure the safety of all road users, in particular pedestrians (including able-bodied pedestrians, wheel-chair users, mobility impaired pedestrians, pushchair users) and cyclists. Therefore, where footpaths or cycle tracks are affected by construction, a safe route will be provided past the work area, and where practicable, provisions for matching existing facilities for pedestrians and cyclists will be made.

5.2.3.5 Public Transport Provisions

Existing public transport routes will be maintained throughout the duration of the Construction Phase of the Proposed Scheme (notwithstanding potential for occasional road closures / diversions as discussed in Section 5.2.3.15). Wherever practicable, bus services will be prioritised over general traffic. However, the temporary closure of sections of existing dedicated bus lanes will be required to facilitate the construction of new bus priority infrastructure that is being developed as part of the Proposed Scheme. Some existing bus stop locations will need to be temporarily relocated to accommodate the works. In such cases, bus stops will be safely accessible to all users and all temporary impacts on bus services will be determined in consultation with the NTA and the service providers.

5.2.3.6 Parking and Access

When roads and streets are being upgraded, there will be some temporary disruption / alterations to on-street and off-street parking provision, and access to premises in certain locations along the Proposed Scheme. Local arrangements will be made on a case-by-case basis to maintain continued access to homes and businesses

affected by the works, at all times, where practicable. Details regarding temporary access provisions will be discussed with homes and businesses prior to construction starting in the area. The duration of the works will vary from property to property, but access and egress will be maintained at all times.

5.2.3.7 Lighting

The majority of the Proposed Scheme is already artificially lit. However, temporary lighting will be required at times along the Proposed Scheme at certain locations during the Construction Phase, where necessary. Where it is necessary to disconnect public lighting during the construction works or to undertake works outside of daylight hours where the existing lighting is low, appropriate temporary lighting will be provided. Temporary lighting will also be installed at the Construction Compounds for the duration of the Construction Phase.

The standard of temporary lighting installed during the Construction Phase will meet the standard of the existing carriageway and will be appropriate to the speed and volume of traffic during construction. Temporary construction lighting will generally be provided by tower mounted floodlights, which will be cowled and angled downwards to minimise spillage of light from the site.

5.2.3.8 Construction Stage Mobility Management Plan (CSMMP)

The appointed contractor will prepare a CSMMP. The CSMMP will be used to encourage personnel to commute by means other than private car. The CSMMP may comprise the following topics, as well as other relevant topics identified by the appointed contractor:

- Introduction;
- Objectives and targets;
- Strategy of travel;
- Construction phase specific measures;
- Access and surrounding road network;
- Opportunities for car sharing;
- Implementation and co-ordination;
- Monitoring; and
- Adherence to public health guidelines.

5.2.3.9 Traffic Management Signage

Temporary traffic management signage will be put in place in accordance with the requirements of the Traffic Signs Manual, Chapter 8, Temporary Traffic Measures and Signs for Roadworks (DTTAS 2019a) to warn road users of the works ahead and to advise of any changes to the carriageway layout. In addition to temporary traffic management signage, requirements may include:

- Provision of temporary signage indicating Construction Access Routes and locations for the appointed contractor and associated suppliers; and
- Provision of general information signage to inform road users and local communities of the nature and locations of the works, including contact details.

5.2.3.10 Timings of Material Deliveries

The appointed contractor will seek to reduce the impact of material deliveries on local communities and residents adjacent to the Proposed Scheme during the Construction Phase, where practicable.

5.2.3.11 Traffic Management Speed Limits

Adherence to posted / legal speed limits will be emphasised to all personnel / suppliers by the appointed contractor during induction training. The use of special speed limits for construction traffic in sensitive areas will be considered, such as 30km/hr (kilometres per hour) at school locations. Recommended speed limits would only apply to construction traffic and not to general traffic. The sign posting of such speed limits is not expected in the interest of clarity for local road users.

5.2.3.12 Vehicle Cleaning

Details and information on vehicle cleaning to be carried out during the Construction Phase of the Proposed Scheme is provided in Section 5.4.5.4.

5.2.3.13 Road Cleaning

Roads being used for dedicated Construction Access Routes shall be regularly inspected for cleanliness. The appointed contractor will monitor for mud and debris on the roads as a result of the Construction Phase works and use a road sweeping vehicle for cleanliness, if needed. The use of road cleaning sweepers should be considered as a last resort with prevention being the main objective.

5.2.3.14 Road Condition

The extent of the lorry traffic movements and the nature of the payload may create problems of:

- Fugitive losses from wheels, trailers, or tailgates; and
- Localised areas of subgrade and wearing surface failure.

Activities which may reduce the impact on road condition are outlined below. They should be incorporated into the CTMP by the appointed contractor where practicable:

- Loads of materials leaving each works area will be evaluated and covered if considered necessary to minimise potential dust impacts during transportation;
- Take all reasonable measures while transporting waste or any other materials likely to cause fugitive losses from a vehicle during transportation to and from the works areas, including but not limited to:
 - Covering of all waste or material with suitably secured tarpaulin / covers to prevent loss; and
 - Utilisation of enclosed units to prevent loss.
- Undertake pavement condition surveys along roads forming part of the Construction Access Route, based on consultation with the NTA and professional judgement regarding the condition of the route, pre-construction. These surveys will record the baseline structural condition of the road being surveyed immediately prior to construction; and
- Throughout the course of construction of the Proposed Scheme, undertake on-going visual inspections and monitoring of the Construction Access Routes to ensure any damage caused by construction traffic is recorded. Arrangements can then be made to repair any such damage to an appropriate standard in a timely manner such that any disruption is minimised.

Upon completion of construction of the Proposed Scheme, the surveys carried out pre-construction shall be repeated, and a comparison of the pre-construction and post-construction surveys will be carried out.

5.2.3.15 Road Closures and Diversions

Road closures and diversions will need to be carried out during the Construction Phase of the Proposed Scheme. However, these measures will be minimised wherever possible. Where necessary, road closures and diversions will take into consideration the impact on road users, residents, businesses etc. Road closures and diversions will be carried out with regard to the Traffic Signs Manual (DTTAS 2019a). All road closures and diversions will be determined by the NTA, in consultation with the local authority and An Garda Síochána, as necessary. Access will be maintained for emergency vehicles along the Proposed Scheme, throughout the Construction Phase.

5.2.3.16 Enforcement of Construction Traffic Management Plan

The appointed contractor shall develop the CTMP for use throughout the Construction Phase. All personnel and material suppliers shall be required to adhere to the CTMP. The appointed contractor shall agree and implement monitoring measures to confirm the effectiveness of the CTMP and compliance shall be monitored by the NTA. Regular inspections / spot checks shall be carried out to ensure that all personnel and material supplies follow the agreed measures adopted in the CTMP.

5.2.3.17 Interface with Other Projects

The likely timelines of the Proposed Scheme construction works have considered the potential for simultaneous construction of, and cumulative impacts with other infrastructure projects and developments which are proposed along, or in the vicinity of the Proposed Scheme. The likely significant cumulative impacts caused by the Proposed Scheme in combination with other existing or planned projects are identified and assessed in Chapter 21 (Cumulative Impacts & Environmental Interactions) in Volume 2 of this EIAR.

Interface liaison will take place on a case-by-case basis through the NTA, as will be set out in the Construction Contract, to ensure that there is coordination between projects, that Construction Access Routes remain unobstructed by the Proposed Scheme works and that any additional construction traffic mitigation measures required to deal with cumulative impacts are managed appropriately.

5.2.3.18 Emergency Procedures During Construction

The appointed contractor shall ensure that unobstructed access is provided to all emergency vehicles along all routes and accesses. The NTA shall provide to the local authorities and emergency services, contact details of the appointed contractor personnel responsible for construction traffic management.

In the case of a construction traffic related emergency, the following procedure shall be followed:

- Emergency Services will be contacted immediately by dialing 112;
- Exact details of the emergency / incident will be given by the caller to the emergency line operator to allow them to assess the situation and respond in an adequate manner;
- The emergency will then be reported to the appointed contractor;
- All construction traffic shall be notified of the incident (where such occurs off site);
- Where required, appointed first aiders will attend the emergency immediately; and
- The appointed contractor will ensure that the emergency services are directed to and arrive at the emergency location.

5.2.3.19 Communication

The appointed contractor shall, through the NTA, ensure that close communication with the relevant local authorities and the emergency services shall be maintained throughout the Construction Phase.

As discussed in Section 5.1.6, the appointed contractor shall, through the NTA, also ensure that the local community, landowners, and strategic stakeholders are appropriately informed of proposed traffic management measures in advance of their implementation. Contact information for key points of contact will be provided for members of the public to obtain additional information and to provide additional knowledge such as local events, sports fixtures etc. which may conflict with proposed traffic management measures. The appointed contractor will liaise with landowners through the Communications Plan agreed with the NTA, where access to their property is temporarily affected by works.

5.3 Invasive Species Management Plan

5.3.1 Introduction

This Invasive Species Management Plan (hereafter referred to as the ISMP) for the Proposed Scheme contains management recommendations in respect of preventing the spread of and managing a range of non-native invasive species along the Proposed Scheme. Invasive Species (IS), Invasive Alien Species (IAS) or Invasive Alien Plant Species (IAPS) are terms sometimes referenced in legislation and or guidance. They are referred to as non-native invasive species in this ISMP but are interchangeable.

The ISMP describes the options available to manage and prevent the spread of Third Schedule, non-native invasive plant species identified in the vicinity of the Proposed Scheme. Only non-native invasive species listed on the Third Schedule of S.I. No 477/2011 – European Communities (Birds and Natural Habitats) Regulations 2011 (hereafter referred to as the Birds and Natural Habitats Regulations) are dealt with in this ISMP.

The ISMP will be developed prior to the commencement of any on-site works for the Proposed Scheme. Construction works can disturb stands of Third Schedule non-native invasive plants and / or soils contaminated with non-native invasive plant material, as well as potentially lead to a new infestation. Therefore, management measures which will be contained in the ISMP will be implemented to avoid any direct or indirect impacts to habitats and species contained within the locality or as a result of its introduction to the area.

5.3.1.1 Legislative Context

The Birds and Natural Habitats Regulations contain specific provisions that govern control of listed invasive species. It is an offence to release or allow to disperse or escape, to breed, propagate, import, transport, sell or advertise species listed on the Third Schedule of the Birds and Natural Habitats Regulations without a Licence. The two regulations that deal specifically with this scheduled list of species are:

- Regulation 49: Prohibition of introduction and dispersal of certain species; and
- Regulation 50: Prohibition on dealing in and keeping certain species.

Following on from that, the following are strictly prohibited:

- Dumping invasive species cuttings anywhere other than in facilities licensed to accept them;
- Planting or otherwise causing to grow in the wild, hence the landowner (in respect of the Proposed Scheme this being the NTA and the appointed contractor) should be careful not to cause further spread);
- Disposing of invasive species at a landfill site without first informing the landfill site (that is licensed under Number 10 of 1996 - Waste Management Act, 1996 (as amended) (hereafter referred to as the Waste Management Act, as amended) to take such Third Schedule material (plant or soil) that the waste contains invasive species material (this action requires an appropriate licence);
- Moving soil which contains Third Schedule-specific non-native invasive species in the Republic of Ireland, unless under licence from the National Parks and Wildlife Service (NPWS) (this licence is separate from and does not discharge any person being in receipt of other necessary waste permits / licences etc.); and
- Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species (hereafter referred to as the IAS Regulation) lists specific Species of Union Concern, some of which overlap with the Third Schedule species.

The IAS Regulation conveys the rules to prevent, minimise and mitigate the adverse impacts of the introduction and spread (both with and without intention) of IAS on biodiversity and the related ecosystem services, as well as other adverse impacts on human health or the economy. Target 4.4 of Ireland's third National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht 2017) requires that '*harmful invasive alien species are controlled and there is reduced risk of introduction and / or spread of new species*'.

5.3.1.2 Limitations

It should be noted that any decision on efficacy of chemical treatments can only be provided by a registered pesticides advisor. A suitably qualified specialist will be appointed by the appointed contractor to monitor the treatment of non-native invasive species. This ISMP shall be updated as necessary by the specialist.

5.3.2 Methodology

5.3.2.1 Guidance

This ISMP and the mitigation strategies that are discussed relating to invasive plant species have been prepared with regard to the following guidance documents, where relevant:

- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII 2020a);
- The Management of Invasive Alien Plant Species on National Roads – Standard (TII 2020b);
- The Environment Agency (EA) Managing Japanese knotweed on development sites - the Knotweed Code of Practice (Version 3, amended in 2013, withdrawn from online publication in 2016) (EA 2013). (This document, although no longer supported by the EA, is nonetheless a practical document in determining the approach and control mechanisms for Japanese knotweed);
- Managing Invasive Non-Native Plants in or near Freshwater (EA 2010);
- Invasive Species Ireland (ISI) Best Practice Management Guidelines for Japanese knotweed (ISI 2008a);
- Best Practice Management Guidelines for Himalayan balsam (ISI 2008b);
- Best Practice Management Guidelines for Giant hogweed (ISI 2008c);
- Non-Native Species Secretariat (NNSS) *Allium triquetrum* (Three-cornered garlic) Great Britain Non-Native Organism (NNSS 2011);
- Countryside Management Publications, Giant hogweed (Department of Agriculture and Rural Development (Northern Ireland) (2016);
- Good Practice management, New Zealand pygmyweed (*Crassula helmsii*) Version 1, August 2018 (Animal and Plant Health Agency *et al.* 2018);
- Management Measures for Widely Spread Species (WSS) in Northern Ireland Nuttall's waterweed (*Elodea nuttallii*) (Northern Ireland Environment Agency 2021);
- Aquatic and Riparian Plant Management: Controls for Vegetation in Watercourses, Technical Guide (EA 2014); and
- Biosecurity Protocol for Field Survey Work (Inland Fisheries Ireland 2010).

5.3.2.2 Surveys

Following on from a desk study review of the National Biodiversity Data Centre (NBDC) records, non-native invasive species surveys were undertaken for the Proposed Scheme in 2019 and 2020, and updated in 2021, within the appropriate botanical season (April to September) when species are readily observable and identifiable.

Non-native invasive species listed on the Third Schedule of the Birds and Natural Habitats Regulations were searched for within and adjacent to the Proposed Scheme. Surveys were carried out by the EIAR ecologists, and all Third Schedule non-native invasive species recorded were mapped and attributed a unique reference identifier. This data fed into the EIAR. Full details of the surveys are included in Chapter 12 (Biodiversity) in Volume 2 of this EIAR.

5.3.3 Results

There were no non-native invasive plant species listed on the Third Schedule of the Birds and Natural Habitats Regulations identified within the Proposed Scheme during the habitat surveys.

The desk study returned several plant records of Himalayan balsam *Impatiens glandulifera* along the River Dodder at Irishtown and Japanese knotweed *Reynoutria japonica* within the 1km grid square O1933 at Irishtown Nature Park. Additional records of Canadian waterweed *Elodea canadensis* (delisted as a Third Schedule species, with

the introduction of S.I. No. 355 of 2015), sea-buckthorn *Hippophae rhamnoides*, and three-cornered garlic *Allium triquetrum* were returned within 1km of the Proposed Scheme (NBDC 2022). Full details of the desk study is provided in Appendix A12.2 Desk Study in Volume 4 of this EIAR.

These species were not found present within the footprint of the Proposed Scheme however owing to their proximity and potential to become established within the Proposed Scheme area between the surveys taking place and construction commencing, these species, as well as any other Third Schedule species known to occur in the wider area, have been addressed in this ISMP on a precautionary basis. The following species listed on the Third Schedule of the Birds and Natural Habitats Regulations are known to occur in the wider area:

- Giant-rhubarb *Gunnera tinctorial*;
- American skunk-cabbage *Lysichiton americanus*;
- Giant hogweed *Heracleum mantegazzianum*
- Parrot's-feather *Myriophyllum aquaticum*;
- Curly waterweed *Lagarosiphon major*;
- Water fern *Azolla filiculoides*;
- Giant knotweed *Fallopia sachalinensis*;
- New Zealand pigmyweed *Crassula helmsii*;
- Rhododendron ponticum; and
- Spanish bluebell *Hyacinthoides hispanica* (NBDC 2022).

Species such as Japanese knotweed, Himalayan balsam and Giant hogweed are highly invasive while Three-cornered garlic is considered a medium impact species, which can be more readily managed. Further details on the ecology of these species are provided in Section 5.3.5.1 to Section 5.3.5.4. New Zealand pigmyweed, Nuttall's pondweed and Canadian pondweed are known to be present in still or slow flowing freshwater bodies. Further details on the ecology of these species are provided in Section 5.3.5.5 and Section 5.3.5.6.

Based on these findings, Section 5.3.5 of this ISMP provides a high-level analysis of these six species and outlines the practical control / eradication measures that could be used to ensure no spread of scheduled plant species to the wider area and in particular into European (designated) sites with their Qualifying Interest (QI) habitats and species and Special Conservation Interest (SCI) Species and supporting wetland habitat in Dublin Bay.

It is recognised that other non-native invasive species, not listed in the Third Schedule, can and do occur within the footprint of the Proposed Scheme and the wider metropolitan surrounds of Dublin. These are not ordinarily dealt with in non-native invasive species management plans, and there is separate legislation and guidance for the control of noxious weeds (e.g. Number 38 of 1936 Noxious Weeds Act, 1936 and S.I. No. 103/1937 Noxious Weeds (Thistle, Ragwort, and Dock) Order, 1937). Species such as Butterfly bush *Buddleia davidii* can quickly become established and spread in suitable urban areas, including gaps in the built environment such as the sides of old buildings, pavements, and on derelict ground. Where large populations occur, it may be a requirement of some local authorities within the Greater Dublin Area that they be managed to ensure no excessive spread (e.g. Dublin City Council (DCC)), as well as new linear infrastructure projects administered by TII. The implementation of the general measures provided in Section 5.3.4 would minimise the risk of any spread of these species as a result of the construction of the Proposed Scheme.

5.3.4 General Measures to Control and Prevent the Spread of Non-Native Invasive Plant Species

5.3.4.1 Pre-Construction Survey

During the interim between the original non-native invasive species surveys and the commencement of construction following grant of planning permission, it is possible that the existing stands of Third Schedule non-native invasive species may have expanded (if unmanaged) or decreased (if there is an active management regime in place), or that newly established Third Schedule non-native invasive species may have become established within the footprint of the Proposed Scheme. A confirmatory pre-construction invasive species survey will be undertaken by a suitably qualified specialist, arranged by the NTA, to confirm the absence, presence and / or extent of all Third Schedule non-native invasive species within the footprint of the Proposed Scheme. Where

an infestation is confirmed / identified within the footprint of the Proposed Scheme, this will require the implementation of the ISMP.

Data collected as part of the pre-construction invasive species survey will include a detailed description of the infestation including the approximate area of the respective colonies (m²) (metres squared), where feasible, the approximate total number of stems, pattern of growth and information on other vegetation present. This information will enable calculations of volumes of infested soils to be excavated where necessary, as part of the measures outlined below.

Following on from the pre-construction invasive species survey, the ISMP will be updated, as advised by a suitably qualified specialist, with regard to the Management of Invasive Alien Plant Species on National Roads - Technical Guidance (TII 2020a) and Standard (TII 2020b) and other species-specific guidance documents including those listed in the ISMP, as necessary. The updated ISMP will detail the strategy that will be adopted during the Construction (and Operational) Phase in order to manage and prevent the spread of invasive plant species, and where Third Schedule non-native invasive species are encountered directly in the works area, the method of treatment / eradication.

5.3.4.1.1 Invasive Species Management Plan (ISMP)

Following on from the pre-construction invasive species survey, the ISMP will be updated to detail the exact measures for any non-native invasive species population present within the footprint of the Proposed Scheme. Depending on the extent and nature of the works, a number of approaches / treatments may be approved, all following on from the measures in the ISMP.

The NTA will ensure that all control measures specified in the ISMP shall be implemented by a suitably qualified and licenced specialist prior to the Construction Phase of the Proposed Scheme to control the spread of newly established non-native invasive species within the footprint of the Proposed Scheme. Furthermore, the appointed contractor will adhere to control measures specified within the ISMP throughout the Construction Phase of the Proposed Scheme. The site will be monitored by the appointed contractor after control measures have been implemented. Any re-growth will be subsequently treated.

All measures that are prescribed in the ISMP shall be equally applicable to advance works as to construction works. In the Operational Phase the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations.

5.3.4.2 General Measures to Avoid the Spread of Non-Native Invasive Species

The unintentional spread of non-native invasive species during construction works (within a construction site or unwittingly from outside of a site, such as through the importation of materials or poor biosecurity practices regarding plant and machinery) can be a significant issue, and if not managed properly, can result in the spread of non-native invasive species to uninfested areas (within or adjacent to works areas), which would increase the future cost and effort required to control the species and could pose further public health and safety risks (Japanese knotweed can cause damage to weaknesses in built environment, whilst Giant hogweed is an environmental public health hazard).

The most common ways that invasive species can be spread is:

- Site and vegetation clearance, mowing, hedge-cutting or other landscaping activities;
- Spread of seeds or plant fragments during the movement or transport of soil;
- Spread of seeds or plant fragments through the local surface water and drainage network;
- Contamination of vehicles or equipment with seeds or plant fragments which are then transported to other areas;
- Importation of soil from off-site sources contaminated with invasive species plant material; and
- Leaving riparian corridors bare of vegetation thus allowing establishment of seed material from outside the site.

5.3.4.2.1 Site Establishment

During advance works and prior to the commencement of construction, any areas where Third Schedule non-native invasive species have been recorded by the pre-construction surveys must be clearly fenced off prior to and during construction (in order to avoid spreading seeds or plant fragments around or off the construction site) until such time that the mitigation measures are implemented and treatment has been completed, or that works in these areas are monitored in accordance with the requirements of the ISMP.

This includes the Construction Compounds and the entirety of the Proposed Scheme footprint. Earthworks or machinery movement must be avoided in any areas where non-native invasive species have been identified during the pre-construction surveys, until the relevant stands have been eradicated.

5.3.4.2.2 Biosecurity and Site Hygiene

It is important to ensure that the spread of non-native invasive species, where present, is curtailed. It is also necessary to ensure that in areas where non-native invasive species are not present, that they are not unintentionally spread (e.g. through the importation of contaminated material being brought onto the site).

Unwashed construction equipment, plant, vehicles, and footwear can provide a vector for the spread of non-native invasive species within the Proposed Scheme and from areas outside the Proposed Scheme, where infestation is present or where vector material potentially containing seed / root material is attached to plant. The following hygiene measures shall be undertaken for the Proposed Scheme.

- Known or potentially infested areas within the working area of the Proposed Scheme shall be clearly fenced off in advance of works and access restricted until such time that treatment has commenced and / or construction works are monitored in accordance with the ISMP in the area. In relation to Japanese knotweed, the guidance recommends an exclusion buffer of 7m (metres) in all directions (within the works area and 3m vertically underground);
- Erection of clear signage at the Construction Compounds etc. and inclusion of detail during tool-box talks or similar (environmental induction) for construction staff in respect of the management of Third Schedule non-native invasive species. The signage and notification should be easily understood so that users are aware of the measures to be taken for known non-native invasive species, or what they should do in the case of suspected non-native invasive species identified. In particular the potential health risks posed by Giant hogweed, where it is recorded from within or adjacent to a Proposed Scheme should be clearly notified to personnel;
- Identify dedicated access points into and out of fenced off areas. These shall not be breached until such time that eradication / removal of non-native invasive species is confirmed or monitoring of the treatment / eradication process is commenced;
- Where possible, the locations of dedicated footwear and wheel wash facilities should be identified in the ISMP. Where a dedicated / bespoke wheel wash cannot be installed owing to space limitations, the appointed contractor will ensure that no excavated loose material is allowed off site from within an exclusion zone. Similarly, where plant that is used to excavate soils, it shall be visually checked for loose soil before movement to another part of site (where possible, the movements of tracked machinery should be restricted within the non-native invasive species exclusion zone). Loose soil shall be scraped off and disposed of, and a solution of Virkon© (or similar approved disinfectant) applied to machinery to ensure that no obscured seed / root material remains viable;
- Vehicular movements within the exclusion area shall be minimised as far as is practical;
- Machinery which has been used for the transport and / or excavation of infected / suspected infected vector material shall be thoroughly washed down, and the washings captured for disposal. All such machinery / plant shall not be permitted to commence work elsewhere on-site or off site until written confirmation of same has been undertaken;
- Dedicated wash down and solution capture should be set up in the Construction Compounds. All washings should be stored in a quarantined bunded container that is rated for such storage until such time that they are removed off site for disposal and transferred to a facility that is authorised to accept such waste;
- Except in very particular circumstances, under the guidance of the specialist, there shall be no temporary storage of infected / suspected infected soils on-site. They must be removed off site as per the guidance in Section 5.3.4.2.3; and

- Where small volumes (e.g. volumes capable of being double bagged in quarantine bags such as cut plants, bulbs or loose soil occur), it may be practical to bag the material and bring it to a clearly demarcated and dedicated quarantine area within the Construction Compounds until such time that the material is disposed of to an authorised facility, similar to the process of disposing of bulk excavated infected soil.

5.3.4.2.3 Soil Excavation

No excavations within a clearly demarcated and fenced off buffer zone shall be permitted. For Japanese knotweed, guidance recommends a horizontal distance of up to 7m from the outside of the stand. This could include under built ground, should suitable areas of weakness or uncompacted ground be encountered by the plants' rhizomes. For other species there will be different buffer zones as guided by the specialist.

Where the excavation of soil containing Third Schedule non-native invasive species (vector material) is the preferred option, the operation shall be monitored for its entirety until the risk of spread of Third Schedule non-native invasive species is negated.

There should be no temporary storage on-site of bulk excavated infected material. Where the ISMP calls for shallow / deep burial, this material shall be removed from the excavated area and transported immediately to approved receptor area on-site. Furthermore, the temporary storage of uninfected material should not occur within a European or National designated site nor within 10m of any watercourse and any land within an identified flood zone. Where temporary stockpiles of infected material cannot for practical limitations, be situated away from a potential flood risk area, the appointed contractor will be required to include a flood response plan within the Environmental Incident Response Plan (see Section 5.6) to ensure that any inundation of Construction Compounds does not result in a pollution event to nearby water bodies.

Plant and machinery used in the control, excavation and transport of invasive material shall also be subject to the recommendations described in Section 5.3.4.2.2.

The installation of industry-rated non-native invasive species-proof membrane before infilling construction of road / paths surface may be required. All waste arising out of this process which has been in contact with the excavated ground shall be treated as infected waste and disposed of at a facility that is authorised to accept such waste (See Section 5.3.4.2.4).

Where the movement of any Third Schedule non-native invasive species is required off site, a licence will be required from NPWS in advance of any movement to a site / facility licensed to accept such waste, as per the Birds and Natural Habitats Regulation. This licence is separate to and does not negate the need for licences / permits / authorisations required under waste legislation.

5.3.4.2.4 Disposal of Material

Where any non-native invasive plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal does not result in a risk of further spread. The movement of invasive plant material, off site, requires a licence from the NPWS, as per the Birds and Natural Habitats Regulations. Invasive species (particularly roots, flower heads or seeds) must be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation (e.g. Waste Management Act, as amended, Section 4 of Number 6 of 1987 - Air Pollution Act, 1987, relevant local authority byelaws and any other relevant legislation). All disposals must be carried out in accordance with the relevant waste management legislation, as per guidance in the Guidelines for the Management of Waste from National Road Construction Projects (TII 2017).

It should be noted that some invasive species plant material or soil (vector material) containing residual herbicides may be classified as either 'hazardous waste' or 'non-hazardous waste' under the terms of the Waste Management Act, as amended, and both categories may require special disposal procedures or permissions. Advice should be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures.

5.3.4.2.5 Measures to be Implemented during the Application of Herbicides

Some of the control options may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a suitably qualified pesticides advisor, registered with the Department of Agriculture, Food and the Marine must be employed.

The appointed contractor is required to refer to the appropriate guidance documents, including but not limited to those listed in Section 5.3.2.1, which provide detailed recommendations for the control of invasive species and noxious weeds.

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control (if applicable), and for measures to avoid environmental damage during the use of herbicides. The appointed contractor (or the specialist as appropriate) will update the ISMP in accordance with the relevant guidelines before commencing works.

It should be noted that where a chemical treatment is to be used, there is a risk of contaminating a watercourse. The choice of herbicide is typically limited to formulations of Glyphosate or 2,4-D amine that are approved for use near water. Full details of any chemical used, where required and as advised by a registered pesticides advisor, will be included in the ISMP prepared in advance of construction of the Proposed Scheme.

5.3.4.2.6 Importation of Soil and Other Material

The bulk importation of material from off site could potentially result in the accidental spread of Third Schedule non-native invasive species, as it is uncertain if these site(s) are free from non-native invasive species. This is likely less an issue for road building material. However, in terms of landscaping, if soil is imported to the site for landscaping, infilling or embankments, the appointed contractor shall seek documentation from suppliers confirming that the material is free from invasive species.

5.3.4.3 Post-Construction Monitoring

Following the construction of the Proposed Scheme, there may be ongoing treatment programmes which extend for a number of years into the Operational Phase. In the Operational Phase, the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations.

The above measures are important for all Third Schedule non-native invasive species, and in particular Japanese knotweed, where it occurs, as maintenance works associated with landscaping, such as mowing and hedge cutting have the potential to spread this plant via the dispersal of very small amounts of shredded plant material. If invasive plants are found, then they shall be treated as per the measures outlined in the ISMP and any species-specific guidelines.

5.3.5 Assessment of Management Options for Third Schedule Non-Native Invasive Species

The general measures included in Section 5.3.4 are required to ensure good on-site practices in respect of known or potential Third Schedule non-native invasive species.

Section 5.3.5.1 to Section 5.3.5.5 further identify practical management controls. The colour scheme shown is a qualitative tool intended to assist the reader to focus on the most likely practical solutions. It is acknowledged that more than one potential control measure exists and that a single or combination of measures may be required. The recommendations presented in this ISMP provide the minimum requirements for the likely control measures and the measures outlined in this ISMP shall be developed (with further detail on methodology used at each location, timing, practical management etc.) by the appointed contractor (or the specialist as appropriate).

The use of chemical treatments is recognised as a potential treatment option. However, the services of a registered pesticide advisor must be employed in the specifying named chemicals including those rated for use adjacent to aquatic environments where required, treatment type, dosage, and timing etc., and / or use of

pesticides in the management of potential Third Schedule non-native invasive species within the Proposed Scheme.

The selected management control to be defined for each non-native invasive species stand within the Proposed Scheme will depend on:

- Results of the pre-construction survey; and
- Construction requirements – timing of works at specific locations, level of infestation and practical considerations such as reducing disturbance to road users / homeowners.

The ISMP, which will be updated following on from the pre-construction surveys, may require the utilisation of a number of controls that are described and assessed below.

5.3.5.1 Japanese knotweed (*Reynoutria japonica*)

Japanese knotweed is high impact non-native invasive species that is particularly effective at colonising disturbed ground (e.g. construction sites) and can spread by the re-growth of cut fragments or root material, so if it is broken up during site clearance or other earthworks it can readily re-grow in new areas to which soil is moved. Japanese knotweed readily reproduces asexually (in Ireland, at least, as only Female plants have been recorded) and regrowth can occur from plant material weighing as little as 0.7g (grams) of viable material. It is acknowledged to be very difficult to effectively control and an even more difficult weed to fully eradicate.

Given the nature of Japanese knotweed, chemical treatments are often preferred over physical methods as they can, if implemented properly, reduce the disturbance of the plant / population, thus reducing the chances of its spread. If herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective or monitored for a minimum of two years during which no regrowth is recorded.

Table 5.7 presents an assessment of potential treatment options available for the treatment of Japanese knotweed. The various methods are analysed and described in further detail as necessary. It should be noted that where it might occur within the Proposed Scheme, that a number of the measures described below may be applicable, depending on the nature of works, the timing etc. These will be fully detailed in the ISMP after the recommended pre-construction survey of the Proposed Scheme.

Table 5.7: Assessment of Management Methods for Japanese knotweed

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Dig and dispose off site, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorizations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species off site. Depending on the nature of the excavation the proximity of services etc., the use of root barrier membrane (Section 5.3.5.1.1) could be required.	Likely – given the nature of the schemes, there may be a need to excavate soil and plant material to enable construction works to go ahead in timely manner.
	Dig and dispose on-site. - Shallow burial - Deep burial	A wildlife licence from NPWS is not ordinarily required if the burial of collected material is proposed for within the consented development site. Shallow burial in a constructed cell such as a dedicated sealed cell within a constructed berm will allow for periodic monitoring and of easy chemical treatment of any regrowth. Deep burial entails a dedicated sealed cell within a constructed excavation, that is at least 2m below the surface of the ground. The landscaping regime should not specify trees or scrub to be planted above. Either shallow or deep option could require the use of root barrier membrane (Section 5.3.5.1.1). The use of chemical pre-treatment of deep/shallow cells could also be required.	Unlikely – given the lack of suitable lands within the largely developed metropolitan area.

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
	Screen on-site – remove fragments off site and reuse soil.	A control option that can be used to reduce the volume of soil / sediment to be moved elsewhere for burial, this option requires suitable plant, adequate space and volumes of soil to make the operation at a location cost effective. This option often requires the use of root barrier membrane (Section 5.3.5.1.1) owing to reuse of screened soil. The use of chemical pre-treatment of deep / shallow cells could also be required.	Possible but unlikely given the space requirements for a screener (unless a bespoke small-scale screener is available).
	Cutting and / or Strimming	Not recommended and does not apparently diminish vigour of plants over time. Largely cosmetic and can result in considerable spread of viable vegetative material that can readily regenerate on suitable conditions.	Not Recommended.
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Chemical treatments are often a preferred option for treating Japanese knotweed, but the process can take between 3 to 5 years before eradication can be guaranteed and requires at least 2-year post implementation monitoring. However, given the nature of the Proposed Scheme, the use of chemical treatment alone is unlikely to be adequate unless treatment regime begins a number of years before construction commencement.
	Spray	Used for isolated plants or large populations using knapsack or weep sprayers. In accessible areas including along riverbanks, lance sprayers can be used. Chemical treatments for infestations near water should be rated for use at or near aquatic locations. Can result in chemical drift.	
	Stem Injection	This method is considered very effective, if the injection is timed appropriately for growth phase. However, it is labour-intensive (sometimes) requiring some cutting) and is usually only carried out on small/isolated populations. Chemical treatments for infestations near water should be rated for use at or near aquatic locations.	Possible and requires specialist equipment to enable working alongside the biohazardous plant. – Despite some advantages over other conventional chemical treatments e.g. reduces drift, not weather dependent.

5.3.5.1.1 Root Barrier Membrane

Following on from the excavation of Japanese knotweed, there may be a need to install a root barrier membrane. These are specialised products that can provide protection to structures / services etc. from regrowth from within or outside a site, if suitably rated and properly installed. Thereafter, any small adjacent infestation can be more readily treated with chemical treatment for example.

5.3.5.1.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Japanese knotweed seedlings in the following spring.

5.3.5.2 Giant hogweed (*Heracleum mantegazzianum*)

This is a high-risk invasive species, that is also a biohazard in that it can pose a threat to humans. The chemistry of its sap is such that exposure to it on skin can result in prolonged photosensitizing reactions with blistering. Thus, a clearly demarcated exclusion buffer, in excess of 4m, is recommend for any individual / populations of this species before commencing works.

It spreads via heavy seeds which can easily be transported by water. Hence, it is often found along river corridors. While the plant favours riverbanks, it is known to be found on waste / derelict ground as well as railway lines for instance. Its presence can impact local biodiversity and undermine bankside integrity. The seedling stage is the most vulnerable. Mortality of seedlings is comparable to many other plants and its seed bank is considered to be persistent for a short number of years only. Since Giant hogweed can only reproduce via seed, control measures applied before flowering and fruit set will limit subsequent generations (and even then, only with favourable conditions). The ideal time to control Giant hogweed via chemical treatment is April, with follow on monthly

applications targeting regrowth, although for this treatment options, it can require up to five years before successful eradication.

Table 5.8 presents an assessment of potential treatment options available for the treatment of Giant hogweed. The various methods are analysed and described in further detail as necessary.

Table 5.8: Assessment of Management Methods for Giant hogweed

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Above ground Cutting	Not recommended. Largely cosmetic and prolongs flowering until such time that control halted. However, if digging is used, it is recommended that the removal be attempted in April /early May when the plant is usually less than 30cm tall. However, the root must be captured also.	Unlikely - requires specialist equipment to enable working alongside the biohazardous plant
	Root cutting	Individual plants may be killed by cutting at a 45-degree angle 15cm below ground level with a spade in April or May. Can be laborious unless small/isolated stands. Can be effective if combined with chemical treatment over four to five years repeat treatment	Given the nature of the project, could be used to remove biohazard plant and thereafter allow for chemical control against any regrowth. Requires specialist equipment to enable working alongside the biohazardous plant
	Strimming	Not recommended owing to spread of sap.	Not Recommended.
	Ploughing	Can provide total control where seedlings and young plants encroach onto agricultural land. However not practical in metropolitan areas and isolated stand along riverbanks.	Unlikely given the locations that Giant hogweed is often found in.
	Grazing	Grazing should begin when early foliage appears in April and should continue until early autumn when re-sprouting stops. Eradication can take between 5-10 years so that seed bank and root stock is fully depleted of resources.	Not possible in metropolitan area
	Pulling	Hand pulling is only suitable for small/immature plants (and with suitable PPE to protect exposure of bare skin). Potential remains for tap root to remain underground and regenerate.	Unlikely for mature plants. Requires specialist equipment to enable working alongside the biohazardous small/immature plants
	Biological Control	Other than natural soil biota, it is not currently permitted to introduce any organisms to areas to deal with Giant hogweed. Research ongoing which would requires permitting thereafter.	Not possible at present.
	Dig and dispose off site, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. Given the phytotoxic nature of the plant, it should not be buried onsite nor disposed of with general C&D waste. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species off site.	Possible and depending on location may be required.
Chemical	Spot Treatment	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Most widely used method, but to be wholly effective, requires total control over ~5 years of treatments within a river catchment or the isolated location. Is weather dependent and can result in chemical drift to adjacent vegetation or watercourses.
	Spray	More suitable for large stands, where machine-mounted blanket sprays are used. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible but unlikely owing to nature and size of population recorded on scheme.
	Stem Injection	Can only be carried out on young stems. Due to difficulties with the timing of application and the potential safety risk of contact with the large leaves this method requires specialist safety equipment.	Possible and requires specialist equipment to enable working alongside the biohazardous plant – Despite some advantages over other conventional chemical treatments e.g. reduces drift, not weather dependent.

5.3.5.2.1 Temporary Storage of Collected Material

Given the phytotoxic nature of Giant hogweed, cut material should not be discarded. Ideally it should be disposed of immediately with similar non-native invasive species waste to a facility authorised to accept such waste.

However, given the nature and relative sizes of Giant hogweed infestations it may be suitable to collect cut biomass (where not disposed of immediately to a facility authorised to accept such waste), and to double bag it for transport to a dedicated quarantine area (location to be approved as part of the ISMP) to decompose before disposal with similar non-native invasive species waste in a facility authorised to accept such waste.

The locations of areas for which Giant hogweed has been eradicated should be notified to the local authority, so that any future public health issue involving similar symptoms can be tracked.

5.3.5.2.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Giant hogweed seedlings in the following spring and retard its establishment.

5.3.5.3 Himalayan balsam (*Impatiens glandulifera*)

This high-risk invasive species is easily disturbed, particularly if in flower and readily becomes re-established along riparian corridors, which are annually subject to alluvial flooding. Unlike Japanese knotweed though, it does not reproduce asexually. Plants can produce in excess of 6,000 seeds, and it aggressively colonises bare ground along riverbanks, including wet woodlands, as well as waste ground where suitable conditions exist. Due to its rapid growth, it can outcompete most native species. While its seedbanks are viable for up to 18 months, the resupply of seed is often achieved through annual river flooding and riparian inundation with freshly deposited soil-laden alluvium.

Table 5.9 presents an assessment of potential treatment options available for the treatment of Himalayan balsam. The various methods are analysed and described in further detail as necessary. Control measures for Himalayan balsam should aim to prevent flowering and are therefore undertaken before June. However, eradication may take up to five years. It should be noted that successful localised management of Himalayan balsam is difficult along watercourses, as the spread of this non-native invasive species from upstream areas (e.g. outside of the Proposed Scheme) onto bare ground often occurs after winter flooding.

Table 5.9: Assessment of Management Methods for Himalayan balsam

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Hand Pull	Small isolated and immature infestations, such as in gardens or roadsides can usually be readily pulled prior to flowering e.g. care must be taken not to leave lower plant sections as these can regrow rapidly. Additionally, any flower heads (if present) should be covered by a tied bag before pulling to ensure no seed drop.	Possible – ideal for smaller areas adjacent to the likely works boundary.
	Dig and dispose off site, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorised to accept it. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species off site.	Possible – given the nature of the scheme, this may be an optimal control measure.
	Mechanical	Repeated cutting or mowing, is effective for larger stands, but plants can regrow if the lower parts (above lowest node) are left intact. Regeneration can be further halted by ensuring full ground vegetative layer through reseedling.	Possible but unlikely main option given the nature of works along existing road infrastructure.
	Grazing	Regular grazing is said to suppress the plant over time.	Not practical – given the nature of the metropolitan landscape and nature of the scheme.
Chemical	Spot / Weed Wiper	Can be used for smaller infestations in spring before flowering occurs, but as late as to allow germinating seedlings to have	Possible – within the works boundary – Where ground is to

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
		become established and thus be able to uptake the chemical treatment. adjacent to the likely works boundary – chemical treatments for infestations near water should be rated for use near aquatic locations.	be excavated, may require physical control also.
	Foliar Spray	Can be applied to larger infestations via knapsack spray / lance spray etc. in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible – within the works boundary – Where ground is to be excavated, may require physical control also.

5.3.5.3.1 Temporary Storage of Collected Material

Given the nature and relative extent of Himalayan balsam infestations in some urban situations, collected biomass (pulled stems / roots and bagged flower heads), where not disposed of immediately to a facility authorised to accept such waste, could be double bagged and put in dedicated quarantine areas (locations to be approved as part of the ISMP). Here, the material could be left to decompose before disposal with similar non-native invasive species waste at an authorised facility.

5.3.5.3.2 Reseeding Following Eradication

Areas devoid of, or cleared of vegetative cover near watercourses, should be resown with appropriate riparian ground cover species in summer months to ensure that bare banks do not provide favourable conditions for Himalayan balsam to become re-established and to protect banks from accelerated erosion.

For any area of ground that is cleared of this non-native invasive species, and which is not subsequently constructed upon, follow-on mechanical cutting regimes and / or chemical treatments may be required to ensure the seed bank is fully exhausted.

5.3.5.4 Three-cornered garlic (*Allium triquetrum*)

A medium impact, rhizomatous species, Three-cornered garlic is often planted and can become established in natural and semi-natural habitats, where it is reported to spread by ant-dispersed seed and division of clumps (NNS 2011). It can readily establish in suitable ground resulting in it posing a threat to biodiversity where the plant forms early season dense monocultural masses, particularly at protected sites.

Management of this species is relatively straightforward, although there is a requirement that it be visible above ground so as to delineate its likely extent and ensure efficacy of management. Management of infestations can be managed through chemical or physical-based options or a combination of both. However, given the possibility of some underground bulbs / seedbank remaining within the ground post-treatment, eradication may require a number of repeat treatments over a number of years to ensure effective treatment of all bulbs.

Table 5.10 presents an assessment of potential treatment options available for the treatment of Three-cornered garlic. The various methods are analysed and described in further detail, as necessary.

Table 5.10: Assessment of Management Methods for Three-cornered garlic

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Hand dig	Hand-dig when small population present, ensuring that all biomass including bulbs collected. May also require a number of years of mechanical cutting to exhaust seed/bulb bank in wider subsurface environment. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species off site.	Likely
	Mechanical Excavation	For larger areas of infestation only, soil can be screened, and bulbs removed.	Unlikely given the nature and size of the identified populations.

		In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species off site.	
Chemical	Spray	Chemical treatment can be made in the spring (when above ground vegetation visible) but before flowering. Multiple applications may be required due to persistence of bulbs and soil seed bank.	Possible - Where ground is to be excavated, may require physical control also

5.3.5.4.1 Temporary Storage of Collected Material

Given the nature and relative sizes of infestations of Three-cornered garlic, bulbs and vegetative material, where not disposed of immediately to authorised facilities, could be double bagged and placed in dedicated quarantine areas to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.3.5.4.2 Reseeding Following Eradication

For any area of ground that is cleared of Three-cornered garlic, and is not constructed upon, a follow-on mechanical hand-pulling / cutting regime and / or chemical treatment may be required post construction to ensure full exhaustion of the bulb / seed bank.

5.3.5.5 New Zealand pigmyweed (*Crassula helmsii*)

The trade and potential escape of New Zealand pigmyweed through the aquarium and garden industry is considered the principal vector for the introduction of this species into new locations, particularly discarded material. Once established, it can readily spread resulting in a threat to native biodiversity, where the plant can form monocultural masses. It does not reproduce from seed, but readily grows from small stem fragments (~5mm (millimetres) in length). It does not like shaded areas, and where present, can thrive in open, slow-moving waters and ponds. It responds well to nutrient enrichment, particularly nitrate enhancement.

Three forms of the plant are recognised, namely submerged, emergent, and terrestrial, with emergent and terrestrial forms easily identified. It is considered to be extremely difficult and costly to control, particularly where large monodominant stands occur, and its ability to form new plants vegetatively from small fragments facilitates its spread to new locations. Management of infestations may be managed through a range of measures, although it is recognised that it is very difficult to fully eradicate unless a catchment- based approach is taken. It is also noted that physical / chemical management is avoided in late summer and autumn.

Table 5.11 presents an assessment of potential treatment options available for the treatment of New Zealand pigmyweed.

Table 5.11: Assessment of Management Methods for New Zealand pigmyweed

Approach	Treatment Options Potential Actions	Comment	Potential for Implementation on the Proposed Scheme
Physical	Dredging	Dredging of material including soils (between October to March) followed by off site composting or incineration. Up and downstream areas would need to be fully enclosed with fine net to captures released material. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species and contaminated soil off site.	Possible but unlikely. Onerous to undertake and efficacy is considered low unless strictly applied, as it could result in further spread.
	Burying	Drying out the waterbody followed by burial (February to March) in excess of 20cm (centimetres) of collected dredged material.	Considered successful, when combined with chemical treatment but usually applied to ponds etc. Not possible if canal navigation to be retained and other species of note e.g. <i>Groenlandia densa</i> potentially present.
	Hand pulling	Up and downstream areas would need to be fully enclosed with fine net to capture released material. Collected material (All year – if plant is visible) could be composted off site or sent for incineration.	Only suitable for areas that can be contained e.g. water flow unhindered despite area being netted. Submerged material may be overlooked.

Approach	Treatment Options Potential Actions	Comment	Potential for Implementation on the Proposed Scheme
		In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species and contaminated soil off site.	
	Covering site	Cover with black polythene or a similar material to shade the plant for at least three months, but preferably six. Has been demonstrated to work for other submerged species e.g. <i>Lagarosiphon</i> , but untested for <i>Crassula</i> .	Unlikely - given the nature of <i>Crassula</i> , treatment likely for small discrete infestation only. Would be very onerous to cover submerged infested area with jute/polythene to shade outgrowth for 3 months plus. Could locally alter the area to detriment of native biodiversity. Does not confirm that dormant submerged material would not become established after removal of covering.
	Saltwater inundation	Flood affected areas with saltwater for a minimum of 31 days.	Only suitable for areas near the sea and where saline water can be prevented from flowing off. Not suitable in freshwater systems, where other native species would not tolerate saline conditions.
Chemical	Knapsack sprayer	Chemical treatment can be made in the April to November. Multiple applications within a season are not usually required if applied at the appropriate time and no further physical disturbance of the treated population occurs. Chemical treatments for infestations should be rated for use near aquatic locations.	Possible, but only captures emergent and terrestrial forms. Emergent form where present would remain untreated.
Environmental		Steepening banks, increasing the shading of the area and introducing fast growing, native species have all been shown to be effective in certain situations, particularly when used in conjunction with other methods above.	Unlikely given the nature of the project

Other options for which unconfirmed data is available or licensed to release biological controls are not yet approved and have been discounted from assessment as potential control methods. They include grazing by introduced Grass carp (a non-native fish species), the release of Gall forming mites (currently at EU approval stage), hot foam and hot water, and drying out the ground.

Although this species was not found present within the footprint of the Proposed Scheme during surveys, measures for addressing this species are covered within this ISMP on a precautionary approach, as it is known in the wider area and in the event that it becomes established within the Proposed Scheme area between the surveys taking place and construction commencing.

A pre-construction survey will be required in advance of works. Given that the presence of submerged vegetation is difficult to note and can be overlooked if dormant, the ISMP will detail the measures that are applicable for all works affecting water bodies. The key element for the Proposed Scheme will be the avoidance, as far as practical, of unnecessary disturbance of water body edge and sediments. Thereafter, standard environmental measures will be applied. This will include rigorous application of biosecurity measures for all plant / equipment brought onto or near water bodies and again before moving to another area. No instream works will be permitted where this species is found present unless specific precautions and control measures have been clearly identified and implemented, to reduce for potential disturbance of riparian vegetation (where it occurs).

5.3.5.5.1 Temporary Storage of Collected Material

If this non-native invasive species is found present, all material, where not disposed of immediately to authorised facilities, will be double bagged and placed in dedicated quarantine areas (away from watercourses) to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.3.5.6 Canadian Pondweed (*Elodea canadensis*) & Nuttall’s pondweed (*Elodea nuttallii*)

Both species are regarded as perennials, overwintering in the deeper water, and reproducing asexually. Disturbance increases the dispersal of a considerable number of propagules and the vigorous re-growth is enhanced through changes in availability of nutrients. In Ireland, although both are ranked as a medium risk plant, they are both ranked as highly invasive. Both species have a wide ecological tolerance and can grow relatively fast, resulting in displacement of native flora. The plant can form dense mats which outcompete native plant species and therefore decrease the biodiversity in an area, as well as interfering with navigation and recreational activities on watercourses.

Although, not considered as widespread as Canadian pondweed, Nuttall’s pondweed is nonetheless spreading, and in the UK and Ireland is regarded as now displacing the former, possibly due to increased eutrophication. Nuttall’s pondweed is also more tolerant of poorer water quality, disturbance, and poorly implemented management such as navigation clearance. Both share many of the same attributes and are usually found in deeper water, rooted in sediment these pondweeds can be free floating in water column if disturbed.

Table 5.12 presents an assessment of potential treatment options available for the treatment of both pondweeds.

Table 5.12: Assessment of Management Methods for New Zealand pigmyweed

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Draw down	Some studies indicate success where water levels can be dropped and sediments dried out, that this can be effective	Not likely, given the nature of the Proposed Scheme and the likely occurrence of this species further up the canal which could result in later reestablishment.
	Cutting	By hand or on specially adapted barges. Best undertaken before July, Repeat harvesting can result in nutrient depletion (if source of eutrophication into watercourse controlled). This is a longer-term solution that would require careful implementation to ensure no unnecessary spread of material.	This is long-term solution would require commitment from NTA and other stakeholders to undertake.
	Covering site	Cover with Jute or a similar material to shade the plant. Has been demonstrated to work for other submerged species e.g. <i>Lagarosiphon</i> , and a DCC sponsored project on the use of jute matting undertaken on parts of the River Liffey between Islandbridge and Chapelizod.	Possible but unlikely - given the nature of <i>Elodea</i> , and its potential distribution elsewhere could be onerous in terms of project timeframes and difficult to cover submerged infested area with jute to shade-out growth. Would not guarantee prevention of re-establishment and would require pollution sources to be addressed to reduce eutrophication.
Environmental	Water dyes	Both species can tolerate some shade of deeper water, but water dyes have been found to be effective in static waters. Additional landscape planting to increase shade are considered to be effective.	Not likely given the location of the canal in highly populated area, unless a well-developed PR campaign is put in place to explain. Potential for landscape planting is also limited by virtue of location and space requirements.
Chemical	There is currently no herbicide product approved for treatment of submerged macrophytes such as <i>Elodea</i> spp.		

Other options for which unconfirmed data is available or licensed to release biological controls are not yet approved and have been discounted from assessment as potential control methods. They include biological control through the introduction of grass carp (a non-native fish) and other bottom feeders.

Although these species were not found present within the footprint of the Proposed Scheme during surveys, measures for addressing these species are covered within this ISMP on a precautionary approach, as they are known in the wider area and in the event that they become established within the Proposed Scheme area between the surveys taking place and construction commencing. A pre-construction survey shortly in advance of works will be required. Given that the presence of submerged vegetation is difficult to note and can be overlooked if dormant, the ISMP will detail the measures that are applicable for the duration of works at water body crossings. The key element for the Proposed Scheme will be the avoidance, as far as practical, of unnecessary disturbance of any water body edge and sediments. Thereafter, standard environmental measures will be applied. This will include rigorous application of biosecurity measures for all plant / equipment brought onto or near the water-feature and again before moving to another area. No instream works will be permitted where these species are

found present unless specific precautions and control measures have been clearly identified and implemented, to reduce for potential disturbance of riparian vegetation (where it occurs).

5.3.5.6.1 Temporary Storage of Collected Material

If these non-native invasive species are encountered, all material, where not disposed of immediately to authorised facilities, will be double bagged and placed in dedicated quarantine areas (away from watercourses) to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.4 Surface Water Management Plan

5.4.1 Introduction

This Surface Water Management Plan (hereafter referred to as the SWMP) for the Proposed Scheme details the control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase.

The control and management measures are best practice approaches that can be used to protect surface water during the Construction Phase of the Proposed Scheme.

5.4.1.1 Objectives

The objectives of the SWMP are to:

- Ensure sediment and pollution control requirements can be built into the design stage and land requirements for the Proposed Scheme as far as practicable;
- Minimise, and where possible, avoid potential for sediment, silty water, and other contaminants such as oil, fuel, concrete, cement, and other materials to discharge to a watercourse;
- Minimise the area and duration of exposed ground which has the potential to create runoff; and
- Minimise any potential impacts in the event of an accidental spillage or site runoff by providing appropriate control and containment measures on-site and by maintaining sediment and pollution controls throughout the Construction Phase of the Proposed Scheme.

5.4.1.2 Guidance

The SWMP and the control and management measures relating to surface water management have been prepared with regard to the following guidance documents, where relevant:

- Construction Industry Research and Information Association (CIRIA) Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (CIRIA 2001);
- Best Practice Guide BPGCS005 – Oil Storage Guidelines (Enterprise Ireland 2003);
- PUB C650 Environmental Good Practice on Site, 2nd Edition (CIRIA 2005);
- Control of Water Pollution from Linear Construction Projects. Technical Guide (C648) (CIRIA 2006a);
- Control of Water Pollution from Linear Construction Projects. Site Guide (C649) (CIRIA 2006b);
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (NRA 2006a);
- S.I. No. 291 of 2013 - Safety, Health and Welfare at Work (Construction) Regulations 2013;
- Design Manual for Roads and Bridges Part 3 DN-DNG-03022 (NRA HD 33/15) (Including Amendment No. 1) (TII 2015a);
- Road Drainage and the Water Environment DN-DNG-03065 (TII 2015b); and
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland 2016).

5.4.1.3 Scope

Table 5.13 provides the contents of the SWMP, and where details can be found in this document.

Table 5.13: SWMP Contents

Content	Section of SWMP
Introduction	5.4.1
Roles and Responsibilities	5.4.2
Environmental Incident Response Plan	5.4.3
Control and Management Measures	5.4.4
Construction Compounds	5.4.5.1
Control of Sediment	5.4.5.2
Use of Concrete	5.4.5.3
Vehicles and Plant	5.4.5.4
Inspections of Water Bodies	5.4.6

5.4.1.4 Potential Sources of Water Pollution

The main activities / areas where sediment and surface water runoff and pollution generation have the potential to arise include the following:

- Earthworks – including planing, excavation and processing, transportation of materials (within and outside of the Proposed Scheme), and deposition of materials and temporary stockpiling (if required). The most significant area of concern regarding sediment control for the Proposed Scheme is when existing low porosity surfaces (existing roads and footpaths) are removed, and the underlying granular layers are disturbed and exposed. Typically, these surfaces are likely to be exposed during the following activities associated with the Proposed Scheme:
 - The preparatory and site clearance works, particularly topsoil stripping; and
 - Tracking of machinery.
- Construction of structures and concreting activities – concrete, grout and other cement-based products which would typically be used in the construction of structures, and carriageway and pavement works are highly alkaline and can generate very fine, highly alkaline silt (11.5 pH);
- Watercourse crossings, in-stream works and riverbank works – there is a higher likelihood of impacts on water quality when construction is taking place over or near surface waters (e.g. the New and Relocated Bridges at George’s Dock (Structure Reference: 01) over River Liffey and at Royal Canal (Structure Reference: 04) over River Liffey and Royal Canal, the Boardwalk (at DCC Docklands Offices) (Structure Reference: 02) over River Liffey and North Wall Quay (Structure Reference: 03) over River Liffey, Dodder Public Transport Opening Bridge (Structure Reference: 05) over River Dodder and River Liffey; and
- Construction Compounds and machinery refueling areas.

Section 5.4.4 details mitigation measures which will be implemented where practicable to reduce the likelihood of the pollution events occurring during the Construction Phase.

5.4.2 Roles and Responsibilities

The roles and responsibilities of key stakeholders are discussed in Section 5.1.5. The EM, or equivalent, will ensure the successful development, implementation, and maintenance of the SWMP.

5.4.3 Environment Incident Response Plan

An Environmental Incident Response Plan (EIRP) has been prepared in Section 5.6 to ensure that, in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for the particular circumstances. The EIRP includes measures to address surface water related incidents such as accidental spillages of noxious substances (e.g. oil and significant releases of sediment or concrete washings). The EIRP details are not repeated in this section of the CEMP. However, it should be read in conjunction with the general measures set out in the SWMP.

5.4.4 Site Specific Control Measures

Following implementation of the general mitigation measures, the majority of impacts will be not significant. However, there are some construction activities at the following locations which will require additional site-specific measures:

- New and Relocated Bridges at George's Dock (Structure Reference: 01) and at the Royal Canal (Structure Reference: 03);
- Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02); and
- Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 04).

5.4.4.1 New and Relocated Bridges at George's Dock (Structure Reference: 01) and at Royal Canal (Structure Reference: 03)

The main concerns relating to the structures at George's Dock and Royal Canal are as a result of overland runoff of surface water carrying debris, silt, and concrete washings. There is also the potential for hydrocarbon contamination from vehicles and plant. These will largely be addressed through the general mitigation measures, however the pouring of concrete associated with the replacement carriageway bridge directly over the Royal Canal means additional measures are required. The pouring of concrete will take place in dry weather only. Silt fences or similar will be installed to prevent overland flow into the Royal Canal or the Liffey Estuary Lower. Other general water protection principles as set out in the SWMP will apply.

5.4.4.2 Custom House Quay Boardwalk (at DCC Docklands Offices) (Structure Reference: 02)

The three piles to support the pedestrian boardwalk will be hollow steel tubes. As a result, this means they will not result in the displacement of material from the estuary bed which could create a preferential pathway for historic contaminants.

For associated works to the quay wall to secure the boardwalk to the DCC Docklands Offices building, sheeting will be attached below the area of works to catch any debris. In-channel and river bank working general principles will apply, in addition to the following:

- The steel piles may be driven from the landside if feasible, reducing the need for machinery in the water;
- All construction machinery operating within or close to any water body will be mechanically sound to avoid leaks; and
- The area of disturbance of the watercourse bed and bank will be the absolute minimum required for the installation of the piles.

5.4.4.3 Dodder Public Transport Opening Bridge (DPTOB) (Structure Reference: 04)

The main control measures for works to construct the DPTOB are the installation of coffer dams for the bridge itself and sheet piling for the reclaimed land. Once dewatered internally, these allow the construction to be undertaken in a dry area and minimise the potential for contaminants entering the water body.

The coffer dams and area behind the sheet piling will be dewatered via silt-buster tanks (or similar) and discharged directly to the estuary. The appointed contractor will liaise with the suitably qualified ecologist and / or environmental specialist engaged by them to ensure that any required permits / licences are obtained.

Any requirement to rescue fish or other fauna during this process will be carried in a manner as specified in Chapter 12 (Biodiversity) in Volume 2 of this EIAR. As the water level approaches the estuary bed, there is a greater risk of disturbing sediments. At this point the rate of emptying will be slowed to allow the silt-buster tanks to continue to operate efficiently.

The dynamic nature of the waterbody in this area i.e. estuarine would result in varied level of suspended solids depending on the time of year and weather conditions. Therefore, the NTA will ensure that monitoring will be carried out monthly for a period of at least six months prior to the commencement of construction at this location, in the manner and of a frequency necessary to inform any applications for permits or licenses to discharge that

may be required. The NTA will also ensure that any discharges from the coffer dam will comply with conditions set out in all relevant permits and licenses.

5.4.4.4 Construction Compounds

Construction Compound R1 and Construction Compound R2 have limited ability to impact upon nearby water bodies. The general measures for the Construction Compounds as set out in Section 5.4.5 are sufficient to control these potential impacts, and no additional measures are required.

Activities within the Construction Compounds on either side of the DPTOB (Construction Compound R3 and Construction Compound R4) will be largely controlled as set out in the general measures in Section 5.4.5. In addition, all surface water drains in the vicinity will be identified and either stopped up or bunded on the side closest to both Construction Compounds. A cutoff drain or equivalent measure, and a silt fence will be installed along the estuary side of the Construction Compounds. The appointed contractor will ensure that appropriate spill control equipment is available (e.g. a suitably sized floating boom), to control any spillages to the river should a spillage occur. The EIRP (Section 5.6), will apply for the management of any incidents that may occur.

5.4.5 Control and Management Measures

5.4.5.1 Construction Compounds

5.4.5.1.1 Construction Compound Establishment

All surface water runoff will be intercepted and directed to appropriate treatment systems / settlement facilities for the removal of pollutants prior to discharge.

5.4.5.1.2 Security

The Construction Compounds will be fenced off, lit (during working hours) and secured with Closed-Circuit Television (CCTV), to ensure safe storage of all material, plant and equipment, if required, to prevent acts of vandalism that could result in leaks or spills from materials.

5.4.5.1.3 Welfare and Sanitary Facilities

The Construction Compounds will be engineered with appropriate services as discussed in Section 5.7 in Chapter 5 (Construction) in Volume 2 of this EIAR. Water and wastewater disposal etc. will be organised by the appointed contractor. At work areas along the Proposed Scheme, where permanent provisions (for the duration of the construction programme) are not practicable, appropriate temporary provisions will be made. Temporary welfare facilities will need to be used, for example, portable toilets in the vicinity of works. Welfare facilities will discharge wastewater either to an existing sewer, with the permission of the sewerage undertaker, or will be collected and disposed of in an appropriate manner to a suitably licensed facility off site to prevent water pollution and in accordance with the relevant statutory requirements.

5.4.5.1.4 Fuel Storage

- All hydrocarbons used during the Construction Phase will be appropriately handled, stored, and disposed of in accordance with recognised standards as laid out by the EPA;
- All chemical and fuel filling locations will be contained within signposted, designated bunded areas, a minimum of 10m from any surface water drain or watercourse;
- At the Construction Compounds, where the site is pervious, an area of hard standing will be installed in a demarcated area for refueling, and vehicle / plant cleaning and service areas. This area will be drained to a soakaway if possible, or to local surface water drains, with the permission of the asset owner;
- Suitable precautions will be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans) including:
 - Each container or piece of equipment will be stored in its own drip tray made of a material suitable for the substance being handled;

- Spill kits and drip trays will be provided for all equipment and at locations where any liquids are stored and dispensed, and staff will be trained on the procedures to be followed; and
- Containers and equipment will be stored on a firm, level surface.
- Procedures and contingency plans will be in place at each works area to address the cleaning up of small spillages as well as dealing with an emergency incident (see Section 5.6). A stock of absorbent materials such as sand, spill granules, absorbent pads and booms will be kept at each work site, on plant working near water and particularly at refueling areas and where fuel or oil is stored;
- When working in or in close proximity to watercourses, an absorbent containment boom will be installed across the watercourse or around the works, securely and closely anchored to the banks or working platform;
- The storage of fuels, other hydrocarbons and other chemicals within the Construction Compounds shall be in accordance with relevant legislation and best practice. In particular:
 - Fuel tanks, drums, and mobile bowsers (and any other equipment that contains oil and other fuels) will be housed within a bund of at least 110% capacity of the fuel tank itself or at least 25% of the total volume of the containers, whichever is greatest. The fuel tank will be double skinned. There will be no passive drainage from the bund; any water collected within it will be pumped out and removed off site for disposal; and
 - Any designated area or areas for oils, fuel, chemicals, hydraulic fluids, etc. storage and refueling will be set up at least 10m from any surface water drains or watercourses (as per CIRIA guidance listed in Section 5.4.1.2) and the storage location within the Construction Compounds shall be organised so as to be as far away from surface water drains or watercourses as is practicable to minimise risks from leaks and spills.
- Storage areas will be covered, wherever possible, to prevent rainwater filling the bunded areas;
- Fuel fill pipes will not extend beyond the bund wall and will have a lockable cap secured with a chain;
- Where fuel is delivered through a pipe permanently attached to a tank or bowser:
 - The pipe will be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use;
 - The pump or valve will be fitted with a lock;
 - The pipe will be fitted with a lockable valve at the end where it leaves the tank or bowser;
 - The pipework will pass over and not through bund walls;
 - Tanks and bunds will be protected from vehicle impact damage;
 - Tanks will be labelled with contents; capacity information and hazard warnings; and
 - All valves, pumps and trigger guns will be turned off and locked when not in use. All caps on fill pipes will be locked when not in use.

5.4.5.1.4.1 Storage of Materials and Waste

The Construction Compounds will operate a 'Just In Time' approach, where practicable, for material deliveries to minimise the amount required to be stored. Where material is required to be stored:

- Storage areas will be at least 10m from surface water drains or watercourses;
- Storage areas for solid materials, including waste soils (where applicable), will be designed and managed to prevent deterioration of the materials and their escape (via surface runoff or wind blow);
- Storage areas will be kept secure to prevent acts of vandalism that could result in leaks or spills; and
- All containers of any size will be correctly labelled indicating their contents and any hazard warning signs.

A register of all hazardous substances, which will either be used on-site or expected to be present (in the form of soil and / or groundwater contamination) will be established and maintained. This register will be available at all times and shall include as a minimum:

- Valid Material Safety Data Sheets (MSDS);

- Health and safety and environmental controls to be implemented when storing, handling, using and in the event of spillage of materials;
- Emergency response procedures / precautions for each material; and
- The Personal Protective Equipment (PPE) required when using the material.

Waste may be stored at the Construction Compounds for a limited amount of time to help to limit the number of vehicle movements to and from site, as far as possible, to minimise effects on the local roads. Where waste is required to be stored:

- It will be stored in secure designated areas, in enclosures or containers to prevent material being dispersed by the wind;
- Designated areas will be sited at least 10m away from surface water drains or watercourses to limit the risk of escape and contamination of watercourses;
- Waste storage containers will be labelled with their waste type and their List of Waste (LoW) code. Any labelling will be consistent with Industry Best Practice at the time construction commences and reviewed annually;
- Liquid wastes will be stored in containers within bunded zones with secondary containment of at least 110% capacity of the largest container or at least 25% of the total tank capacity inside the bunded zone (whichever is the greatest); and
- Incompatible or hazardous wastes will be stored and handled in accordance S.I. No. 324/2011 - European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011.

5.4.5.2 Control of Sediment

There are a number of sources of sediment or silt-laden water on a construction site, including silty 'runoff' from stripped soils; and the stockpiling of soils. Control measures for each of these will be provided.

5.4.5.2.1 Construction Sequencing – Installation of Drainage Features

In order to protect water bodies from potential impacts, such as increased volumes of runoff, silty water and accidental spills, temporary drainage control measures will be installed at the outset, prior to any site clearance works. This will include measures such as construction of cut-off ditches, silt fences erected and the set-up of settlement tanks.

5.4.5.2.2 Silty Water Runoff

- Clearing and stripping of topsoil or existing roads and footpaths exposing underlying granular layers at each phase of works will be delayed as long as possible, being carried out shortly before construction begins;
- Cut-off ditches, berms or diversion channels will be utilised around working area boundaries, where possible, to limit surface water entering the excavated areas and silty water running off the site into surface water drains or watercourses;
- Silt fences will be installed / erected along the boundary of the Construction Compounds and around surface water drains or watercourses to prevent any silt laden runoff from impermeable surfaces; and
- Weather conditions will be taken into account by the appointed contractor when planning construction activities to minimise the risk of silty water runoff from the site.

5.4.5.2.3 Stockpiling Material

- Clearing and stripping of topsoil or existing roads and footpaths exposing underlying granular layers at each phase of works will be delayed as long as possible, being carried out shortly before construction begins rather than stripping the whole site many months before construction;
- Where an excavation contains a combination of acceptable and non-acceptable material for reuse, the excavation will be conducted so that the acceptable material is excavated and stockpiled separately without contamination by the unacceptable material;
- Temporary stockpiles will be located away from surface water drains or watercourses at a minimum distance of 10m;

- The topsoil, and upper level of subsoil, will be stripped and stockpiled in identified locations;
- For watercourse crossings, stockpiles will not be located anywhere within the crossing working area;
- No stockpiles will be located within a European or National designated site or within a floodplain area;
- Management of stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be required with the final measures to be determined by the appointed contractor. These will include the following measures or equivalent measures:
 - Allowing the establishment of vegetation on the exposed soil;
 - Providing silt fences or straw barriers at the toe of the stockpile to mitigate runoff during rain events;
 - Surrounding stockpiles with cut-off ditches to contain runoff;
 - Directing any runoff to the site drainage system or filter drains along the construction working width and to the settlement pond (or other) treatment systems; and
 - Providing bunds or another form of diversion to keep runoff from entering the stockpile area.

5.4.5.3 Use of Concrete

- The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Alternate construction methods are encouraged, for example, the use of pre-cast concrete or permanent formwork will reduce the amount of in-situ concreting required;
- Weather conditions will be taken into account when planning construction activities which require the use of wet concrete to minimise the risk of the runoff of concrete 'washout' from site;
- Where concrete batching is proposed by the appointed contractor, this activity will be carried out at least 10m from surface water drains or watercourses. Washout from such mixing plant will be carried out only in a designated contained impermeable area;
- Batching and mixing activities and material storage areas will be located at least 10m (as per CIRIA guidance listed in Section 5.4.1.2) away from surface water drains or watercourses;
- Chute washout will be carried out at designated locations only, at least 10m from surface water drains or watercourses. These locations will be signposted throughout the construction works areas. Chute washout locations will be provided with appropriate designated, contained impermeable areas and treatment facilities including adequately sized settlement tanks;
- The clear water from the settlement tanks shall be pH corrected prior to discharge to any surface water drains or watercourses;
- There will be no hosing of concrete, cement, grout, or similar material spills into surface water drains or watercourses. Such spills shall be contained immediately, and runoff prevented from entering the watercourse; and
- Discharge of washout water to wastewater (foul) sewer will only be carried out with the express permission of the sewerage undertaker and will be treated to the standard required, for example, because of its high pH (alkalinity), washout water may need treatment before disposal to the foul sewer.

5.4.5.4 Vehicles and Plant

- Vehicles and plant provided for use on the Proposed Scheme will be in good working order to ensure optimum fuel efficiency, and will be regularly inspected to ensure they are free from leaks and are promptly repaired when not in good working order;
- Spill kits will be carried on all vehicles;
- Vehicles and plant will not park near or over surface water drains or watercourses;
- Refueling of vehicles and plant will be carried out on hard standing surfaces, using drip trays to ensure no fuel can contaminate the ground outside of the bunded areas;
- For deliveries and dispensing activities, the appointed contractor will ensure that:
 - Site-specific procedures are in place for bulk deliveries;
 - Delivery points and vehicle routes are clearly marked; and
 - Emergency procedures are displayed, and a suitably sized spill kit is available at all delivery points, and staff are trained in these procedures and the use of spill kits.

- The appointed contractor will provide wheel washing facilities, and any other necessary measures to remove mud and organic material from vehicles, at the Construction Compounds, where necessary. These will be located at least 10m away from any surface water drains or watercourses;
- The cleaning of delivery trucks shall be carried out at the Construction Compounds and shall not be undertaken at the works areas;
- The surface runoff from vehicle washing areas will be directed to an on-site treatment system where possible. This will also increase the potential for reusing the water. Such a treatment system would typically include:
 - A settlement lagoon to remove suspended solids such as mud and silt; and
 - Catchpits or silt traps on drains, ensuring that they are in place during cleaning and that they are emptied at regular intervals;
- The use of detergents in the cleaning process will be minimised, where required. Biodegradable and phosphate-free detergents will be used;
- Where detergents are used in the washing process, the wash water will be contained in a containment tank prior to disposal off site using a suitable licensed waste disposal operator, or if a foul or combined sewer is nearby, the surface runoff could be directed to it, with the permission of the sewerage undertaker; and
- To further minimise water used for washing vehicles, trigger-operated spray guns will be used, with an automatic water supply cut-off.

5.4.6 Monitoring of Water Bodies

The appointed contractor shall carry out visual monitoring of surface water control measures (settlement tanks, silt fences, fuel storage areas etc.) on a daily basis. In addition, weekly visual inspections of all of the water bodies crossed by the Proposed Scheme will be carried out by the appointed contractor.

Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface; and
- Floating detritus, or scums and foams.

If hydrocarbons are observed or other water quality parameters are suspected to have been exceeded, an investigation will be carried out to determine whether any element of the construction of the Proposed Scheme could be causing the contamination. If any potential sources of contamination are observed, appropriate actions will be taken (depending on the source and nature) to prevent further contamination and the incident shall be recorded and investigated in more detail to prevent a recurrence. If required, the relevant regulatory authorities will be informed.

5.5 Construction and Demolition Resource and Waste Management Plan

5.5.1 Introduction

This Construction and Demolition Resource and Waste Management Plan (CDRWMP) has been prepared to ensure that waste arising during the Construction Phase and Demolition Phase of the Proposed Scheme, will be managed and disposed of in a way that ensures compliance with the provisions of the Waste Management Act, as amended, and associated Regulations to ensure that optimum levels of reduction, reuse and recycling are achieved. The purpose of this CDRWMP is to facilitate reuse and recycling and divert waste from landfill.

The CDRWMP is consistent with best practice management practices and any relevant mitigation measures as contained within the EIAR. The content and headings used in this CDRWMP comply with the EPA Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects (EPA 2021).

This CDRWMP is based on the estimated quantities of waste generation and the proposed management measures from the Proposed Scheme at planning stage.

5.5.1.1 Legislation, Policy and Guidance

Resource and waste management takes place in a legislative and policy framework. Applicable legislation, policy and best practice guidance was reviewed during the preparation of the CDRWMP. The key components of European Union (EU), national and local policy, legislation, and guidance relevant to proposed construction and demolition (C&D) waste are summarised as follows:

- Prevention and minimisation of waste is the preferred option;
- Where C&D waste is generated, it should be source separated to facilitate reuse and recycling and to maximise the diversion of waste from landfill;
- Where waste may not be prevented or recycled, it should be transported and disposed of in accordance with applicable legislation and without causing environmental pollution; and
- Waste may only be transferred by a waste collection permit holder and delivered to an authorised waste facility.

5.5.1.1.1 Legislative Context

The EPA Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects (EPA 2021) states that a plan is mandatory for all C&D projects, as best practice to inform the planning consent process. At planning stage, it is estimated that the Proposed Scheme will generate more than 100m³ (metres cubed) in volume of C&D waste, through demolition. Therefore, to comply with these guidelines, a Tier 2, bespoke C&D Plan has been prepared (this CDRWMP).

5.5.1.1.2 Guidance

An overview of relevant legislation, policy and best practice guidance related to waste management is presented in Appendix A18.1 Legislation and Policy in Volume 4 of this EIAR. However, the main guidance documents used in the preparation of the CDRWMP were:

- The Eastern Midlands Region Waste Management Plan 2015-2021 (Eastern Midlands Waste Region 2015);
- EU Construction and Demolition Waste Management Protocol (European Commission 2018);
- Construction & Demolition Waste Soil and Stone Recovery / Disposal Capacity (Update Report 2020) (Regional Waste Management Offices 2020);
- The Department of Communications, Climate Action and Environment (DCCA) A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020-2025 (DCCA 2020);
- Circular Economy Action Plan, For a Cleaner and More Competitive Europe (European Commission 2020);
- Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction and Demolition Projects (Draft for Public Consultation) (EPA 2021);
- The Circular Economy Programme 2021-2027 (EPA 2021b);
- Department of Environment, Climate and Communications (DECC) Whole of Government Circular Economy Strategy 2021-2022 (Pre-Consultation Draft) (DECC 2021a); and
- Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less' (DECC 2021b).

5.5.1.1.3 Sustainable Resource and Waste Management Principles

As stated in Section 18.2 in Chapter 18 (Waste & Resources) in Volume 2 of this EIAR, the principal objective of sustainable resource and waste management is to use resources more efficiently, where the value of products, material and resources is maintained in the economy for as long as possible such that the generation of waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy.

As stated in the Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020-2025:

'In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value' (DCCAE 2020).

The Circular Economy Action Plan, For a Cleaner and More Competitive Europe notes that:

'the EU needs to accelerate the transition towards a regenerative growth model that gives back to the planet more than it takes, advance towards keeping its resource consumption within planetary boundaries, and therefore strive to reduce its consumption footprint and double its circular material use rate in the coming decade' (European Commission 2020).

However, where residual waste generation is unavoidable, it will be dealt with in a way that follows the waste hierarchy (as shown in Section 18.2 in Chapter 18 (Waste & Resources) in Volume 2 of this EIAR). The waste hierarchy supports the need to achieve efficient use of material resources, minimise the amount of waste produced (or otherwise increase its value as a resource) and reduce, as far as possible, the amount of waste that is disposed to landfill.

The Whole Government Circular Economy Strategy 2022-2023 (DECC 2021b), sets out a policy framework for transitioning to a circular economy, including measures to reduce the circularity gap, raise awareness and support investment into circular initiatives and to identify barriers.

5.5.1.1.4 Waste Management Target

Ireland achieved 82.4% material recovery of C&D waste in 2019, as stated in the EPA National Waste Statistics, Summary Report for 2018 (EPA 2021b). Under Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives and Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (hereafter referred to as the Waste Framework Directive), EU Member States must achieve 70% of material recovery of non-hazardous and non-soil-and-stone C&D waste by 2020.

Every effort will be made to achieve the required level of material recovery of C&D waste as part of the Proposed Scheme. A baseline of available waste capacity for 2020 was calculated in Chapter 18 (Waste & Resources) in Volume 2 of this EIAR and summarised in Table 5.14. This data has been used to establish a baseline for 2020. The available C&D waste and by-product capacity in the EMWR for 2020 is approximately 11.7 million tonnes based on the following assumptions:

- Using the available capacity for permitted facilities for C&D wastes;
- Including only licensed facilities accepting soil and stones; and
- Including all Article 27 notifications dated 2020 in the EMWR.

Table 5.14: C&D Waste Management Baseline for EMWR, 2020 (Permitted, Licensed and Article 27 Notifications)

C&D Waste Management Baseline for 2020	Capacity / Annual Intake (Tonnes)
Permitted capacity (Regional Waste Management Office (Offaly County Council 2022)	5,336,915
Licensed annual intake (soil and stone facilities) (EPA 2022c)	3,893,800
Article 27 (by-product) notifications (EPA 2020)	2,504,482
Total	11,735,197

5.5.2 Proposed Scheme Description

Information on the Proposed Scheme will be included in this Section of the CDRWMP. This information will assist those without detailed knowledge of the Proposed Scheme in quickly familiarising themselves with the key elements of the Proposed Scheme and will also assist those who have a need to examine, review or audit the CDRWMP.

Details will include a description of the key elements of the Proposed Scheme, an overview of the main works required at each section, the construction programme, construction methodology, plant and equipment

requirements, details on the Construction Compounds, construction traffic management measures, and interfaces with other projects.

5.5.3 Roles and Responsibilities

The roles and responsibilities of key stakeholders are discussed in Section 5.1.5. The appointed contractor will appoint a suitably qualified person to maintain the CDRWMP, who will be responsible for the following:

- Detailing and maintaining the CDRWMP, and updating it as appropriate;
- Following each update or revision of the CDRWMP, providing the CDRWMP to the NTA, appointed contractor and all relevant personnel;
- Ensuring that all personnel are instructed about the objectives of the CDRWMP and informed of the responsibilities which fall upon them as a consequence of its provision. This will be carried out during the induction process for new personnel;
- Communicating the requirements of the CDRWMP using for example, toolbox talks, prominently displayed notices and audits as relevant;
- Implementing the CDRWMP throughout the Demolition, Excavation, and Construction Phases of the Proposed Scheme; and
- Ensuring, where training is required regarding the handling and management of wastes on-site, that this is provided, where required.

The appointed contractor and all personnel handling wastes must be in a position to:

- Distinguish reusable materials from material suitable for recycling;
- Ensure maximum segregation of waste and recyclables at source;
- Co-operate with the appointed contractor on best locations for stockpiling reusable material;
- Separate material for recovery; and
- Identify and liaise with operators of recovery outlets as appropriate.

Copies of the CDRWMP will be made available to all relevant personnel.

5.5.3.1 Auditing

Resource audits will be conducted during the Construction Phase. The quantity and types of waste and materials leaving site during the Construction Phase will be recorded. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity to each facility. Records will show material, which is recovered, which is recycled, and which is disposed of.

These audits will cover work practices, record keeping, and off site tracking as follows:

- Periodic audits and inspections of work practices to assess compliance with the CDRWMP. The audit protocol will be risk based and focus on key issues of concern;
- A review of all records of wastes and resources generated on-site and transported off site periodically throughout the Construction Phase. If waste movements are not accounted for, the reasons for this are to be established to understand why the record keeping system has not been maintained and implement corrective actions if needed;
- The resource records will be compared with established targets for the site (e.g. reuse of resource target or recycling of waste target);
- Examining material management on-site to determine where the largest percentage residual waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how project contract targets can be achieved; and
- Issue corrective actions (training, penalties, etc.) as required to site operatives where deviations of the CDRWMP are observed.

5.5.3.2 Tracking and Tracing

The appointed contractor is required to maintain records for all resource material which is used on-site and leaves the Proposed Scheme, either for reuse, recycling, energy recovery, backfilling or other recovery or disposal on

third party sites. A recording system must be put in place to record residual waste and resources generated on the Proposed Scheme. The type of information to be recorded in the site tracking system is described below:

- For each movement of a resource off site, a signed docket / invoice will be obtained from the haulier / contractor detailing the following:
 - A description of the resource stream;
 - LoW Code for each stream (where applicable); and
 - Validated quantity of material moved off site by the haulier / contractor (typically reported in tonnes).
- The name and authorisation of the haulier to transport the material. In the case of a 'waste' this requires a valid Waste Collection Permit (WCP). In the case of by-product or other materials that are not a waste, no WCP is required. In both cases the vehicle registration number should also be recorded for each load of material removed from site;
- The name and authorisation of the destination site for the resource, again, for a 'waste' this requires a valid Cert of Registration, Waste Permit or Waste Licence, and in the case of a by-product, the relevant by-product determination;
- The waste contractors must be required to provide details of end-use or waste treatment in waste reports;
- This recording will be carried out for each resource type and the system will also be linked with the delivery records. In this way, the percentage of residual resource generated for each material can be determined; and
- The system will allow the comparison of these figures with the targets established for the prevention, reuse and recovery of resources to highlight the successes or failures against these targets.

It is the obligation of the appointed contractor or their appointed person to ensure that all resources taken off site are in line with the relevant legislation and the key area relates to ensuring that hauliers and collection sites have the appropriate authorisations.

5.5.4 Key Materials, Quantities and Costs

5.5.4.1 Introduction

C&D waste is defined as waste which arises from construction, renovation and demolition activities. Typical C&D wastes which are likely to arise during the Construction Phase of the Proposed Scheme are set out in Appendix A18.2 List of Waste Codes for Construction and Demolition Wastes in Volume 4 of this EIAR, including EPA LoW codes.

The most environmentally sustainable means of managing excavated material is its prevention and minimisation. See Section 18.3.5 in Chapter 18 (Waste & Resources) in Volume 2 of this EIAR for the principles of waste management. The appointed contractor will be responsible for the implementation of these for the Proposed Scheme. In recent years there has been a shift in focus on best practice waste management and waste minimisation in construction and an increase in the reuse of construction by-products in projects.

It is expected that materials will be generated by the Proposed Scheme during the following activities:

- Demolition;
- Excavation; and
- Construction.

Likely materials that will be generated during each of these activities are discussed in further detail in Section 5.5.4.2 to Section 5.5.4.5.

5.5.4.2 Demolition Waste Generation

As described in Chapter 5 (Construction) in Volume 2 of the EIAR, the main structures to be demolished along the Proposed Scheme are:

- New and Relocated Bridges at George's Dock (Structure Reference: 01);

- New and Relocated Bridges at Royal Canal (Structure Reference: 04); and
- St Patrick’s Rowing Club at DPTOB (Structure Reference: 05).

A large portion of demolition waste is expected to be inert waste such as concrete, brick and tiles etc. Metal waste will also be generated from demolition. Segregated wood, glass and plastic will also be generated.

The estimated quantity and type of waste that will be generated by demolition activities in connection with the Proposed Scheme is provided in Table 5.15. The estimated 180 tonnes of demolition waste which will be generated as a result of the Proposed Scheme is equivalent to 0.002% of the C&D waste management baseline in the EMWR set out in Table 5.14.

Table 5.15: Estimated Demolition Waste Types and Quantities

Waste Type	Approximate Waste and Material Quantity (Tonnes)
Concrete, bricks, tiles and similar	100
Metals	50
Segregated wood, glass, and plastic	30
Total	180

5.5.4.3 Excavation Waste Generation

Excavation waste will arise from such activities as:

- Excavation of existing carriageways (e.g. road narrowing, removal of islands);
- Excavation of existing footpaths and cycle tracks and pedestrianised areas (e.g. widening, urban realm improvement; and
- Excavation for utility diversions and / or protections.

Excavation material will be generated as a result of the construction of the DPTOB.

The waste types likely to be generated during the Construction Phase are set out in Table 5.16. The total forecast of surplus excavation material from the Proposed Scheme will be 18,000 tonnes and is equivalent to 0.17% of the C&D waste management baseline for the EMWR set out in Table 5.14.

Table 5.16: Summary of Excavation Material Type and Quantities

Materials from C&D Sources	Approximate Waste and Material Quantity (tonnes)
Soil and stone	7,000
Concrete, bricks, tiles and similar	4,000
Bituminous mixtures	7,000
Total	18,000

5.5.4.4 Construction Waste Generation

Construction works, site offices and temporary works facilities are also likely to generate waste. General construction waste can vary significantly from site to site but typically will include the following non-hazardous fractions:

- Soil and stone;
- Concrete, brick, tiles and ceramics;
- Bituminous mixtures;
- Metals;
- Wood;
- Municipal type wastes generated by construction employees; and
- Other.

The hazardous waste streams which could arise from construction activities include the following:

- Waste electrical and electronic equipment (WEEE) components;
- Batteries;
- Asbestos;
- Wood preservatives;
- Liquid fuels; and
- Contaminated soil.

Also included within this definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

The Construction Phase will require the importation of a number of key construction materials for the Proposed Scheme works. This material will include items such as concrete, granular fill / aggregate, bituminous mixtures and structural steel. Table 5.17 provides an estimate of the quantities of the major materials required to complete the Construction Phase of the Proposed Scheme.

Table 5.17: Estimated Quantities of Major Construction Materials Required by the Proposed Scheme

Materials	Estimated Quantity (tonnes)
Bituminous mixtures	20,400
Concrete	36,600
Precast Concrete Kerbs	400
Fill Material	49,000
Brickwork and Blockwork	12
Structural Steel	3,100

In the case of the Proposed Scheme, the most likely type and quantity of general construction waste will be surplus concrete and unusable or damaged pipe segments which may arise on-site. Quantities of these materials are estimated to be small; assumed to be approximately between 5% to 15% of construction material delivered to site, as stated in the Waste and Resources Action Programme (WRAP) Builders: Estimating Waste (WRAP 2014). There is adequate capacity for the management of such wastes (see Table 5.14). Segregation facilities will be provided to ensure that recovery and recycling of such wastes are maximised.

5.5.4.5 Municipal Waste Generation

It is anticipated that there will be approximately 20 to 30, possibly up to 50 at peak, construction staff employed over the Construction Phase of the Proposed Scheme. Small volumes of general municipal wastes will be generated by construction staff during the Construction Phase (e.g. from offices and welfare facilities). Segregation facilities will be provided on the construction site to ensure that recovery and recycling of such wastes is maximised.

5.5.4.6 Costs of Waste Management

While landfill disposal has been the most commonly used method for waste management in Ireland in the past, waste to energy incinerators are also now in operation at Poolbeg, Dublin 4 and in Carranstown, County Meath.

Typically, the current cost of disposal of waste to landfill in Ireland exceeds €170 per tonne. From 1 July 2013 in accordance with S.I. No. 194/2013 - Waste Management (Landfill Levy) (Amendment) Regulations 2013, the 'landfill levy' increased to €75 per tonne for waste disposed to landfill. Disposal of hazardous waste can cost from €350.

In addition to landfill operator fees and landfill levies there are additional costs included in the 'true cost of waste management' including:

- The purchase cost of waste materials (including imported soil);
- Handling costs;
- Storage and transportation costs; and
- Revenue generated from sales.

Therefore, in order to reduce costs associated with waste management, surplus materials should be reused and recycled where possible and materials should be carefully stored and handled to minimise risk of damage.

5.5.5 Waste Management

5.5.5.1 Introduction

The NTA is committed to implementing the principles of sustainable resource and waste management, as set out in Section 5.5.1.1.3. Waste from the Proposed Scheme will be managed in accordance with the principles of a circular economy and the waste hierarchy. Waste disposal will be minimised, in so far as is reasonably practicable, and opportunities for reuse of materials, by-products and wastes will be sought throughout the Construction Phase of the Proposed Scheme.

Following appointment, the contractor will be responsible for maintaining the CDRWMP. It will be at the discretion of the appointed contractor to determine how material from the Proposed Scheme will be managed. It is assumed, as a worst-case scenario, that all excavated soil will be managed or disposed of at an authorised facility, either in Ireland or abroad. However, all of the below options may also be used.

5.5.5.2 Demolition Waste Management

All material generated from the Proposed Scheme will be considered for reuse for construction within the Proposed Scheme or in other construction projects in accordance with Article 27 of S.I. No. 323/2020 – European Union (Waste Directive) Regulations 2020 (hereafter referred to as the Waste Directive Regulations). It will be the responsibility of the appointed contractor to review feasibility of reuse of materials and ensure that the necessary testing is undertaken to demonstrate compliance with Article 27, as appropriate.

Materials will require on-site segregation by waste classification, and if not suitable for reuse, will be delivered to an authorised recycling, recovery or disposal facility.

Where practicable and appropriate, and if in a reusable condition, street and roadside infrastructure such as bus stops, lighting poles, traffic signals, manhole access covers, and signs will be reused within the Proposed Scheme. If not reused, they will be delivered to appropriately authorised recycling or recovery facilities.

Where metal railings and gates are removed, they may have inherent value due to their metal content. These will be delivered for metal recycling to an authorised waste facility where not reused.

Some example facilities which are currently authorised to accept metal and electronic waste include:

- Irish Lamp Recycling Co. Ltd, Woodstock Industrial Estate, Kilkenny Road, Athy, Co. Kildare; and
- Hammond Lane Metal Company, Pigeon House Road, Dublin 4, Dublin.

The least preferable option is disposal to an authorised facility and will be considered by the appointed contractor when reasonable opportunities for reuse, recycling and recovery are unavailable.

5.5.5.3 Excavation Waste Management

In line with current practice in Ireland, surplus materials and wastes from the Proposed Scheme will be managed as follows:

- Where practicable, naturally occurring excavated material will be reused within construction in the Proposed Scheme in accordance with Article 2 of the Waste Directive Regulations, the Waste Framework Directive and Section 3 of the Waste Management Act, as amended;
- Excavation material will be used as engineering and landscaping material within the Proposed Scheme and on other projects requiring the types of materials generated, where practicable, through Article 27. Reuse of topsoil and excavated material within the Proposed Scheme is proposed, where practicable. The material will also be subject to testing to ensure it is suitable for its proposed end use;
- Should material meet the acceptance criteria set out in Article 28 of the Waste Directive Regulations, this material will be delivered to recovery or disposal facilities which are authorised to collect this

- material under the Waste Management Act, as amended (i.e. which hold a Certificate of Registration (CoR), Waste Facility Permit (WFP) or EPA Licence), should such recovery or disposal facilities become available by the time of commencement of construction of the Proposed Scheme;
- In accordance with the law, all excavation wastes requiring removal from site for recycling or recovery will be delivered to facilities which are authorised under the Waste Management Act, as amended (i.e. which hold a CoR, WFP or EPA Licence). Examples of recycling / recovery activities for excavation material include:
 - Processing of stone to produce construction aggregate;
 - Backfilling of quarries; and
 - Raising land for site improvement or development.
 - Any hazardous waste arising will be managed by the appointed contractor in accordance with the applicable legislation; and
 - In accordance with the law, all wastes removed from site will be transported by the holder of the appropriate waste collection permit, granted in accordance with S.I. No. 820 of 2007 - Waste Management (Collection Permit) Regulations 2007.

Excavation material will be generated as a result of the construction of the Dodder Public Transport Opening Bridge (DPTOB). The appointed contractor will reuse the material generated, if practicable and appropriate, where it meets the required standards and regulations. It will be recycled or recovered where practicable if it is not suitable for reuse. Where reuse, recycling and recovery are not possible the material will be disposed of to an authorised facility by the appointed contractor. Any hazardous wastes will be moved in accordance with the European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011) to authorised facilities (e.g., EPA licenced facilities) in Ireland or exported to authorised facilities outside of Ireland in accordance with the Transfrontier Shipment Regulations. Where there are sites with planning permission and required authorisations such as foreshore licences granted and to which the material can be delivered for placement, reuse, recovery, or disposal excavated material may also be delivered to these sites by the appointed contractor.

It will be the responsibility of the appointed contractor to secure agreements for acceptance of surplus excavation materials from the Proposed Scheme in authorised and regulated facilities, in accordance with the Waste Management Act, as amended, and associated regulations.

Where carriageway is removed it will be reused where possible within the Proposed Scheme through the implementation of the measures set out below.

Due to the nature of the works in an urban environment there are limited opportunities to achieve a cut / fill balance of materials that could be more readily accommodated on a greenfield project where earthworks embankments / bunds are more common. Material from the existing pavement layers will be temporarily stockpiled at the Construction Compounds and sent to a suitable recovery facility for recycling and reuse as recycled aggregate material in the industry, as further described in Section 18.5 in Chapter 18 (Waste & Resources) in Volume 2 of this EIAR.

Material for excavation will need to be tested by the appointed contractor for quality, contamination and could potentially be reused as general fill or general landscape fill material in construction under the provisions of Article 27. Material which meets the necessary acceptance criteria will be delivered to an authorised soil recovery facility. Material which requires recycling will be sent to an authorised waste facility and may be used in accordance with Article 28 of the Waste Directive Regulations, as amended. Article 28 sets the criteria which must be complied with, and the EPA must use to determine a waste reaches 'end of waste' status and becomes a material.

Excavated materials such as capping, subbase, bituminous and concrete materials could be reused or recycled in line with TII specifications:

- Capping, subbase, bituminous and concrete materials could be reused or recycled in fill and capping materials (e.g. 6A, 6B, 6C, 6F, 6G, 6H, 6I, 6M, 6N) providing they comply with the Specification for Road Works Series 600 – Earthworks (CC-SPW-00600) (TII 2013a);
- Subbase, bituminous and concrete materials could be reused or recycled in subbase or base materials (e.g. Granular Material Type A to Clause 803) providing they comply with the Specification

- for Road Works Series 800 – Unbound and Cement Bound Mixtures (CC-SPW-00800) (TII 2013b); and
- Subbase and bituminous materials could be recycled in base or binder materials (e.g. Asphalt Concrete base and binder products to Clause 3 or Low Energy Bound Mixtures to Clause 8.1) providing they comply with Road Pavements – Bituminous Materials (CC-SPW-00900) (TII 2015c).

Information on quantities of potential material reuse or recycle is provided in Table 5.18. These pavement materials will either be removed directly from the Proposed Scheme or temporarily stored and removed at a later date as part of a spoil / waste management strategy having consideration of the intermittent nature of the street works construction activities.

5.5.5.4 Construction Waste Management

The following measures will be implemented during construction, where practicable, to ensure the maximum quantity of material is reused on the Proposed Scheme and to contribute to achieving the objectives set out in A Waste Action Plan for a Circular Economy Ireland’s National Waste Policy 2020-2025 (DCCAE 2020) as follows:

- Stockpiling of existing sub-base, capping layer and topsoil material generated on-site for direct reuse in the Proposed Scheme where practicable in the Construction Compounds (subject to material quality testing to ensure it is suitable for its proposed end use); and
- Recycled aggregates and reclaimed bituminous mixtures will be specified in the Proposed Scheme where practicable. For example, suitable recycled aggregates and appropriate site won material may be specified in the proposed road base / binder layers, sub-base layers under footpaths / cycle tracks, and capping layer material within the road, footpath and cycle track pavement, subject to testing to ensure material is suitable for its proposed use.

Information on the quantities of potential material reuse is provided in Table 5.18. It is estimated that potentially up to approximately 3,900 tonnes of recycled or reused materials could be incorporated into the Proposed Scheme. The waste management measures which will be implemented by the appointed contractor in so far as reasonably practicable are also set out in Table 5.18.

Table 5.18: Quantities of Proposed Material for Reuse and Recycling

Reuse or Recycle	Material for Reuse or Recycle	Approximate Quantity (Tonnes)	Reuse or Recycle Specification for Example TII Series or Other Reuse or Recycle Specification	Reuse or Recycle Class (note: Class to be Provided in all Cases where TII Specification is used)
Recycle on Proposed Scheme	Bitumen (Surface, Binder, Base)	500	TII Series 800 (TII 2013b)	Bituminous planings for reuse in base and binder layer
Reuse on Proposed Scheme	Subbase material under footpaths and roads	2,900	TII Series 600 (TII 2013a)	Sub-base material under footpaths and cycle track
Reuse on Proposed Scheme	Granular capping material from road widening	500	TII Series 900 (TII 2015c)	Road pavement capping material

5.5.5.5 Article 27

Surplus excavation material may be declared a by-product (under Article 27 of the Waste Directive Regulations) for reuse in one or more known construction projects.

By-product notifications to the EPA provide an opportunity for reuse of surplus clean soil and stone material arising from construction activity. This can apply to locations other than authorised recovery facilities (e.g. quarries operating under planning permission, parks or other developments requiring earthworks and importation of clean soil and stone). This option can bring significant economic benefits while facilitating beneficial reuse of by-products. This plays a role in Ireland’s implementation of Circular Economy principles.

An Article 27 notification to the EPA under Article 27 of the Waste Directive Regulations, is required to achieve by-product status for soil and stones. It is noted that the use of Article 27 is limited to clean soil and stone, and it must be demonstrated to the EPA that the following four conditions are met:

- Further use of the soil and stone is certain;
- The soil and stone can be used directly without any further processing other than normal industrial practice;
- The soil and stone is produced as an integral part of a production process; and
- Further use is lawful in that the soil and stone fulfil all relevant requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

Where it is proposed to use an Article 27 EPA notification in relation to excavation material from the Proposed Scheme, the appointed contractor is responsible for submission of the Article 27 notification to the EPA. Where it is proposed to use soil from off site with an Article 27 notification, the appointed contractor is responsible for carrying out any necessary due diligence regarding the material and ensuring that all EPA guidelines relating to that Article 27 notification have been complied with before the soil is imported into the site. Where feasible, appropriate and available Article 27 materials arising from other sites will be used in the development of this site.

The appointed contractor is responsible for ensuring all applicable regulatory requirements under waste, planning and other laws are complied with prior to movement of excavation material. Any hazardous waste arising will be managed in accordance with the applicable legislation.

5.5.5.6 Soil Recovery at Sites Holding CoR, WFP or EPA Waste Licence

Where removal of wastes from the Proposed Scheme is unavoidable, it will be delivered by the appointed contractor only to facilities which are authorised under the Waste Management Act, as amended, and which hold the appropriate CoR, WFP or EPA Waste Licence.

S.I. No. 821/2007 - Waste Management (Facility Permit and Registration) Regulations 2007, as amended sets out the classes of waste activity requiring CoR or WFP. The most relevant class of activity in relation to soil recovery facilities is:

Class 5 (Third Schedule, Part 1 of the Regulations) for the 'Recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purposes of the improvement or development of land, where the total quantity of waste recovered at the facility is less than 100,000 tonnes.'

For CoR and WFP the capacity is typically a lifetime capacity, and when reached, the facility typically closes. CoR and WFP are granted to private operators by local authorities.

EPA licensed waste activities authorised to accept soil and stones for recovery and disposal include soil recovery sites, landfills, transfer stations and materials recovery facilities. These typically handle a larger tonnage of wastes than facilities holding CoR or WFP. EPA Waste Licences typically include an annual maximum intake capacity and a maximum lifetime capacity for the licensed facility.

Where the appointed contractor proposes to deliver excavated materials from the Proposed Scheme to facilities holding a CoR, WFP or EPA Waste Licence, the appointed contractor is responsible for ensuring the authorisation is valid and allows acceptance of the relevant LoW Code.

A copy of the authorisation will be included in the Plan and evidence will be provided that the proposed facility will have the capacity to accept the required quantity of waste from the Proposed Scheme.

5.5.6 Proposed Scheme Infrastructure

5.5.6.1 Construction Compounds

Construction Compound requirements to facilitate the Construction Phase of the Proposed Scheme are illustrated in Section 5.7 in Chapter 5 (Construction) in Volume 2 of this EIAR. Construction Compound R1 will be located

along North Wall Quay, at George's Dock, north of the existing Scherzer Bridges, either side of the George's Dock culvert and across the culvert. Construction Compound R2 will be located along North Wall Quay, at Spencer Dock, north of the existing Scherzer Bridges, either side of the Royal Canal. Construction Compound R3 will be located at the end of Sir John Rogerson's Quay. Construction Compound R3 has been split into two separate Construction Compounds (Construction Compound R3a and Construction Compound R3b), as it is envisaged that the DPTOB will be constructed under a separate Construction Contract from the remainder of the Proposed Scheme. Construction Compound R3a will be used to complete the works along the south quays; City Quay and Sir John Rogerson's Quay. Construction Compound R3b will be used to complete the works at DPTOB. Construction Compound R4 will be located southwest of the Tom Clarke East Link Bridge. The Construction Compound R4 layout and boundary will change throughout the DPTOB (Structure Reference: 05) construction programme. Whilst reclamation works, construction of the new SPRC building, and demolition of the old SPRC building are underway, a smaller Construction Compound will be established. Once these works are complete, the Construction Compound size will increase in size.

The Construction Compounds will contain a site office, and welfare facilities for NTA personnel and contractor personnel. Limited car parking will be allowed at Construction Compound R1, Construction Compound R3a, Construction Compound R3b, and Construction Compound R4. Materials such as topsoil, subsoil, concrete, rock etc., will be stored at the Construction Compounds for reuse as necessary. Items of plant and equipment will also be stored within the Construction Compounds. All necessary authorisations, under the Waste Management Act, as amended, will be obtained prior to undertaking temporary storage.

5.5.6.2 Waste Collection and Transportation

Waste from the Proposed Scheme will be transported by authorised waste collectors in accordance with S.I. No. 820 of 2007 - Waste Management (Collection Permit) Regulations 2007, as amended.

A list of currently authorised waste collectors used to transport waste during the Proposed Scheme will be maintained at the Construction Compounds and updated by the appointed contractor. Copies of valid appropriate waste collection permits will also be held at the Construction Compounds by the appointed contractor. A list of the currently authorised waste collectors is available on the following website (<https://www.nwcpo.ie/permitsearch.aspx>.)

5.5.6.2.1 Hazardous Wastes

The following steps must be taken where hazardous waste is being transported from the Proposed Scheme to a hazardous waste recovery or disposal facility within Ireland:

- Waste transfer forms shall be obtained by the waste producer from the local authority website, and completed online before the waste is collected;
- A copy shall be downloaded, printed and signed, accompanying the consignment of hazardous waste when it is in transit; and
- On the load's arrival, the operator of the recipient disposal or recovery facility shall log-in and complete the relevant details documenting the receipt of the waste.

Export of hazardous waste from the Proposed Scheme outside of Ireland is subject to a Europe-wide control system founded on Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste (known as the Transfrontier Shipment Regulations), as amended. This legislation is supplemented by S.I. No. 419/2007 - Waste Management (Shipments of Waste) Regulations 2007, as amended, which makes DCC responsible for the enforcement of this regulatory system throughout Ireland. Export of hazardous waste from the Proposed Scheme outside Ireland should comply with the procedures set out in this legislation.

5.5.6.3 Waste Recovery and Disposal

Wastes will be delivered to authorised waste facilities in accordance with the Waste Management Act, as amended. The following authorisations are applicable:

- CoR from the local authority (issued to private sector);

- CoR from the EPA (issued to local authority);
- WFP from the local authority; and
- Waste Licence from the EPA.

A list of currently authorised (CoR or WFP) waste sites in each local authority is available on the following website (<http://facilityregister.nwcpo.ie/>). A list of sites currently licensed by the EPA (Waste Licence) is available on the following website (<http://www.epa.ie/terminalfour/waste/>).

An up-to-date list of all waste facilities to which waste from the site will be delivered will be maintained on-site and updated by the appointed contractor. Copies of valid facility CoR, WFP, and EPA Waste Licences will be held on-site by the appointed contractor.

5.6 Environmental Incident Response Plan

5.6.1 Introduction

This Environmental Incident Response Plan (EIRP) has been prepared to ensure that in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for the particular circumstances. The EIRP details the procedures to be undertaken in the event of a significant release of sediment into a watercourse, or a significant spillage of chemical, fuel or other hazardous substances (e.g. concrete), non-compliance incident with any permit or license, or other such risks that could lead to a pollution incident, including flood risks. The EIRP will identify the on-site risks and appropriate responses. The focus of including the measures in this EIRP is on prevention of the incident arising in the first place.

5.6.1.1 Objectives

The objectives of this EIRP are to:

- Ensure the health and safety of personnel and visitors along the Proposed Scheme;
- Minimise any impacts to the environment and ensure protection of water quality and the aquatic species dependent on it;
- Minimise any impacts on properties, services etc.; and
- Establish procedures that could enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property, and the environment.

5.6.1.2 Guidance

This EIRP has been prepared with regard to the following guidance documents, where relevant:

- Control of Water Pollution from Linear Construction Projects. Technical Guidance (C648) (CIRIA 2006a);
- Control of Water Pollution from Linear Construction Projects. Site Guide (C649) (CIRIA 2006b);
- Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (CIRIA 2001);
- Department of Housing, Local Government and Heritage (DHLGH) A Framework for Emergency Management (DHLGH 2021); and
- Dublin City Council Major Emergency Plan 2015 (DCC 2015).

5.6.2 Roles and Responsibility

The EIRP will be reviewed and updated regularly so that it continues to apply to construction activities and is amended when applicable regulations are revised or when amendments are required by a regulatory authority. It will be the responsibility of the EM, or equivalent, as stipulated by the appointed contractor to maintain and change the EIRP as required. The EIRP may also require amendments from the various stakeholders or suppliers as the Proposed Scheme progresses.

The appointed contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment. All such plant and equipment shall be maintained in place and in working order for the duration of the works.

As part of the development and management of the EIRP, the appointed contractor will:

- Assess the pollution risks and develop emergency and spill response procedures for specific construction activities;
- Obtain details of key people that may need to be contacted for help in the event of an incident;
- Provide equipment for dealing with pollution incidents;
- Identify emergency access routes along the Proposed Scheme;
- Train personnel to follow procedures and use equipment correctly;
- Audit the EIRP; and
- Take action following an incident to ensure it does not occur again.

5.6.2.1 Contacts

The EIRP will detail the initial contact that should be made in case of an emergency incident as well as those responsible for following up once an emergency event is declared. To cover the full length of the Proposed Scheme, more than one contact may be needed. The EIRP will indicate which contacts apply to which sections of the Proposed Scheme.

Contact details will include the organisation, position title, name, mobile phone number and email address of the relevant personnel. Numbers will be obtained for contacts, including the following:

- Radio / mobile contacts for management staff and trained personnel;
- Out-of-hours contacts;
- Environmental regulators (hotline or local contact);
- Local authorities;
- Fire Services;
- Irish Water (IW);
- NPWS;
- EPA
- DECC;
- DHLGH; and
- Spill response and clean-up contractors.

5.6.2.1.1 Training and Testing

Personnel will be trained on the implementation of the EIRP and how to use the necessary equipment such as spill kits. Emergency arrangements will need to be reviewed and tested periodically (and always after an incident) to ensure that measures are effective, and that the workforce is aware of what to do in the event of an incident. Emergency drills will be recorded, and improvements noted and actioned accordingly.

5.6.3 Environmental Emergency Response Procedures

5.6.3.1 Fuel and Chemical Spillages

For pollution prevention measures, refer to the SWMP in Section 5.4. Emergency procedures will be further developed; either Proposed Scheme specific, works area specific or activity specific, and all personnel will be required to know these procedures.

An effective pollution EIRP relies on the following elements, with regards to fuel, and chemical spillages:

- Identification of receptors / pathways (e.g. surface water drains and / or watercourses);
- Identification and clear marking of surface water drain locations within the Construction Compounds;

- Identification of all possible emergency scenarios;
- Effective planning (e.g. availability of booms, spills kits at appropriate locations along the Proposed Scheme);
- Identification and dissemination of contact numbers;
- Definition of personnel responsibilities;
- Assurance that all appropriate personnel are aware of the emergency procedure(s) (e.g. spillage, leakage, fire, explosion, and flooding), that drain covers and spill kits are available, and personnel know how to use them;
- Knowledge of incident scenarios, such as spill drills; and
- Implementation of lessons learnt from previous incidents.

In terms of pollution spill response procedures, these will vary depending on the sensitive receptor and nature of construction activities. However, the following information will be included as a minimum and displayed at appropriate locations along the Proposed Scheme, at river crossings, near outfalls, refueling locations, fuel storage areas etc.:

- Instructions on how to stop work and switch off sources of ignition;
- Instructions on how to contain the spill;
- Location of spill clean-up material;
- Name and contact details of responsible personnel (these personnel should assess the scale of the incident to determine whether the environmental regulator needs to be called); and
- Measures particular to that location or activity (for example, close to a settlement pond).

More detailed plans may be location-specific, or specific to a particular activity depending on the nature of the work. They will identify the potential sources of pollution and pathways to receptors so that containment measures can be put in place at these locations. Suitable equipment, such as spill kits, oil booms and absorbent material, will be held at appropriate locations along the Proposed Scheme and personnel will be trained in the use of the equipment.

Emergency equipment will be obtained from a reputable supplier, and personnel will be trained in its correct use. Material Safety Data Sheets (MSDS) and best practice assessments will be used for advice on appropriate spill measures. The type of equipment required will depend on the activity taking place. The Control of Water Pollution from Linear Construction Projects (C648), Technical Guidance document (hereafter referred to as the CIRIA Technical Guidance Document) (CIRIA 2006a), provides details on the types and applications of emergency equipment. Refer to Table 15.2 of the CIRIA Technical Guidance Document for further information.

Every effort will be made to prevent an environmental incident during the Construction Phase of the Proposed Scheme. The objective of the measures in the EIRP and the SWMP (see Section 5.4) is to prevent an incident arising in the first place. Oil / fuel spillages are one of the main environmental risks that will exist during the Construction Phase of the Proposed Scheme which will require an emergency response procedure. An example of the steps that could be followed in the event of a spillage to ensure that the environmental risk is reduced to as low as is reasonably practical is provided in this Section. This procedure can be tailored to be location / activity specific as required:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;
- Notify the EM immediately giving information on the location, type, and extent of the spill so that they can take appropriate action;
- If necessary, the EM will inform the appropriate regulatory authority, including the Fire Services, depending on the size and nature of the spill. The appropriate regulatory authority will vary depending on the nature of the incident;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not use detergent or hoses to disperse spilled fuel;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats;
- Clean up as much as possible using the spill control materials;

- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited;
- The details of the incident will be recorded on an Environmental Incident Form (such as that provided in Section 5.6.3.3 or equivalent identified by the appointed contractor), which will provide information such as the cause, extent, actions, and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident. This form will be appended to the EIRP;
- A record of all environmental incidents will be kept on file by the EM and the appointed contractor. These records will be made available to the relevant authorities if required; and
- The EM will be responsible for any corrective actions required as a result of the incident (e.g. an investigative report, formulation of alternative construction methods or environmental sampling), and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential fuel or chemical spillages.

5.6.3.2 Other Environmental Incidents

Environmental incidents are not limited to just fuel spillages. For example, other environmental incidents could include:

- Accidental stripping of a protected habitat;
- Accidental excavation of protected archaeological structure (without archaeologist present);
- Accidental release from settlement pond / tank etc.; and
- Unplanned utility strikes, resulting in foul water releases, temporary loss of services etc.

Therefore, any environmental incident will be investigated in accordance with the following steps:

- Immediately notify the EM, giving information on the location, type, and extent of the incident so that they can take appropriate action;
- In the very unlikely event of an incident occurring which may impact on a sensitive receptor, the EM will inform the appropriate persons / regulatory authority. The appropriate persons / regulatory authority will vary depending on the nature of the incident;
- The details of the incident will be recorded on an Environmental Incident Form (such as that provided in Section 5.6.3.3 or equivalent identified by the appointed contractor) which will provide information such as the cause, extent, actions, and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident. This form will be appended to the EIRP;
- A record of all environmental incidents will be kept on file by the EM and the appointed contractor. These records will be made available to the relevant authorities if required; and
- The EM will be responsible for any corrective actions required as a result of the incident (e.g. an investigative report, formulation of alternative construction methods or environmental sampling), and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential accidents or incidents.

5.6.3.3 Environmental Incident Form

An example of an Environmental Incident Form is provided in Table 5.19. An Environmental Incident Form will record details of any environmental incidents. This form will be appended to the EIRP.

Table 5.19: Environmental Incident Form Example

Incident Details	
Date:	
Time:	
Location:	

Incident Details				
Extent:				
Direct Activity being Undertaken:				
Cause:				
Dangerous Substances(s) Involved (identity and quantity):				
Remedial Measures Undertaken:				
Parties Involved in the Incident				
Name	Role	Phone Number	Email	Address
Description of the Incident				
Recommendations following the Incident				

5.6.3.4 Fire Control

Every effort will be made to prevent the outbreak of a fire during the Construction Phase of the Proposed Scheme. Fire extinguishers and first aid supplies will be available in the work area. In the event of such an incident, the health and safety of all personnel will be a priority. All relevant legislation and guidance on health and safety of people and in particular fire safety will be complied with.

5.6.3.5 Flood Risk Control

Where temporary stockpiles of invasive species infected material cannot, for practical limitations, be situated away from a potential flood risk area, the appointed contractor will be required to include a flood response plan within the EIRP, to ensure that any inundation of the Construction Compounds does not result in a pollution event to nearby water bodies.

5.6.4 Corrective Action

When an incident happens, it is important to learn from it and ensure that such an incident does not occur again. This may involve changing the method of work for a particular activity, providing containment or treatment materials, or simply training personnel so they are aware of the correct method of work. Similarly, if an audit of planned arrangements indicates that measures are not in place, or those in place need to be improved, action will be taken immediately.

A record of corrective actions and lessons learned will be kept and communicated to all relevant persons, teams, sub-contractors etc. across the Proposed Scheme.

5.7 References

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Number 10 of 1996 - Waste Management Act, 1996 (as amended)

Number 38 of 1936 Noxious Weeds Act, 1936

Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste

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