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# Chapter 18

## Mitigation Measures

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## Chapter 18

## Mitigation Measures

### 18.1 Introduction

Mitigation measures are the measures proposed in order to avoid, reduce or, where possible, remedy the significant adverse environmental effects of the proposed River Suir Sustainable Transport Bridge. Mitigation measures have been incorporated into the design of the proposed bridge and will be applied during both the construction and operation phase where they have been assessed as necessary.

This chapter provides a summary of the mitigation measures for the River Suir Sustainable Transport Bridge as contained within chapters 5 – 17 of the Environmental Impact Assessment Report (EIAR). This is a summarised version stating only the mitigation measures to be provided and does not discuss the requirement for the measure to be applied or the residual impacts. This chapter also deals only with mitigation measures to be applied to the River Suir Sustainable Transport Bridge and does not address the avoidance or reduction mitigation which has been applied through the design development.

### 18.2 General Mitigation and Monitoring Measures

**Table 18.1 General Mitigation and Monitoring Measures**

No.	Description
1.1	<p>Construction Environmental Management Plan</p> <p>Prior to any demolition, excavation or construction a Construction Environmental Management Plan (CEMP) will be produced by the successful contractor. The CEMP will set out the Contractor's overall management and administration of the construction project. The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the outline CEMP, Environmental Operating Plan (EOP) and the Construction and Demolition Waste Management Plan (CDWMP). The Contractor will be required to include details under the following headings:</p> <ul style="list-style-type: none"> <li>• Details of working hours and days;</li> <li>• Details of emergency plan – in the event of fire, chemical spillage, cement spillage, collapse of structure or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services</li> <li>• Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages);</li> <li>• Details of construction plant storage, temporary offices;</li> <li>• Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing network traffic; temporary road closures; temporary signal strategy; routing of construction strategy; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;</li> <li>• Truck wheel wash details (including measures to reduce and treat runoff);</li> <li>• Dust management to prevent nuisance (demolition &amp; construction);</li> <li>• Landscape management;</li> <li>• Management of demolition of all structures and assessment of risks for same;</li> <li>• Stockpiles;</li> <li>• Project procedures &amp; method statements for;</li> </ul>

No.	Description
	<ul style="list-style-type: none"> <li>○ Demolition &amp; removal of buildings, services, pipelines (including risk assessment and disposal);</li> <li>○ Diversion of services;</li> <li>○ Excavation and blasting (through peat, soils &amp; bedrock);</li> <li>○ Piling;</li> <li>○ Construction of pipelines;</li> <li>○ Temporary hoarding &amp; lighting;</li> <li>○ Borrow Pits &amp; location of crushing plant;</li> <li>○ Storage and Treatment of peat and soft soils;</li> <li>○ Disposal of surplus geological material (peat, soils, rock etc);</li> <li>○ Earthworks material improvement;</li> <li>○ Protection of watercourses from contamination and silting during construction;</li> </ul> <ul style="list-style-type: none"> <li>● Site Compounds</li> </ul> <p>The production of the CEMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.</p>
1.2	<p><b>Environmental Operating Plan</b></p> <p>The EOP is a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of a national road scheme. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractor during the project construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of the Boards decision (if approving the proposed development) will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.</p> <p>Before any works commence on site, the Contractor will be required to prepare an EOP in accordance with <i>TII/NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan</i>. The EOP will set out the Contractor's approach to managing environmental issues associated with the construction of the scheme and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include:</p> <ul style="list-style-type: none"> <li>● All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services (NPWS) and Inland Fisheries Ireland (IFI) as well as a method documenting compliance with the measures;</li> <li>● A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and</li> <li>● Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.</li> </ul> <p>To oversee the implementation of the EOP, the Contractor will be required to appoint a suitably competent Site Environmental Manager (SEM) to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.</p>
1.3	<p><b>Construction and Demolition Waste Management Plan (CDWMP)</b></p> <p>The CDWMP will be included within the CEMP, clearly setting out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline CDWMP has been prepared for the proposed development. The outline CDWMP is a live document that will be amended and updated to reflect current conditions on</p>

No.	Description
	<p>site as the project progress. The obligation to develop, maintain and operate a CDWMP will form part of the contract documents for the project. The plan itself will contain, but not be limited to, the following measures:</p> <ul style="list-style-type: none"> <li>• Details of waste storage to be provided for different waste;</li> <li>• Details of where and how materials are to be disposed of – landfill or other appropriately licensed waste management facility;</li> <li>• Details of storage areas for waste materials and containers;</li> <li>• Details of how unsuitable excess materials will be disposed of where necessary; and</li> <li>• Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.</li> </ul>

### 18.3 Mitigation and Monitoring Measures for Traffic and Transport

**Table 18.2 Mitigation and Monitoring Measures for Traffic and Transport**

No.	Description
2.1	<p>No mitigation measures for traffic and transport are deemed necessary. No significant impacts are predicted as standard best practice measures are incorporated into the project design.</p>

### 18.4 Mitigation and Monitoring Measures for Population and Human Health

**Table 18.3 Mitigation and Monitoring Measures for Population and Human Health**

No.	Description
3.1	<p>Develop and implement all mitigation measures detailed in Chapter 4 (Description of the Proposed Development) this is to include development of Construction Environmental Management Plan (CEMP) and associated Traffic Management Plan (TMP) to address all modes of transport including the navigational channel and will be required to be agreed with WCCC prior to construction stage.</p> <ul style="list-style-type: none"> <li>• The TMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties.</li> <li>• The TMP will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points.</li> <li>• The contractor shall provide an appropriate information campaign for the duration of the construction works.</li> <li>• The TMP should minimise disruption to economic, marine users and residential amenities to be agreed by WCCC prior to construction and ensure access is maintained along the R680 for vehicles, pedestrians, cyclists and economic operators at all times and ensure marine navigation is maintained.</li> <li>• Include appropriate measures relating to working at heights and near water as part of EOP. Install and maintain ringbuoys as part of construction design stage in consultation with the Irish Water Safety and Waterford Search and Rescue Organisations.</li> </ul>

No.	Description
3.2	The contractor will be required to develop and implement Stakeholder Management and Communication Plan and will be required to be agreed with WCCC prior to construction stage. <ul style="list-style-type: none"> <li>All stakeholders will be required to be agreed with WCCC prior to construction commencing.</li> <li>Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed on the nature and duration of construction works.</li> </ul>
3.3	Detailed design to identify a suitable location to relocate the pay station/ office in consultation with QPark operator to be agreed by Waterford City and County Council.
3.4	Noise and Vibration mitigation will be provided for during construction of the development. Measures to mitigate noise and vibration impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities including the application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures.
3.5	In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan (refer to Appendix 13.1 of this EIAR).
3.6	Installation of 24/7 CCTV cameras across the bridge to be agreed by Waterford City and County Council prior to construction.
3.7	Design and maintain suitable landscaping and public realm infrastructure to complement other environmental mitigation, e.g. lighting, seating, landscaping, pleasant surroundings to discourage anti-social behaviour, graffiti, etc.
3.8	Implement the recommended mitigation measures detailed in Chapter 10 (Hydrology) to address potential risk of flooding.
3.9	Appropriate directional information signage will be put in place on local roads to guide residents and visitors to the use of the sustainable transport bridge, greenway and connections to other sustainable transport infrastructure.
3.10	Replacement of public amenities in suitable locations, as required (i.e. toilets, seating, bicycle stand and tourist information signage) on south quays as part of detailed design stage within the South Plaza or along the south quays and will be required to be agreed with WCCC prior to construction stage.
3.11	Install and maintain ringbuoys as part of detailed design stage in consultation with the Irish Water Safety and search and rescue organisations in Waterford.

## 18.5 Mitigation and Monitoring Measures for Biodiversity

**Table 18.4 Mitigation and Monitoring Measures for Biodiversity**

No.	Description
4.1	<p><u>Sedimentation and surface water run-off</u></p> <p>In order to attenuate flows and minimise sediment input into the River Suir from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged to the existing South Quays sewer network.</p> <p>Sheet piling for the new quay wall either side of the southern bridge abutment shall be installed prior to excavation on the south quays and demolition of the existing reinforced earth wall. This will form an effective barrier to run-off from the south quays during construction.</p>

No.	Description
	<p>The removal of cofferdams and temporary support piles will be undertaken at or near high water to maximise the dilution factor for any disturbed sediments and minimise the time during which any contaminants bound to disturbed sediment is suspended in the water column.</p> <p>Owing to the nature and scale of the Project, there will be minimal stockpiling of materials on site. However, any material stockpiled shall be located as far from the riverbank as practicable, covered and remain stockpiled for as short a time as possible.</p> <p>The Contractor shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events.</p> <p>Prior to the Construction Environmental Management Plan being accepted and implemented, it shall be submitted to both the NPWS and IFI to ensure that all requirements of those bodies are satisfied.</p>
4.2	<p><u>Cementitious materials</u></p> <p>The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Suir from the landside elements of the construction.</p> <p>In addition, all shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times.</p> <p>In order to eliminate any remaining risk of input of cementitious material into the River Suir from the landside elements of the construction, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather.</p> <p>In order to prevent input of cementitious materials into the River Suir from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible.</p> <p>In addition, at all locations where concrete or other wet materials are to be used, bunded steel decks will be used to capture any spilled concrete, alkaline water displaced from inside tubular steel piles or spilled sealants or other materials.</p> <p>Any such materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan.</p>
4.3	<p>Vehicles and plant shall be refuelled off-site where possible and all fuelling of machinery shall be undertaken at least 10 m from the River Suir.</p> <p>All fuelling of vessels shall be undertaken on an impervious base in bunded areas and all fuelling equipment shall be regularly inspected and serviced.</p> <p>Standing plant and machinery shall be placed on drip-trays.</p> <p>All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impervious base which shall be bunded to 110% capacity and appropriately secured.</p> <p>All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery.</p> <p>Spill kits shall be available on site during construction, including on the jack-up barge during pile driving.</p>
4.4	<p>Paints containing organotin compounds, e.g. TBT, shall not be permitted for use. In order to minimise the risk of paint spillage into the River Suir, a platform shall be provided to form an effective barrier between the repainting works and the River Suir, capturing any spilled paint or other chemical.</p>
4.5	<p>Construction lighting will be limited to the minimum area required to be lit and minimise light spill onto the river channel.</p>

No.	Description
4.6	<p>The following are the mitigation measures which will apply to pile driving:</p> <ul style="list-style-type: none"> <li>• All pile driving shall be restricted to the following periods: <ul style="list-style-type: none"> <li>○ 1<sup>st</sup> June to 31<sup>st</sup> August, inclusive; and,</li> <li>○ 1<sup>st</sup> November to 31<sup>st</sup> January, inclusive.</li> </ul> </li> <li>• All pile driving shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.</li> <li>• All pile driving shall be restricted to between 8:00 am and 6:00 pm.</li> <li>• All breaks between pile drives shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent.</li> <li>• A 30-minute soft-start/ramp-up procedure shall apply to each pile drive.</li> <li>• If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCCC, the NPWS and IFI.</li> <li>• All of the above shall be supervised by an Ecological Clerk of Works appointed by the Contractor.</li> </ul>
4.7	<p>The welfare of Otter will be ensured primarily through the provision of continued safe access for Otter upstream and downstream of the development. Adequate provision for Otter at the bridge crossing is required to allow the species to retain continued access throughout the River Suir. The design of the bridge includes a gap between the south abutment and the quay wall. This will allow the continued connectivity both for intertidal mudflats and for Otter at the south bank of the River Suir. This is not required on the northern bank where passage is maintained.</p>
4.8	<p>There will be no spillage of light to the river or to land within 10 m of the river banks. Therefore, no further mitigation is required in respect of lighting impacts on Otter.</p>
4.9	<p>The lighting design will ensure that no lighting is focused onto areas of ecological sensitivity including onto the River Suir and that lighting design provides for low levels of lateral light spillage to avoid unwanted areas of illumination.</p>
4.10	<p>The Contractor shall prepare a Biosecurity Protocol detailing his/her proposed approach to ensuring that invasive species are not imported or spread during construction. The Contractor's Biosecurity Protocol shall have the approval of the Ecological Clerk of Works prior to its acceptance and implementation.</p> <p>The Biosecurity Protocol should include the following measures to prevent the spread of invasive species:</p> <ul style="list-style-type: none"> <li>• Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.</li> <li>• All plant and equipment employed on the construction site (e.g. barges, piling equipment etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species</li> <li>• All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the Construction Environmental Management Plan.</li> <li>• Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.</li> <li>• All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron and Cherry Laurel.</li> </ul>
4.11	<p>Any available resources should be used to prevent the spread Common Cordgrass to new sites</p>
4.12	<p><b>Fish rescue</b></p> <p>During the erection of cofferdams, there is a risk that fish may become trapped within. In order to prevent the death of these fish, they should be removed from the</p>



No.	Description
	<p>cofferdam during dewatering. Owing to the high conductivity, there is a significant Health &amp; Safety issue with electrofishing within the cofferdams at this location. Therefore, rescue of any fish present within the cofferdams should be carried out using nets as the cofferdam is being dewatered.</p>
4.13	<p><b>Water quality monitoring</b></p> <p>Monitoring of water quality shall be undertaken in the River Suir, with samples taken monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored, include but are not limited to:</p> <ul style="list-style-type: none"> <li>• Suspended solids and turbidity;</li> <li>• Total hydrocarbons;</li> <li>• Ammonia, nitrates, nitrites and total nitrogen;</li> <li>• Phosphates and total phosphorus;</li> <li>• Dissolved oxygen and biological oxygen demand; and,</li> <li>• Temperature and salinity.</li> </ul> <p>Samples shall be taken from at least two different locations, including at least one location at an appropriate distance upstream of the Project and at least one other at an appropriate distance downstream of the Project. The final number and location of sampling points will be determined by the Site Environmental Manager. Given the strong tidal influence at the location of the Project, the date and exact time at which each sample is taken, as well as the direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions.</p> <p>The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation shall be undertaken to identify the source of this non-compliance and corrective action will be taken where this is deemed to be associated with the Project.</p>
4.14	<p><b>Hydroacoustic monitoring</b></p> <p>In order to allow for greater accuracy in the assessment of future plans and projects, it is recommended that hydroacoustic monitoring be undertaken for the full duration of the proposed development's construction. This monitoring should establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be carried out by specialist underwater noise surveyors and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works, who may make appropriate adjustments / improvements to the mitigation in this EIAR based on the result so this monitoring.</p>
4.15	<p><b>Record of intertidal habitats</b></p> <p>In order to record any changes in the intertidal habitats, particularly mud habitats, in the vicinity of the proposed development, a photographic record shall be made of these habitats. This record shall cover both sides of the river from 150 m upstream of the proposed bridge location to 300 m downstream. All photographs shall be taken at low tide, every two months, beginning 6 months prior to commencement of construction and finishing 12 months after completion.</p>
4.16	<p>During construction, all works must comply with relevant legislation and guidelines in order to reduce and minimise environmental impacts and to protect all ecological receptors. In particular, there must be full compliance with the following:</p> <ul style="list-style-type: none"> <li>• The Schedule of Commitments.</li> <li>• The mitigation prescribed in this Chapter of the EIAR and in the NIS.</li> <li>• Any conditions which might be attached to the proposed development's planning consent.</li> </ul>

No.	Description
	<ul style="list-style-type: none"> <li>• Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:               <ul style="list-style-type: none"> <li>○ <i>Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters</i> (IFI, 2016).</li> </ul> </li> <li>• All applicable legislative requirements in relation to environmental protection.</li> <li>• All relevant construction industry guidelines, including:               <ul style="list-style-type: none"> <li>○ <i>C532 Control of water pollution from construction sites: guidance for consultants and contractors</i> (CIRIA, 2001).</li> </ul> </li> <li>• Any biosecurity requirements arising from the preceding points.</li> <li>• The Transport Infrastructure Ireland (TII) and National Roads Authority (NRA) Environmental Assessment and Construction Guidelines, specifically:               <ul style="list-style-type: none"> <li>○ <i>Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes.</i></li> <li>○ <i>Guidelines for the Treatment of Bats during the Construction of National Road Schemes.</i></li> <li>○ <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.</i></li> <li>○ <i>Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes.</i></li> <li>○ <i>Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes.</i></li> <li>○ <i>Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.</i></li> <li>○ <i>Guidelines on the Management of Noxious Weeds on National Roads.</i></li> <li>○ <i>Guidelines for the Treatment of Noise and Vibration in National Road Schemes.</i></li> <li>○ <i>Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.</i></li> <li>○ <i>Management of Waste from National Road Construction Projects.</i></li> <li>○ <i>Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.</i></li> </ul> </li> </ul> <p>This list is non-exhaustive. All environmental commitments/requirements and relevant legislation and guidelines which are current at the time of construction will be followed.</p>
4.17	<p>The CEMP, the EOP, including the IRP, and the CDWMP are grouped together as Environmental Management Plans (EMPs). Outline Environmental Management Plans (EMPs) will be provided to the Contractor and it will be his/her responsibility to develop his/her own EMPs based on the outlines provided. Prior to their acceptance and implementation, the Contractor's EMPs will be subject to approval by the Site Environmental Manager and Ecological Clerk of Works as well as the Employer's Representative.</p>
4.18	<p>To ensure the successful development, implementation and maintenance of the EOP, the Contractor will appoint an independent Site Environmental Manager (SEM). The principal functions of the SEM will be to ensure that the mitigation prescribed in this EIAR, the NIS, the CEMP, the EOP and the CDWMP, is fully and properly implemented and to monitor the construction stage from an environmental perspective. The SEM will also provide independently verifiable audit reports.</p>
4.19	<p>Separate from the on-going and detailed monitoring carried out by the Contractor as part of the EOP, the SEM will carry out the inspection and monitoring described below on behalf of WCCC. The results will be stored in the SEM's monitoring file and will be available for inspection or audit by WCCC, the NPWS or IFI.</p> <ul style="list-style-type: none"> <li>• Daily reporting on weather and flood forecasting and daily reporting on the monitoring of water levels in the Lower River Suir.</li> </ul>

No.	Description
	<ul style="list-style-type: none"> <li>• Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor.</li> <li>• Daily inspections of surface water treatment measures.</li> <li>• Daily inspections of all outfalls to watercourses.</li> <li>• Daily visual inspections of watercourse to which there are discharges from the works and those in the vicinity of construction works.</li> <li>• Weekly inspections of wheel-wash facilities.</li> <li>• Daily monitoring of any stockpiles.</li> <li>• Auditing at least six times per quarter of the Contractor's EOP monitoring results.</li> </ul>
4.20	In order to ensure the successful development and implementation of the CEMP, the Contractor will appoint an independent Ecological Clerk of Works (ECoW).

## 18.6 Mitigation and Monitoring Measures for Soils and Geology

**Table 18.5 Mitigation and Monitoring Measures for Soils and Geology**

No.	Description
5.1	All suitable material excavated for installation of pile caps shall be re-used to the greatest possible degree as fill material on the development.
5.2	All unacceptable material excavated shall be disposed of in accordance with legislative requirements with due regard for the impact on the licensed waste disposal site. Where possible this material will be utilised in landscaping of the development.
5.3	A geotextile screen and boom with oil barrier will be required around marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as setting and driving steel casings and boring in overburden or rock from polluting the river. An Emergency Incident Response Plan (EIRP) shall also be required to deal with any unexpected spills during construction (See Appendix 4.1).
5.4	Minimisation of excavation and removal of potentially contaminated soils where alternative engineering solutions can be used in the proposed development to ensure the existing ground is capable of providing adequate formation to the south plaza.
5.5	Temporarily surcharging the footprint of the south plaza with an additional height of general fill in order to speed up the settlements in the underlying soft soils and alleviate the settlements in the operational phase. The surcharge will need to be held for 12 to 14 months. This hold period can also be significantly improved (down to 3 – 6 months) by installing vertical wick drains under the surcharge. Installing of wick drains is fast and produces minimal noise and vibration over general construction traffic levels. After the surcharge hold period, the temporary surcharge can be reused in other areas such as in the proposed park areas.
5.6	Surcharge height will be tapered back on the approach to the Clock Tower in order not to include the settlements to the protected structure. In addition, the Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor ground and vibration levels in real-time.
5.7	In case a piling option is selected to prevent the settlements under the south plaza, CFA piles at suitable depth and spacing will be specified in order to avoid the excessive noise and vibrations in close proximity to the surrounding sensitive receptors.

## 18.7 Mitigation and Monitoring Measures for Hydrogeology

**Table 18.6 Mitigation and Monitoring Measures for Hydrogeology**

No.	Description
6.1	Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding.
6.2	Runoff will be controlled and treated to minimise impacts to surface and groundwater.
6.3	Temporary pumping of groundwater shall be treated by means of a temporary sedimentation pond (or similar) prior to discharge.
6.4	All hazardous materials will be sorted within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase.
6.5	Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction.
6.6	Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering the River Suir (refer to Chapter 10 of this EIAR for details).

## 18.8 Mitigation and Monitoring Measures for Hydrology

**Table 18.7 Mitigation and Monitoring Measures for Hydrology**

No.	Description
7.1	<p>An Environmental Operating Plan (EOP) has been prepared and the following will be implemented:</p> <ul style="list-style-type: none"> <li>• A draft Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of licence or other such risks that could lead to a pollution incident.</li> <li>• All necessary permits and licenses for in stream construction work for provision of the bridge and landings will be obtained prior to commencement of construction.</li> <li>• Inform and consult with IFI and WI.</li> <li>• Implement the Environmental Operating Plan contained in Appendix 4.1 of Volume 3 of this EIAR.</li> </ul> <p>This draft EOP will be developed by the selected construction contractor to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team. In doing so, the measures detailed in the appended reports will be considered minimum requirements to be considered and improved upon.</p>
7.2	Site works will be limited to the minimum required to undertake the necessary elements of the project.
7.3	As far as is practicable, construction works shall proceed within predetermined Construction Areas on a phased basis.
7.4	Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels or cut-off ditches.
7.5	Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and the diversion of runoff water from these stockpiles to the construction settlement ponds.

No.	Description
7.6	Protection of waterbodies from silt load will be carried out through use of timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses.
7.7	Settlement ponds, silt traps and bunds will be used. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.
7.8	The anticipated site compound/storage facility on the South Quays will be fenced off at a minimum distance of 10m from the top of the edge of the quay/river edge. Any works within the 10m buffer zone will require measures to be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the watercourse. See the OCEMP within the EOP in Appendix 14.1.
7.9	Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 20m from watercourses.
7.10	Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution.
7.11	The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses.
7.12	Riparian vegetation (if present) along the River Suir will be fenced off at a distance of 3m either side of the proposed crossing point to provide a buffer zone for its protection.
7.13	Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used to promote the early set of concrete surfaces exposed to water.
7.14	When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used.
7.15	Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.
7.16	Placing of concrete in or near watercourses will be carried out only under the supervision of the Ecological Clerk of Works (ECoW).
7.17	There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately, and runoff prevented from entering the watercourse.
7.18	Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses and lakes.
7.19	On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas.
7.20	Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the construction compound (or other appropriate facility designated by the manufacturer).
7.21	Chute washout will be carried out at designated locations only. These locations will be signposted. The Concrete Plant and all Delivery Drivers will be informed of their location with the order information and on arrival to site.
7.22	Chute washout locations will be provided with an appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to

No.	Description
	discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the Contractor's Waste Management Plan.
7.23	<p>Monitoring of water quality shall be undertaken in the River Suir, with samples taken monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored, include but are not limited to:</p> <ul style="list-style-type: none"> <li>• Suspended solids and turbidity;</li> <li>• Total hydrocarbons;</li> <li>• Ammonia, nitrates, nitrites and total nitrogen;</li> <li>• Phosphates and total phosphorus;</li> <li>• Dissolved oxygen and biological oxygen demand; and,</li> <li>• Temperature and salinity.</li> </ul> <p>Samples shall be taken from at least two different locations, including at least one location at an appropriate distance upstream of the Project and at least one other at an appropriate distance downstream of the Project. The final number and location of sampling points will be determined by the Site Environmental Manager. Given the strong tidal influence at the location of the Project, the date and exact time at which each sample is taken, as well as the direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions.</p> <p>The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation shall be undertaken to identify the source of this non-compliance and corrective action will be taken where the this is deemed to be associated with the Project.</p>

## 18.9 Mitigation and Monitoring Measures for Landscape and Visual

**Table 18.8 Mitigation and Monitoring Measures for Landscape and Visual**

No.	Description
8.1	An opaque hoarding will be erected of a minimum 2.0 metres in height around the site compound and works area on the South Quays.
8.2	Hours of construction activity will be restricted in accordance with local authority guidance.
8.3	Visually, the arched profile and colour of the bridge and good quality materials used (steel, glass and concrete) compliment the environment.
8.4	Bridge landing areas are designed to create high quality public spaces with paving, green space and walling. Some ornamental planting is also integrated into the design for the Meagher's Quay landing and within the South Quay Plaza which will aid in addressing the sensitive context of the Clock Tower.
8.5	Lighting will not be focused onto the River Suir and the lighting design will provide for low levels of lateral light spillage to avoid unwanted areas of illumination.
8.6	Monitoring and maintenance of the bridge and landscape will be required to ensure that there is no deterioration in the quality of the proposed elements over time which could lead to greater levels of visual impacts.

## 18.10 Mitigation and Monitoring Measures for Noise and Vibration

**Table 18.9 Mitigation and Monitoring Measures for Noise and Vibration**

No.	Description
9.1	No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
9.2	Best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
9.3	All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
9.4	Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
9.5	Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
9.6	During construction, the contractor will manage the works to comply with noise limits outlined in <i>BS 5228-1:2009+A1 2014. Part 1 – Noise</i> .
9.7	All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.
9.8	Hours will be limited during which site activities which are likely to create high levels of noise or vibration are permitted.
9.9	Levels of noise and vibration will be monitored during critical periods and at sensitive locations.
9.10	Channels of communication will be established between the contractor/developer, Waterford City and County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration
9.11	A Site Environmental Manager (SEM) will be appointed by the Contractor to be responsible for matters relating to noise and vibration
9.12	Plant with low inherent potential for generation of noise and/or vibration will be selected.
9.13	Good quality, printed site hoarding will be erected around the South Quays which will act as a noise barrier to general construction activity at ground level.
9.14	Barriers will be erected as necessary around items such as generators or high duty compressors.
9.15	Noisy plant will be situated as far away from properties as permitted by site constraints.
9.16	Normal working times will be 07:00 to 19:00 hrs Monday to Friday and 08:00 to 16:30 hrs Saturday and Sunday. Works will not be undertaken outside these working hours without the written permission of Waterford City and County Council.
9.17	Piling works will only be permitted between 08:00 to 18:00hrs Monday to Friday during the months of June, July, August, November, December and January.
9.18	The Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor vibration levels in real-time during construction works in order to ensure compliance with the thresholds defined in Section 12.3.1 and Table 12.6 of the EIAR. Should the specified vibration levels be exceeded works will cease until an appropriate solution has been identified.
9.19	During operation, best practice guidelines will be adhered to by plant servicing the bridge.

No.	Description
9.20	Noise monitoring will be undertaken during the initial 6 month period following the opening of the bridge and should baseline noise levels at Receptors R3 and R4 be exceeded by more than 3dB, additional noise mitigation measures will be adopted.
9.21	Hydroacoustic monitoring will be undertaken for the full duration of the construction of the proposed development. This monitoring will establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be undertaken on a continuous basis for the duration of construction and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works.

## 18.11 Mitigation and Monitoring Measures for Air Quality and Climate

**Table 18.10 Mitigation and Monitoring Measures for Air Quality and Climate**

No.	Description
10.1	Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
10.2	Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
10.3	Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities such as rock blasting or earthworks are necessary during dry or windy periods.
10.4	Before entering onto public roads, trucks will be adequately inspected to ensure there is no potential for dust emissions and will be cleaned as necessary.
10.5	The contractor will be required to erect opaque hoarding of a minimum 2.0m in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing.
10.6	In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

## 18.12 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

**Table 18.11 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage**

No.	Description
11.1	It is recommended that removal of any quayside masonry or furniture should be carried out under archaeological monitoring to facilitate further recording. It may be deemed appropriate to retain and reuse any elements of particular cultural heritage significance as part of the development and these can be identified during archaeological monitoring.
11.2	The riverbed surrounding Piers D and E will be enclosed within cofferdams as part of the construction process. The cofferdams are to be dewatered as part of that process; it is recommended that an additional archaeological inspection of the riverbed within the footprint of the cofferdam is undertaken.



No.	Description
11.3	Photogrammetry of the stone quay at the North Quay landing point of the proposed development should be undertaken in advance of the commencement of construction works. The photogrammetry survey should be annotated and a record should be made of the section of quay wall being removed.
11.4	All excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work. Should archaeological material, wreckage, timbers or other artefacts be recorded in the course of the monitoring, the archaeologist will be empowered to recover and record the material. This may involve the temporary suspension of the work to recover the material. In the event that excavation works impact on an archaeological site, the standby archaeological dive team, in place for such eventualities, should be mobilised to undertake a dive inspection of the impacted site which may lead to further investigations and / or potentially full excavation.

### 18.13 Mitigation and Monitoring Measures for Architectural Heritage

**Table 18.12 Mitigation and Monitoring Measures for Architectural Heritage**

No.	Description
12.1	Mitigation will be required on the quay where the landing of the new bridge will be located, necessitating the formation of a breach in the stonework of the quay. This should be mitigated by making good either side of the breach in the wall with stones salvaged in the works and laid in a lime-based mortar to match the stonework of the original wall.
12.2	Any cut stone removed from the quay wall or the surface of the quay is to be reused in a similar manner or, where this is not possible or appropriate, the stone is to be salvaged and stored for future use elsewhere along the quays.
12.3	Mitigation will be required to safeguard the Clock Tower during the works. The Clock Tower is to be excluded from the working area and the hoarding surrounding the working area is to be located outside the ring of post-and-chain fencing around the northern, eastern and western sides of the tower.
12.4	Prior to the commencement of works and prior to the erection of the site hoarding a detailed photographic record of the Clock Tower is to be made showing both the interior and the exterior of the tower. A report based on this photographic survey is to be prepared and lodged with the Conservation Officer, with a copy also lodged with the Waterford City and County Libraries Central Library.
12.4	Prior to the commencement of the works on the quays a vibration monitor is to be set up within the Clock Tower and this is to have the facility to send an alarm to a designated engineer in the event of the vibrations within the tower exceeding a predetermined limit to be set by the engineer at a level below which any damage to the tower through vibration is likely to occur.

### 18.14 Mitigation and Monitoring Measures for Material Assets and Land

**Table 18.13 Mitigation and Monitoring Measures for Material Assets and Land**

No.	Description
13.1	Measures to control the production of dust will be put in place by the contractor (refer to Chapter 13 Air Quality and Climate which presents a series of measures to control dust).

No.	Description
13.2	Noise mitigation will be provided during construction of the development. Measures to mitigate noise impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities
13.3	A Traffic Management Plan will be implemented during construction in order to minimise disruption to local residents, commercial business operators and the general public.
13.4	Access will be maintained for vehicles, pedestrians and cyclists at all times during the construction phase.
13.5	The new drainage system along the South Quay will be designed to ensure that the current drainage situation will not be impacted and there will be no increased risk of flooding as a consequence of the River Suir Sustainable Transport Bridge.
13.6	Any services that are interfered with, including services to the marina, as a result of the proposed development will be repaired or replaced without unreasonable delay.
13.7	It is anticipated that a combination of a sufficiently open and lit area will be enough to prevent groups from congregating. More secure gates will be installed at the marina gangways to ensure a higher level of protection for boat owners as a result of increased numbers of passers-by.
13.8	Communication will be maintained with the Port of Waterford and the Harbour Master during construction works.
13.9	Compensatory car parking spaces are available across Waterford City. New car parks have recently opened in the city. Directional signage will be erected to assist visitors. The development of the SDZ area will result in increased parking facilities in the area.
13.10	The removal of berths will be compensated at the marina downstream of the proposed bridge.
13.11	All construction works will be temporary and will be carried out in line with best practice guidelines thus minimising the impacts to the receiving communities.
13.12	The contractor will work within stringent construction limits and guidelines to protect surrounding amenities.
13.13	As discussed in Chapter 4 of this EIAR, a Construction Environmental Management Plan (CEMP) will be implemented by the contractor and will ensure commitments included in the statutory approvals are adhered to.