Appendix 4.2 – Environment Management Framework

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1 INTRODUCTION

1.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

This Environmental Management Framework forms the basis for a full Environmental Management Plan (EMP) for the construction of the Galway Harbour Extension.

An Environmental Management Plan is a document consisting of the action map detailing the programme, policies, standards, instructions, guidelines and procedures to be observed, followed and implemented by the project stakeholders to prevent, control and/or mitigate the adverse impacts of the environmental and other associated risks that were identified and evaluated by the initially made assessment studies on the project. As a key outcome of the Environmental Impact Assessment (EIA), it is the implementation manual for environmental management of the project.

This Environmental Management Framework provides the basis for the development of a full EMP prior to construction.

1.2 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT FRAMEWORK

This Environmental Management Framework has been prepared to consider the phased construction of the project and covers the following works:

- Dredging of material from an area of sea bed and the use of these materials to create an area of infill up to a final finished level of + 4.7m OD (7.6m CD). The infill will be surcharged by some 2m above final level initially to accelerate consolidation, with excess amounts to be moved to the last stage when adequate consolidation has taken place.
- Edge protection of parts of the reclaimed area by use of embankments protected on the seaward side with rock armour revetments.
- Breakwaters and Quay Wall Construction including sheet piling, combi-walls, filling and all accessories including ecologically engineered concrete.
- Marina Infrastructure
- Slipway, Kayak Landing and other water amenity facilities
- Roadways, Yard Pavements, Pathways and associated facilities
- Railway Line including embankments, bridge and associated infrastructure
- All Utilities and Services
- Buildings for a Harbour Office, a Marina Office, a Passenger Terminal, including all security gatehouse facilities, ESB substation and Fire Water Pump house
- Upgrade Works to existing roadway at Lough Atalia Railway Bridge and at existing harbour access junction

Specifically, the purpose of the Environmental Management Framework, and in due course the developed EMP, is to:

- Ensure the Contractor's and Subcontractor(s)' commitment in minimising environmental effects;
- Document environmental concerns and implement appropriate protection measures;
- Provide guidance to Management, regarding procedures for protecting the environment and minimizing environmental impacts;
- Provide relevant information and training regarding environmental issues, as and when required;
- Provide a reference to applicable legislative requirements.

The information contained in this Environmental Management Framework and in due course the developed EMP will be supplemented by the contractor's Environmental Implementation Plan (EIP) containing the specific action plans of the contractor regarding the requirements of the EMF

stated here, such that the environmental issues and regulatory requirements are properly addressed.

2 PROJECT OVERVIEW

2.1 THE DEVELOPMENT

The Galway Harbour Extension is described in detail in the EIS. The Galway Harbour Extension will provide a multifaceted port facility to reasonably meet all port user requirements. These can be summarised as follows: -

- Deep Water Berths for Large Cruise Liners with easy sea approach access
- Safe and Secure Berths for Oil and Bitumen Tankers
- Berths for Coal, Steel and General Cargo with direct linkage to transport infrastructure
- Protected Berths for Fishing Vessels
- Facilities for Marine Sport and Leisure Activities
- Launching Facilities
- Safe and Secure Berths for Yachts and Pleasure Craft
- Land Based Areas for Uncovered Storage, Buildings and associated Harbour Facilities
- Utilities, Transport and Services Infrastructure

Again, as set out in the EIS, these will be achieved by the phased construction of a range of civil, marine and building engineering elements, which can be summarized as follows: -

- Lagoon Walls to contain marine dredged materials and provide access roads to construction areas
- Lagoon Walls protected with breakwater revetment on sides exposed to sea climate
- Use of ecologically engineered concrete to enhance settlement by flora and fauna
- New Approach Channels dredged to provide safe easy access to all berths
- Dredged Materials Filled into confined Lagoons
- Reclamation of Land within Lagoon Areas
- Creation of Defined Open Areas within Reclaimed Land
- Outer Harbour Protection Breakwater
- Quay Walls for Deepwater Berths for Liners, Oil and Bitumen Tankers, and Cargo Vessels
- Fisherman's Pier
- Nautical Centre Slipway
- Marina Protection Breakwater
- Marina Berths
- Dedicated Utilities and Services for Oil, Bitumen, and Marina Berths
- General Utilities and Services to All Areas
- Rail Transport Link to Outer Quays
- Individual Site Developments

2.2 ENVIRONMENTAL POLICY, OBJECTIVES & TARGETS

- Preventing damage to the natural environment by minimizing nuisance and disturbance to the natural ecosystems
- Minimising waste production and ensuring correct waste management on site
- Proper managing and controlling of operations of potential sources of changes to air, vibration and noise and suspended solids levels
- Actively promoting an environmentally responsible approach to project activities amongst the entire workforce
- Ensuring Subcontractors/Suppliers/Visitors apply appropriate Environmental practices
- Involving and committing Project Management as well as each employee to the Project Environmental Policy, Objectives and Targets;

2.3 HEALTH AND SAFETY POLICY, OBJECTIVES AND TARGETS

The Galway Harbour Company, as Client, will commit to best practice with respect to the Health Safety and Welfare of the community during the preparation, design and construction of this project. It will appoint entities who will allocate adequate and competent resources to fulfil this goal, so that, at a minimum, compliance with all statutory safety health and welfare legislation is met. The key objective will be to proactively prevent harm, damage and loss to all personnel, who could be affected by the project. To achieve this, the Galway Harbour Company, as Client, will: -

- Appoint designers with the necessary competence and resources to design all of the project elements so that they can be safely constructed
- Appoint a competent Project Supervisor Design Process who will organize cooperation between all designers and ensure coordination of all their design activities which could affect the safety health and welfare of any persons who could be affected by the construction on this project
- Appoint a competent Project Supervisor Construction Stage, who will organize cooperation between all contractors and see that arrangements are put in place to construct all of the project elements so as to protect any persons who could be affected by the construction on this project
- Appoint contractors who will provide adequate and competent resources to construct the project elements so as to protect any persons who could be affected by the construction on this project

3 REGULATORY FRAMEWORK

3.1 NATIONAL AND LOCAL ENVIRONMENTAL REGULATIONS

The Contractor will abide by the regulatory standards as a minimum, to protect the environment, and any others who may be affected by the project activities. The Contractor and his Subcontractors must comply with the following:

- Applicable environmental codes and regulations of Ireland;
- Applicable international laws, as relevant;
- Contract environmental requirements;
- Contractor internal environmental requirements;
- Industry Standards and good practices, where appropriate.

4 CONSTRUCTION METHODS

The construction methods, briefly summarized below, are all described in detail in Chapter 4 of the EIS.

4.1 SURVEY AND PREPARATION

Topographic surveys will be performed prior to commencement of the dredging and reclamation operations to determine the initial conditions of the site, access roads, surrounding, beaches, public places, etc. The findings of these surveys will establish the baseline against which the site restoration work will be evaluated after dredging, reclamation, civil and marine engineering works and other construction operations have been completed. Pre-dredging bathymetric surveys will be carried out to verify the actual depths, immediately prior to dredging and the volume of materials that is intended to be dredged. During the progress of the construction, close monitoring of the progress of the dredging works and production volumes will be performed through ongoing surveys to confirm that the dredging operation are being executed based on the requirements and that the operation is being carried out within the boundaries of the dredge area. At the completion of the operation, post-dredge surveys will verify the total amount of dredged material and confirm that the dredging operation was executed based on the requirements and within the boundaries of the dredge area. Results of the surveys will be prepared in a formal report within 2 months of the completion of the field work.

4.2 VESSELS AND EQUIPMENT

The precise vessels and equipment that will be used will depend on the particular contractor carrying out the works. In the EIS, details of the proposed methodologies have been described with reference to generic vessel and equipment types. There will be a significant variety of vessels and equipment used during the works and the separate sections below for the key elements of the project will summarise these.

Vessels and Equipment		
Illustration	**Vessel /Equipment**	**Operation**
	Trailing Suction Hopper Dredger (TSHD)	Appropriate for dredging at deeper sections of the area; can dredge and at the same time store materials temporarily in its hull and transport to the lagoons or pump to the lagoons via a floating pipeline. Will be generally used to dredge the upper soft layers.
	Back hoe dredger (BHD)	Excavation of coarser materials including rock fractured by explosives and lower stiffer layers.
	Jack up rig / raft	Drilling holes for placement of explosives, base for back hoe dredger
	Sediment / rock transport barge with tug	Transports material from the dredge area to the lagoons

	Floating pipeline	Transports sediments from the dredge area to the lagoons
	Bull Dozer	Required for the formation of bunds and for spreading the dredged materials around the site. Will be utilized to push stiffer materials within the lagoons,
	Backhoe	For placing materials and for back hoe dredging, loading and unloading barges.
	Lorry	For transport of roadmaking materials from quarries and dredged materials within the reclamation site
	Dumper	For transport of materials within the reclamation site

Table 1 - Vessels and Equipment

4.3 DREDGING & RECLAMATION OPERATION

In the EIS, the methodologies for dredging and reclamation are described in detail.

For dredging, two types of dredger are proposed, (i) the Trailer Suction Hopper Dredger (TSHD) and (ii) the Backhoe Dredger (BHD).

The type of dredger to be used will depend on the sediment/material being dredged. The TSHD will excavate the softer sediments and these will be transferred via pump through sealed floating pipelines into the lagoons. In the case of soft sediment, the cutter head will hydraulically suck in the slurry mixture of the sand and water and pump the fluidized materials into a floating pipeline to be discharged at the bunded lagoon area.

The BHD will excavate the firmer sediments and the blasted/loose rock. These will in turn be transferred via barge and another quay mounted backhoe dredger onto trucks for distribution into the lagoons using grab buckets, dumpers and spreaders as appropriate.

The infilling process will commence as soon as the area is fully bunded via the floating pipeline of the dredger or by a back hoe dredger. Except for seepage of transport water and rain water through the geotextile material lining the lagoon bund walls, no discharge will occur from the bunded area.

The contractor will implement surcharging to maintain the distribution of materials inside the reclamation site. This will prevent possible problems due to unequal bearing strength and compaction brought by natural separation of particles inside the lagoon footprint as well as eliminate the possibility of escape of fine materials. Heavier particles will settle nearer the inflow pipe because finer particles are carried further away by water flow. Bulldozers, backhoes, trucks and dumpers will then transfer materials throughout the site. A separate detailed method statement will be required from the contractor regarding soil quality improvement, surcharging and soil waste management.

Shore protection from sea waves will be provided by lagoon walls faced with outsourced rock armour revetment.

4.4 BREAKWATERS AND QUAY WALL CONSTRUCTION

The outer commercial port and the Western side of the Marina will be protected from the sea by breakwaters. These will comprise sheet piling and combi-walls containing rock fill up to approximately Mean High Water Springs level. Armour rock revetment faced breakwaters will extend above this level to protect against overtopping. The armour rock will be placed by barge mounted crane grab. Rock armour will be delivered by sea.

The quay walls generally comprise steel sheet piling and combi-wall construction. These include large diameter (up to 1200mm diameter) tubular steel piles and heavy sheet piling (typically Larssen 6) anchored in pre-blasted rock trenches. All of these operations will involve sea barge / jack up raft mounted pile driving equipment and guide frames. Divers will be used to monitor for any potential grout seepage into the water column which will be carefully controlled by installation through the tubular piles and into trenches capped with stone and sandbags. Rock fill installed between the piling to form the quays will be carried out from the shore side with the rock fill being generally imported by road. The quays will be capped generally with concrete slabs.

The design of all quay walls, revetments and breakwaters will take into account recent research (*e.g.* Firth, 2013; Chapman and Brown, 2011; Martins and Thompson, 2009) which has shown that minor design changes *e.g.* the addition of pools, pits, crevasses and water retaining

features, leads to a statistically significant increase in the settlement and diversity of marine flora and fauna on these artificial structures.

4.5 MARINA INFRASTRUCTURE

The Marina Infrastructure will comprise floating pontoons fixed to steel piling guides. The pontoons will be pre-fabricated and delivered to site via road, and installed by land-based crane. The equipment involved will include delivery trucks and trailers and mobile cranes. The remainder of the equipment comprises lighting, electrical fittings, water delivery connections anchor cleats and general pontoon fitting (e.g. light rubbing fenders).

4.6 SLIPWAY, KAYAK AND WATER AMENITY FACILITIES

The slipway will be formed using precast concrete flat slabs, delivered to site using road truck and trailer. Mobile cranes will be used to lift the slabs into final position. Prior to this, carefully prepared stone filling will be placed to grade and will be protected using armour rock revetment either side of the slip. The placing of the stone and rock armour will be carried out from land, using truck and trailer delivery and crane grab.

The bottom edge of the slipway will be protected using sealed Fabriform bagged concrete.

4.7 ROADS, YARDS AND PATHWAYS

Once adequate consolidation has been achieved, excess surcharge will be removed from the reclaimed land lagoon areas; this will be placed into Lagoon 7. Lagoon 7 will be surcharged with surplus lagoon wall rock fill as lagoon walls are reduced to proposed levels. These areas will then be rolled, capped with redistributed lagoon wall stone and imported stone and compacted prior to finishing. The type of finish to yards, roads and paths will depend on the use, varying from compacted stone, to concrete to bitumen macadam. Normal land-based machinery will be used, including graders, dozers, vibratory rollers, bitumen macadam layers and associated delivery trucks. Finish yard materials will be imported by road.

4.8 RAILWAY LINE INCLUDING EMBANKMENTS, BRIDGE AND ASSOCIATED INFRASTRUCTURE

The New Harbour Extension will incorporate a new dedicated rail connection spur line off the main Galway to Dublin Rail Link. This will involve the construction of a new embankment using imported granular material to supplement materials recovered on site. These will be placed and compacted in layers using dumpers, rollers and dozers. On the top of the embankments, imported stone railway ballast will be placed when the precast concrete rail sleepers are in place. The bridge will be formed using in-situ concrete abutments and standard precast bridge beams. The bridge beams will be delivered by road and erected onto the abutments using mobile cranes.

Pallisade security fencing will be installed each side of the embankment and will be delivered by truck and trailer and erected by light crane.

4.9 ALL UTILITIES AND SERVICES

There will be a significant amount of utilities and services to be installed, from oil and bitumen delivery pipelines from the new outer commercial quay, into the existing storage facilities in the Enterprise Park. In addition, there will be pipelines for water, sewerage (both connected to the public system), and surface water all to be installed using conventional pipeline systems. In addition, there will be telecom, gas, ESB and data connections. All of these utilities and services will be installed in pre-formed precast concrete ducts, within the roadways typically, so that they can be accessed easily in the future for maintenance. All the materials will be delivered by

truck and trailer by road and installed using backhoe excavators, cranes (for precast ducts and pipes).

4.10 BUILDINGS

The Buildings for a Harbour Office, a Marina Office, a Passenger Terminal, including all security gatehouse facilities, ESB substation and Fire Water Pump house will all be constructed using conventional building methodologies, either block work for the smaller buildings and steel or concrete frame for the larger. All materials will be imported by road on truck and trailer or fixed truck. The ESB substation will involve transformer and switch gear installation, again delivered by truck and installed by crane and skids.

The foundations for these buildings are likely to comprise piled systems due to the nature of the reclaimed ground. It would be intended to utilize drilled piling systems, where boulders may be encountered and precast driven piles where the building is located within lagoons with soft sediments above solid existing ground.

4.11 UPGRADE WORKS TO EXISTING ROADWAY AT LOUGH ATALIA RAILWAY BRIDGE AND AT EXISTING HARBOUR ACCESS JUNCTION

On the Lough Atalia Road, the existing railway bridge presents a significant height restriction to commercial and construction traffic. The bridge cannot be moved or raised and it is proposed to excavate the road and provide a lower road level within the environs of the bridge. This will involve careful excavation, so as not to affect the integrity of the existing bridge structure; the foundation of the abutments being below the proposed lowered road formation level avoids any risk of undermining. As this is preliminary work, the excavated material may require to be removed from site. If programme allows, the excavated material will be reused in filling the lagoons. The new road will comprise an asphalt pavement and will be drained to a storage tank and Pumping Station to be disposed of to the existing GHEP drainage system. An oil interceptor will ensure that no oil contaminants are allowed into the water column.

At the junction of the Lough Atalia and the existing entrance to the Enterprise Park, an upgrade is proposed to improve the access and the interface with existing public traffic. This will mean realigning the road and kerb lines and improving the road width and structure.

All materials will be delivered by road.

4.12 ON-SHORE SITE WORKS

The onshore works during the dredging and reclamation phase will involve the following:

- Providing the site offices, yard and workshop facilities
- Providing land-based machinery for reclamation work in which the dredged material will be spread and leveled and also for placement of rock revetment

The location and maps of the proposed pipelines, offices and large vessels (e.g. dredgers) will be provided upon finalization of the selection of the contractor.

4.13 DEMOBILIZATION AND RE-INSTATEMENT

After completion of the works, all construction equipment will be removed along with any temporary facilities. All equipment, tools and surplus materials will be placed in shipping containers and shipped off site. The various work sites will then be cleaned of any remaining debris.

5 ENVIRONMENTAL MANAGEMENT

5.1 SITE AND WORK MANAGEMENT

5.1.1 Site and Work Preparations

An access route plan for transport of any special deliveries of components or materials must be submitted to the Galway City Council for approval.

The Harbour Master must be properly informed for the arrival and usage of any marine vessels within the area. Communication facilities will be required to be installed at these vessels as deemed necessary for the monitoring of location and regular contact during the operation of the vessels.

5.1.2 Workplace Requirements

Site offices will be installed to house the contractor's personnel, consultants and other members of the supervisory staff to perform their management and administrative duties, with water and power supplies and facilities such as meeting rooms, rest rooms and first aid or emergency area. Emergency fire fighting portable equipment will be installed at selected areas.

Waste containers will be provided at strategic places at the offices, accommodation areas and construction sites for responsible disposal of solid domestic wastes, such as food wrappers and containers etc. Waste segregation will be required prior to disposal or collection.

Construction wastes will be properly stored at a separate area away from the work site, properly secured and labeled and will be collected regularly to prevent accumulation.

Portable toilets and washrooms will be installed at strategic areas on the site

Entrance and exit gates will be installed to control access to the site.

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Life saving ring buoys will be provided and installed at strategic areas particularly at the lagoons.

5.1.3 Maintenance of equipment, vessels and vehicles

Contractor will be required to provide for the implementation of a preventive maintenance program. The Project Managers will be responsible for the accurate implementation of the policy.

The primary goal of the Contractor's preventive maintenance program is to avert the failure of equipment before it actually occurs, thus avoiding downtime and impacts on the health, safety & environment, as well as in quality and productivity. The preventive maintenance activities will include equipment checks, partial or complete overhauls at specified periods, oil changes, lubrication and so on.

Long-term benefits of preventive maintenance include:

1. Improved system reliability;
2. Decreased cost of replacement;
3. Decreased system downtime;
4. Better spares inventory management;
5. Protection of the environment.
6. Improved safety and health of workers

Material Safety Data Sheets for all fuel oils and greasing products used will be made available in the site offices.

All waste oil will be placed in drums and transported to a waste oil depot / treatment facility. All other materials will be placed in waste containers and disposed of at approved licensed facilities.

5.1.4 Equipment Refueling

For the equipment, such as earth moving machines, dump trucks, generators etc refueling will take place at specific bunded locations within the works site during construction activities. To ensure that refueling activities cause no harm to the environment, the Contractor must take the following preventive measures to avoid possible environmental incidents:

- Only trained and well-experienced personnel should be allowed to perform refueling activities.
- During refueling activities the machines will be switched off and no open flames allowed;
- A fire extinguisher is to be available at all times within easy reach;
- During the refueling activities a spill kit must be available in order to contain any spillage and prevent contamination.
- Valves and taps must not be left open unattended and must be locked when not in use;
- Personnel carrying-out refueling activities are to be made aware of the requirements listed in the EMP and be instructed in the use of spill kits and emergency procedures.

5.2 MATERIALS AND STORAGE

All materials and supplies delivered will be properly documented, segregated and stored at allocated areas at the site based on their sizes, volumes, types and characteristics.

Bulk and materials in volumes will be stored away from traffic and segregated, arranged, properly covered / enclosed and secured.

Flammable, reactive and hazardous materials and chemicals will be stored separately from other materials.

Liquid chemicals and supplies such as paints, thinner, petrol, and oil will be stored in tightly sealed containers in bunded cemented facilities or placed on top of catch basins during storage.

5.3 TRAFFIC & SECURITY

Security and traffic rules and regulations will be made and widely implemented by the contractor for the operations of the construction site. This will include the following items:

- Contractor will provide directional mapping for visitors to the site.
- Road signage will be clearly displayed and installed along the roads leading to the entrance of the site, and within the traffic routes inside the side.
- Visitors' ID will be provided and recorded to the visitors at site.
- All persons entering the site will wear appropriate personal protective equipment.
- Specific areas at the site will be allotted for parking.
- Restricted areas will be identified at the site to control the movement of the vehicles and the people.
- Vehicle drivers shall follow strictly a maximum allowable speed of 30 kph.
- Traffic roads will be clearly identified with road signs and traffic cones and barriers and shall be maintained in safe, flat and compacted working conditions.
- All vessels must secure approval for use from the Department of Agriculture, Food and the Marine. All crews will be properly licensed to work aboard the marine vessels.

- A standby boat will be provided to give ferry services for the dredger crews, supplies and be used during water sampling and marine monitoring.

5.4 AIR QUALITY

This is a large scale construction project which has the potential to generate undesirable air emissions in the form of nuisance dust and odours. Careful planning however can ensure that the project can be carried out in a manner which seeks to prevent any visible airborne emission or odour outside the site boundary.

5.4.1 Dust Emissions

Dust is a generic term used to describe fine particles that are suspended in the atmosphere. Dust comes from a wide variety of sources, including soil, vegetation (pollens and fungi), sea salt, fossil fuel combustion, burning of biomass, and industrial activities. It is formed when fine particles are taken up into the atmosphere by the action of wind or other physical disturbances or through the release of particulate into the atmosphere.

Particle size is an important factor influencing the dispersion and transport of dust in the atmosphere and the effects of dust on human health. Suspended dust particles in the atmosphere can be as small as a few nanometers and as large as 100µm. Particles larger than 100µm tend to settle very close to the source. A particle of 100µm can stay buoyant for periods of 15 minutes whereas particles of 1000µm settle within 1 second of release.

Visible dust is in the range 50µm to 10,000µm and the size range of dust from construction activities is normally on the upper end of this scale. Specific activities such as welding or cutting materials can generate finer dusts which, in the context of this project, will result in very small quantities.

Studies of large open sites have shown that 40% of nuisance dust arises from haul-roads and a further 10-20% from loading activities, the balance coming from various other activities. Dust control measures such as the use of wheel wash facilities at the site entrance and the use of bowsers in dry weather can significantly control dust emissions and will be implemented as part of the plan.

Mean monthly dust deposition rates will be controlled not to exceed 350mg/m²/day on the site boundary with no one sample to exceed 650mg/m²/day.

5.4.2 Odour Emissions

The primary source of odours during the construction phase of this project will arise during dredging. The material dredged from the bottom of Galway Harbour is a combination of muddy sand, natural organic plant life and seawater. Dredged material will form an important material resource for the construction of the harbour extension working area.

Occasionally, low level odours emanate from dredged material in the immediate proximity of the discharge point. Hypoxic / anoxic conditions give rise to these odours and are principally due to the minute presence of hydrogen sulphide gas, a natural byproduct of anaerobiosis.

The human olfactory mechanism is capable of detecting the presence of hydrogen sulphide gas in quantities as low as 0.001 parts per million (ppm). Hydrogen sulphide is a colourless toxic gas which is heavier than air and in low concentrations (below 1ppm) smells like rotten eggs. Levels over 500 ppm are fatal, so a short term exposure limit of 10ppm and a daily exposure limit of 5ppm is generally applied for safety reasons in industry.

Dredging activity will be controlled to the extent that hydrogen sulphide limits at the site boundary will be maintained below 1 ppm at all times. In the event of levels reaching 0.01ppm at the site boundary corrective action will be put in place immediately.

5.4.3 Air Quality Monitoring

An automatic weather station will be maintained for the duration of construction with real-time data on wind speed, wind direction, precipitation and sunshine hours. This weather data will form a template over which air quality monitoring is carried out and reported. Air quality monitoring will include daily and routine monitoring in addition to any complaints that may arise.

Daily logging of visible dust plumes and detectable odours at the site boundary will be carried out and the results maintained on site in addition to being made available to the planning authority when requested.

Continuous dust deposition monitoring for the duration of construction will be carried out. A minimum of three sites will be monitored on the west, north and eastern site boundaries. Additional locations may be required for specific construction activities. Dust deposition monitoring will be carried in accordance with TA Luft VDI Method 2119 (Bergerhoff Gauge).

Daily odour monitoring will be carried out during dredging activity when odour may be an issue by means of a transect survey on the site boundaries. The methodology for the transect survey will be that outlined in the UK Environment Agency Odour Guidance.

In order to provide numerical data on odour levels a weekly transect survey of the boundaries will be carried out during dredging phases when odour may be an issue.

5.4.4 Frequency and Reporting

Monitoring will be carried out as outlined above on a daily and weekly basis. In the event of an odour complaint, a transect survey will be carried out using the Sulphur Dioxide Analyser and action based on the air quality threshold levels will be implemented.

5.4.5 Reporting Action Guidelines

In the event that any planning condition or threshold limit as set out below is not being complied with, the environmental consultant will be informed immediately along with a recommendation of appropriate remedial action. A full written report will be submitted to the environmental consultant within 3 working days.

A formal air quality complaint handling procedure will be put in place on site.

5.4.6 Threshold Limits and Alert Levels

The following Dust Threshold limits are proposed.

Dust Deposition Limits		
Day & Time	**Mean monthly dust deposition**	**No one sample to exceed**
At any time on the site boundary	350 mg/m^2/day	650 mg/m^2/day

Table 2 - Dust Deposition Limits

The following H_2S Threshold limits are proposed.

H_2S Threshold Limits			
Day & Time	**Caution Level**	**Warning Level**	**Breach Level**
At any time on the site boundary	0.01ppm	0.1ppm	1ppm

Table 3 - Odour Threshold Limits

Using these threshold limits, alert levels are defined in Table 4 following:-

Alert Level	Air Quality Level/Complaints	
	Site Boundary Location	External Complaint
Normal	**Mean monthly dust deposition level is less than 100 mg/m2/day** **H_2S level below 0.01ppm**	**No complaints**
Caution	**Mean monthly dust deposition level exceeds 100 mg/m2/day** **H_2S level 0.01 to 0.1ppm**	**Single complaint**
Warning	**Mean monthly dust deposition level exceeds 200 mg/m2/day** **H_2S level 0.1 to 1ppm**	**Complaint from more than one person**
Breach	**Mean monthly dust deposition level exceeds 350 mg/m^2/day** **H_2S level exceeds 1ppm**	**Complaint from regulatory agency**

Table 4 - Dust and Odour Alert Levels

5.5 VIBRATION

5.5.1 Vibration Levels

Vibration levels from all activities other than blasting will be confined to areas inside the site footprint. Blasting however has the potential to cause elevated vibration levels outside the site boundary. These impacts need particular consideration in relation to potential property damage and disturbance of sensitive species e.g ground nesting birds

In relation to property damage, it is well established that vibration levels of 50mm/s peak particle velocity (ppv) are required to cause structural damage to modern constructions. Levels of 12mm/s ppv have been set by bodies such as An Bord Pleanála, The Environmental Protection Agency and the National Roads Authority for various projects. In line with EPA guidance a more conservative limit of 8mm/s is being adopted for this project.

All blasting, drilling and pile driving activities will be restricted to daylight hours. In relation to explosives a maximum instantaneous charge of 10kg will be permitted (see Chapter 10 of the EIS).

The areas identified as 'critical' for blasting vibration levels are the three tank farms, in case of damage to pipes or tanks which could result in a spillage. Due to the separation distances involved vibration levels are likely to be under 4mm/s ppv, providing a significant safety factor for these locations.

A secondary impact of blasting is air overpressure. This comprises a low frequency wave generated by the blast, which can be sensed by mammals and birds as 'vibration'. The impact is generally felt in the air cavities and is a single shot event. Due to the distances involved air over pressure levels due to blasting will not have any impact.

The Alaskan Department of Fish and Game Blasting Standards for the protection of Fish require an underwater ppv level of 0.5 inches per second (12.5 mm/s). There are no known limits for the sensitivity of birds to air overpressure.

Birds are known to be sensitive to sudden noise events although they habituate to them in time. A study on 211 raptor nests[1], exposed to blasting, gunshots and low altitude overflights found that no eggs or young were ever ejected. Parents on nests were four times less likely to startle than roosting parents and when startled the birds usually left for a matter of a few minutes.

Nesting birds in the inner part of Galway Bay are currently exposed to gunfire from the Military Range at Renmore Barracks and could to some extent be habituated to impulsive noise.

Pile driving could produce ground-borne vibration levels that may be perceptible within approximately 100-200 meters of the pile-driving activity. Ground-borne vibration levels at distances of approximately 60 meters or more will not result in adverse effects. Pile driving very close to structures, within 18 meters, can cause structural damage due to displacement of soil and resulting lateral movement. No structures are within this range and no sensitive species other than possibly salmon will be present within 20 metres of pile driving activity. No impact driving will take place in the period April to July to mitigate any potential impact on salmon.

Vibrations from blasting and pile driving activities may harass the harbour seals when foraging in waters close to the development. Appropriate mitigation measures to avoid impacts to harbour seals will include monitoring of an exclusion zone by a Marine Mammal Observer (MMO) prior to piling. The NPWS draft guidance to Manage the Risk to Marine Mammals from man-made sound

[1] Knight, R.L., and K.J. Gutzwiller, editors. 1995. *Wildlife and Recreationists: Coexistence Through Management and Research*. Island Press, Washington, DC. 372 pp.

sources in Irish Waters (2012) outlines how soft start methods will be used to mitigate during works. The harbour seal haul-out site at Rabbit Island is located a considerable distance from proposed pile driving and blasting activities and will be monitored periodically during construction activities to determine if seals are substantially disturbed even with these measures. Blasting will only occur during the months of August through to March.

Blasting and dredging activities are addressed in the EIS and are likely to result in localized elevated suspended sediment concentrations. Mitigation measures to avoid and minimize impacts to fish and salmon critical habitat include measures such as limiting maximum instantaneous charge and construction sequencing, where blasting and dredging will be avoided during the peak smolt migration period.

Pre-construction nesting bird surveys inside the site boundary and immediate environs will be conducted by an Ecologist no more than 10 days prior to planned construction in order to locate nests within and adjacent to the proposed work area. An additional verification survey will be performed no more than 3 days prior to construction to assure discovery of any new nesting activity initiated since the original survey. If a nest is detected during the pre-construction nest survey, the Ecologist will include the details of nesting areas along with appropriate minimisation, avoidance measures and buffer zones (if required).

If nesting is detected during a verification survey or during construction monitoring, the details will be included in a Nest Monitoring Log. In addition to the pre-construction nesting bird survey and the verification survey, the Ecologist will perform a weekly sweep for each week during construction activities within the breeding season to look for biological resources, including nesting birds. If a nest is identified during the weekly sweep, the Ecologist will subsequently observe the nest and report the findings as appropriate.

5.5.2 Vibration Monitoring

Vibration monitoring will be carried out at the following locations during blasting.

1. Cold Chon tank farm
2. Enwest Oil terminal
3. Leeside Oil terminal
4. Liam Mellows Park
5. Dún Aengus Apartments
6. Grattan Road
7. Hare Island

5.5.3 Frequency and Reporting

The vibration (and air overpressure) monitoring will be carried out for the first six blasts and the data evaluated by a qualified ecologist to determine if any further monitoring is required on Hare Island (to minimise disturbance on nearby Rabbit Island).

5.5.4 Reporting Action Guidelines

Subsequently all of sites 1 to 3 above and one of sites 4 to 6 in rotation will be monitored. The results of the monitoring will be provided to the environmental consultant on the day of the blast and a written report will be provided and kept on site within 2 weeks of the blast taking place.

5.5.5 Threshold Limits and Alert Levels

The following vibration exposure limits are proposed.

Vibration Limits – Peak Particle Velocity at the closest part of any sensitive property to the source of vibration at a frequency of		
Less than 10 Hz	**10 to 50 Hz**	**Above 50 Hz**
8mm/s	12.5mm/s	20mm/s

Table 5 - Vibration Limits - Peak Particle Velocity

Using the above threshold limits, alert levels are defined in Table 6 following.

Alert Level	Vibration level, Complaint or Observation	
	Vibration Level	Observation
Normal	**< 4mm/s**	**No Complaints**
Caution	**4 - 6mm/s**	**Any single complaint or note of disturbance to sensitive species noted by MMO or Ecologist**
Warning	**6 - 8mm/s**	**More than one complaint or note of injury to sensitive species noted by MMO or Ecologist**
Breach	**>8mm/s**	**Complaint from regulatory agency**

Table 6 - Vibration Alert Levels

5.6 NOISE

5.6.1 Occupational Noise

Monitoring of noise levels will be conducted during day and night (if there will be night shifts schedules) on a monthly basis throughout the construction period. Noise levels will not exceed the following noise exposure limits based on criterion level of 85 dB (A) and exchange rate of 3 dB (A): This exposure limit is more preferable compared that of the "5 dB (A) rule" since it is more stringent, logical and generally when it is used, there is normally no separate regulation for impulse/impact noise. The equivalent sound exposure level takes impulse noise into account in the same way as it does to continuous or intermittent noise.

5.6.2 Airborne Noise

The scale of this project is such that it will cause increased noise close to any of the construction activities. The purpose of this Environmental Management Framework is to ensure that the activities can be carried out in a manner that is as environmentally efficient as possible, i.e. minimising the environmental impacts at locations outside the site boundaries.

With large construction projects it is always necessary to strike a balance between working quietly and working quickly. The duration of a project can be extended significantly in order to implement noise reduction measures thus prolonging the noise exposure period. The National Roads Authority (NRA) Guidelines as cited in the Environmental Impact Statement provide a balance in this regard. By permitting these noise levels the construction period is minimised.

Noise levels as set out in the NRA Guidelines are the maximum permitted level at any noise sensitive location during construction. This does not mean that these noise levels will be present for the entire period. The large scale of the site means that construction activities will take place in different areas at different periods so some areas will have no change on pre-existing noise levels for long periods during construction but may experience levels up to those set out in the Guidelines for short periods. This Environmental Management Framework is designed to ensure that such periods are minimised.

Noise levels can be controlled by various mitigation measures as set out in the Environmental Impact Statement. Best practice measures will be adopted for noisy activities and a noise monitoring programme will be implemented for the duration of construction.

5.6.2.1 Noise Monitoring

Noise sensitive locations (NSLs) are deemed to be any location in which the inhabitants can be disturbed by noise from the construction site. This incorporates Environmental Protection Agency and the Department of the Environment, Community and Local Government's (DoECLG) guidance, i.e. any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels and may include areas of particular scenic quality or special recreational amenity importance.

In order to provide a representative sample of such locations 4 external noise monitoring locations have been chosen:

1. Ballyloughan Beach
2. Liam Mellows Park, Renmore
3. Dún Aengus Apartments, Galway Docks
4. Grattan Road

All noise measurements shall be made in accordance with I.S.O. Recommendations R1996/1, 2 and 3 "Acoustics – Description and measurement of Environmental noise".

Construction noise measurements will take the form of a noise survey over two measurements of 30 minutes (separated by a minimum of 4 hours) during the daytime period and one 15 minute measurement during the night time period at each noise sensitive location. Concurrent wind speed, wind direction and rainfall data should be collected on the site. The commonly used noise indices of LAeq, LAmax, LAmin and LAn statistical parameters, including the LA90, should be logged with rainfall and wind speed and direction. Any data corresponding to periods of heavy rainfall will be excluded from analysis.

Measurements will be taken at the four noise sensitive locations to determine the 'worst-case' impacts from the site operations. To ensure 'free field' levels are measured, the monitoring will be positioned at least 3.5 m away from a reflecting surface at a 'typical' receiver height of 1.2 to 1.5 m.

An independent environmental consultant will be assigned to monitor and audit the noise monitoring programme.

5.6.2.2 Frequency and Reporting

Monitoring will be carried out at the commencement of each phase of operation or stage of construction, including but not limited to; TSHD dredging, Backhoe dredging, pile-driving and rock transport and rock placement. This is to ascertain the noise level attributable to each stage or process so that if required mitigation measures can be implemented from an early stage.

Noise monitoring will be carried out on a quarterly basis for all of these activities.

5.6.2.3 Reporting Action Guidelines

In the event that any planning condition or NRA Guideline is not being complied with, the environmental consultant will be informed immediately along with a recommendation of appropriate remedial action. A full written report will be submitted to the environmental consultant within 3 working days.

A formal noise complaint handling procedure will be put in place on site.

5.6.2.4 Threshold Limits and Alert Levels

The following Noise Threshold limits are proposed.

Table 8 – NRA Construction Noise Limits		
Day & Time	LAeq (1 hr) dB re 20 µPa	LpA (max) slow dB re 20 µPa
Monday to Friday07:00 to 19:00 hrs	70	80
Monday to Friday 19:00 to 22:00 hrs	60	65
Saturday 08:00 to 16:30 hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30 hrs	60	65
All other Times	-	-

Table 7 - Noise Limits

Using the above threshold levels, alert levels are defined in Table 8 following.

Alert Level	Noise Level/Complaints	
	Noise Sensitive Location	Noise Complaint
Normal	**10dBA below limit**	**No complaints**
Caution	**5dBA below limit**	**Single complaint**
Warning	**At limit value**	**Complaint from more than one person**
Breach	**Above limit**	**Complaint from regulatory agency**

Table 8 - Noise Alert Levels

5.6.3 Underwater Noise

The scale of this project is such that it will cause increased underwater noise levels close to any of the construction activities. The purpose of this Environmental Management Framework is to ensure that the activities can be carried out in a manner that is as environmentally efficient as possible, i.e. minimising the environmental impacts.

There has been increasing concern internationally about the potentially harmful effect of man-made sound on the marine environment and species therein that could be sensitive to it. Under the 1976 Wildlife Act and its subsequent Amendments (2000, 2005 and 2010), it is an offence to hunt (except in some instances under licence or Ministerial permit), injure (except when hunting under such licence) or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species.

Species of particular concern regarding underwater noise levels potentially raised due to this development include the Harbour Seal (*Phoca vitulina)*, Otter (*Lutra lutra*), Salmon (*Salmo salar*), Sea lamprey (*Petromyzon marinus*), Great Northern Diver (*Gavia immer*), Red-breasted Merganser (*Mergus serrator*) and Cormorant (*Phalacrocorax carbo*) all of which are qualifying interests or species of conservation interest (SCI) for the Galway Bay Complex cSAC and Inner Galway Bay SPA. Additionally, Common Tern (*Sterna hirundo*) and Sandwich Tern (*Sterna sandvicensis*) are also SCIs for the SPA. They are shallow diving species which would be at less risk than the deeper diving birds such as Divers, Cormorant and Saw bills. Even though they are not qualifying interest for the cSAC, it should be noted that three species of cetacean forage or transit through the area, the most common being the Harbour Porpoise (*Phocoena phocoena).*

The excavation of material from the seabed during dredging operations is known to produce significant underwater noise in addition to the sound from attendant vessels. Sound exposure levels from this operations are below that expected to cause injury to a marine mammal, except at close range, they have the potential to cause lower level disturbance, masking or behavioural impacts, for example.

Dredging activity will occur in a defined area for a prolonged period of months. Therefore it has the potential to introduce continuous anthropogenic sound at levels that may impact upon marine species and the risk of acoustic impacts associated with this activity will be mitigated to ensure good environmental management.

Pile driving is widely acknowledged to produce substantial levels of anthropogenic sound both in air and in water with quite rapid rise times in each pile strike impulse.

The noise level is proportional to the diameter or maximum width of the pile and potentially can cause permanent hearing injury (i.e., Permanent Threshold Shift PTS), temporary hearing loss (i.e., Temporary Threshold Shift TTS) or other injury for some marine species in close proximity to such operations. The potential of this development to cause significant behavioural disturbance to marine species is limited by the size of the proposed piles and the shallow water environment.

The use of explosives or other blasting methods to break sections of bedrock or seabed (for pier construction) will be required during this project. Man- made explosions mainly produce pulsed sounds at low frequencies (several Hz to several kHz), which are detectable by a wide range of marine species. Active blasting will occur intermittently in a defined area for a prolonged period of months. Preparation for underwater blasting will take place from fixed platforms (i.e., rig, platform or barge) which will be moved a safe distance away for the time of explosion. The blasting associated with this development will take place in boreholes drilled into the rock. The vast majority of the energy generated in each blast will be dissipated in fracturing the rock. By mitigating the potential blast impact by design, using appropriate stemming and limiting the amount of explosive detonated at any single instant for example, the source level of the blast is considerably reduced. Due to the shallow water in the location of the proposed blasting activity, noise transmission is also reduced.

Noise mitigation measures such as the use of bubble curtains have been examined but the significant currents in the area limit their effectiveness. In order to minimise the impact of construction the following general measures have been adopted:

- Use of alternative, lower impact equipment and methods where possible (e.g., vibratory hammer, smaller pile diameter, limiting maximum instantaneous charge).

- Use of clear “ramp-up” or “soft-start” procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause significant behavioural impact on marine species to the full output necessary for completion of the activity.

- Use of trained marine mammal observers (MMO’s) to provide effective means of detecting marine species in the vicinity of operations.

- Use of Rigid Inflatable Boat to deter bird species prior to blasting activities.

5.6.3.1 Underwater Noise Monitoring

Underwater noise levels have only recently been measured in Irish Waters. The technology for carrying out this type of measurement on sites without significant infrastructure such as undersea cables is in its infancy.

In order to provide a representative sample of underwater background noise levels in the area surrounding the proposed development 4 underwater noise monitoring locations have been chosen:

1. Mid-channel on the lower section of the River Corrib at Nimmo’s Pier
2. Approximately 100m south of the head of Nimmo’s pier
3. Mid-way between Rabbit and Hare Islands
4. Mid-way between the Leverets and Mutton Island

All noise measurements shall be reported in accordance with TNO-DV 2011 C235 *Standard for measurement and monitoring of underwater noise, Part I: physical quantities and their units*

Pre-construction underwater noise measurements will take the form of a noise survey over a diel cycle once per quarter prior to the start of construction. The commonly used noise indices of Lmax, Lmin and LAn statistical parameters, including the LA90, will be logged with rainfall and

wind speed and direction. Any data corresponding to periods of heavy rainfall will be excluded from analysis.

An independent environmental consultant will be assigned to monitor and audit the noise monitoring programme.

5.6.3.2 Frequency and Reporting

Monitoring will be carried out at the commencement of each phase of operation or stage of construction, including but not limited to; TSHD dredging, Cutter Suction dredging, Backhoe dredging, pile-driving and rock transport and rock placement. Monitoring will follow the same methodology and will be carried out at the same locations as pre-construction monitoring. This is to ascertain the noise level attributable to each stage or process so that if required mitigation measures can be implemented from an early stage.

Noise monitoring will be carried out on a quarterly basis for all of these activities.

During general construction activity post sediment settlement noise monitoring will reduce to six monthly intervals unless more frequent monitoring is required.

5.6.3.3 Reporting Action Guidelines

In the event that any underwater noise limit identified in the EIS being exceeded, the environmental consultant will be informed immediately along with a recommendation of appropriate remedial action. A full written report will be submitted to the environmental consultant within 3 working days.

An underwater noise reporting procedure will be put in place on site.

5.6.3.4 Threshold Limits and Alert Levels

The following Underwater Noise exposure limits are proposed.

Table 9 - Proposed Underwater Noise Exposure Criteria			
Criterion	**Metric**	**Type of Impact**	**Reference**
Cetaceans			
230 dB re 1uPa peak	SPL peak unweighted	PTS	Southall et al, 2007
198 dB re 1 uPa^2-s	SEL (based on pulsed noise sources)	Instantaneous exposure PTS	Southall et al, 2007
215 dB re 1 uPa^2-s	SEL (based on non-pulsed noise sources)	Instantaneous exposure PTS	Southall et al, 2007
224 dB re 1uPa peak	SPL	Instantaneous exposure, behavioural response, single pulse	Southall et al, 2007
183 dB re 1 uPa^2-s	SEL	Instantaneous exposure behavioural response, single pulse	Southall et al, 2007
183 dB re 1 uPa^2-s	SEL (high frequency weighted)	TTS onset	Southall et al, 2007
140 dB re 1uPa peak	SPL	behavioural response, non-pulsed	Southall et al, 2007
Pinnipeds			
218 dB re 1uPa peak	SPL peak unweighted	TTS onset single pulse	Southall et al, 2007
186 dB re 1 uPa^2-s	SEL (pinniped frequency weighted)	Single pulse	Southall et al, 2007
186 dB re 1 uPa^2-s	SEL (pinniped frequency weighted)	Multiple pulses	Southall et al, 2007
203 dB re 1 uPa^2-s	SEL (pinniped frequency weighted)	Non pulsed	Southall et al, 2007
190 dB re 1uPa peak	SPL	behavioural response, non-pulsed	Southall et al, 2007
Fish			
195 dB re 1 uPa^2-s	SEL	PTS onset Blast 0.1 kg Fish	Popper et al.
200 dB re 1 uPa^2-s	SEL	PTS onset Blast 1.0 kg Fish	Popper et al.
187 dB re 1 uPa^2-s	SEL	Behavioural response Blast 0.1 kg Fish	Popper et al.
192 dB re 1 uPa^2-s	SEL	Behavioural response Blast 1.0 kg Fish	Popper et al.

Table 9 - Noise Limits

Using the above threshold limits, alert levels are defined in Table 10 following.

Alert Level	Noise Criterion/Observation	
	Criterion	Observation
Normal	**10dBA below criterion**	**No Observations**
Caution	**5dBA below criterion**	**Any note of biologically significant disturbance to marine species noted by MMO or Ecologist**
Warning	**At criterion level**	**Any note of injury to marine species observed by MMO or Ecologist**
Breach	**Above criterion level**	**Complaint from regulatory agency**

Table 10 - Noise Alert Levels

5.7 SUSPENDED SOLIDS (SS)

Increases in suspended solids concentrations are inevitable during dredging and bund construction and to a lesser extent, infilling activities. However, it can be managed and controlled by incorporating best operating practices.

Closed bunding within the lagoons and careful filling together with strict monitoring will be properly observed in order to ensure minimum impact to the marine environment.

With regard to dredging operations in relation to the approach channel and turning circle, suspended solids will be monitored at both static and mobile stations. The suggested monitoring stations are indicated below:-

Station Monitoring Sampling Station Guidelines		
1	500 meters from the boundary of dredge area	SS level must not exceed 10 mg/L above the baseline reading
2	100 meters from the dredger.	SS level must not exceed 50 mg/L above the baseline reading
3	Control Sites Triplicate samples 200 m equidistant from each other to be taken from 1 to 2 km from the dredger to serve as control sites.	Source of baseline reading
4	1 sample to be taken in the middle of the plume.	SS level not to exceed 500 mg/l

Table 11 - Station Monitoring Sampling Station Guidelines

Concerning the period of bund construction, monitoring will be undertaken during the construction periods when rock is being deposited on the sea bed through the water column.

With regard to filling of lagoons and settlement of material, although it is intended to use a geotextile to minimise escape of sediments from the lagoon, it will be a requirement to monitor for any seepage. The location of these sites cannot be predicted at this time. 10m is a suggested distance from the bund wall and a level of 30mg/l above background is considered appropriate. This will be reviewed regularly and amended as appropriate.

The monitoring duration must commence one month before dredging operation and bund construction begin and continue for one month after the completion of both activities.

5.7.1 Sampling Methodology, Frequency and Reporting

Suspended solids samples will be collected from Ballyloughane Beach and on the seaward side of the lagoons once a day. Samples will be collected in plastic 1 litre bottles at the surface, midwater and off bottom using a water bottle. Three replicates will be sampled at control while only one (1) replicate will be obtained from the rest of the stations. Samples will be sent to an approved laboratory for determination of SS. Results of these analyses will be submitted to the EPA on a weekly basis.

An independent environmental consultant will be assigned to monitor and audit the SS monitoring programme.

5.7.2 Data Analysis

Suspended solids SS readings from the samples are recorded and compared to readings at Control Stations to determine significant differences in concentrations. Differences are calculated by subtracting the actual measurements from the control measurements.

Results will be presented graphically showing the comparison of average value of control stations with that of the standards and the actual SS sample readings

5.7.3 Threshold Limits and Action Levels

The following SS Threshold limits are proposed.

SS Limits	
Location	**Suspended Solids Limit**
500 meters downstream of the dredger	10 mg/L above baseline
100 meters downstream of the dredge area	50 mg/L above baseline
Within the plume	500 mg/l above baseline
10m from bund construction area	50 mg/l above baseline
10m from lagoon for seepage	30 mg/l above baseline

Table 12 – SS Limits

Using the above threshold limits, alert levels are defined in Table 13 following.

Alert Level	Suspended Solids Reading	
	500 m from dredger; 500 m from dredge area;	
Normal	**SS < 5 mg/L** above baseline	
Caution	**5 =< SS < 8 mg/L** above baseline	
Warning	**8=< SS < 10 mg/L** above baseline	
Breach	**SS = > 10 mg/L** above baseline	

Table 13 - TSS Alert Levels

5.8 BREACHES OF THRESHOLD LEVELS

The following Tables 14 to 17 describe the corresponding actions required for breaches of the threshold levels for dust, odour, vibration, noise and suspended solids respectively.

Action Plans Based On Breaches of Threshold Levels									
Alert		Immediate Action		Preventive Actions					Review
Alert Level	Reading or Status	Advisory	Immediate Measure	Identification of Root Cause	Plan Corrective Measure	Evaluate	Approval	Monitoring / Report	System Review
NORMAL	**No complaints observed.** Reading or status is below normal **Dust** <100mg/m²/day **Odour** <0.01 ppm **Vibration** <4mm/sec **Noise** <10 dBA **SS** <5mg/l	No need to advise Alert Level.	Normal Level operations. No necessary precautionary measures to implement. Continue monitoring with the normal frequency.						Review the effectiveness of the system and modify for further improvement, on a monthly basis. Adjust the scaling for each level to be more adaptable to real conditions of the operation.

Table 14 - Action Plans Based On Breaches of Threshold Levels

Action Plan Based on Breaches of Threshold Levels									
Alert		Immediate Action		Preventive Actions					Review
Alert Level	Reading or Status	Advisory	Immediate Measure	Identification of Root Cause	Plan Corrective Measure	Evaluate	Approval	Monitoring / Report	System Review
CAUTION	• Single complaint **Dust** >100mg/m²/day **Odour** 0.01-0.1ppm **Vibration** 6mm/sec **Noise** 5dBA below limit value **SS** ≥5 <8mg/l	Advise Caution Alert Level Report to Site Manager Advise the consultant. Advise the concerned operator / people who will assess what if any corrective action is warranted.	Exercise caution on operations by starting to look into possible causes of increase in readings or level. Continue with the normal monitoring frequency	Check possible factors such as weather conditions, current flow, nearby activities, sampling methodology, laboratory testing procedures, human factor and operational adjustments.	If an external factor that is beyond control is the cause of the increase in the level or reading such as weather conditions, no further action is required. Advise concerned people if human factor was identified as the cause. Imposed administrative rules if necessary. Consult resident engineer concerning matters of operation. Implement any corrective actions within 3days.	Site Manager to evaluate countermeasures proposed. Prioritise which actions have highest importance	Site Manager to approve implementation plan. Seek advice of consultant.	Monitor the implementation of the countermeasures and record on the incident log. Respond to complaint regarding action taken.	

Table 15 - Action Plan Based on Breaches of Threshold Levels

Action Plan Based on Breaches of Threshold Levels									
Alert		Immediate Action		Preventive Actions					Review
Alert Level	Reading or Status	Advisory	Immediate Measure	Identification of Root Cause	Plan Corrective Measure	Evaluate	Approval	Monitoring / Report	System Review
WARNING	More than one complaint. **Dust** >200mg/m²/day **Odour** 0.1-1.0ppm **Vibration** 8mm/sec **Noise** at limit value **SS** ≥8 <10mg/l	Advise Warning Level Report the condition to the Site Manager Advise other consultant, client and other concerned.	Elevate to Warning Level Verify reading with the audit findings of consultant, if data are available. Decide if necessary to increase monitoring to daily basis. Consider changes to operations to reduce levels	Look into external factors such as weather conditions, current flow, nearby activities, sampling methodology, laboratory testing procedures, human factor and operational adjustments.	The site manager will advise concerned groups or people and will come up with measures for the identified causes within 24 hours.	Site manager to evaluate the effectiveness of the plan and prioritize implementation of corrective and preventive measures.	In consultation with the consultant, client and other concerned, the manager will get their consensus for the implementation of the plan	Monitor the implementation of the countermeasures and record on the incident log. Respond to complaints regarding action taken.	

Table 16 - Action Plan Based on Breaches of Threshold Levels

Action Plan Based on Breaches of Threshold Levels									
Alert		Immediate Action		Preventive Actions					Review
Alert Level	Reading or Status	Advisory	Immediate Measure	Identification of Root Cause	Plan Corrective Measure	Evaluate	Approval	Monitoring / Report	System Review
BREACH	**Complaint from Regulatory Agency** **Dust** >350mg/m²/day **Odour** >1ppm **Vibration** >8mm/sec **Noise** >limit value **SS** ≥ 10mg/l	Advise Breached Level Report Condition to Site Manager. Advise consultant, client and other concerned	Elevate to Breached Level Verify reading with the audit report of consultant, if data are available. Increase monitoring to daily basis. If the breach persists beyond allowable limits, cease operations.	Look into external factors such as weather conditions, current flow, nearby activities, sampling methodology, laboratory testing procedures, human factor and operational adjustments.	Call immediately for a meeting for all concerned to come up with joint corrective measures within the day.	Site manager to evaluate the effectiveness of the plan and prioritize implementation of corrective and measures	In consultation with the consultant, client and other concerned, the manager will get their consensus for the implementation of the plan. Report to the Regulatory Authority regarding the incident.	Monitor the implementation of the countermeasures and record on the incident log.	

Table 17 - Action Plan Based on Breaches of Threshold Levels

5.9 ECOLOGICAL MONITORING

5.9.1 Intertidal benthos

Intertidal annual seasonal sampling should commence pre-construction and for one year post-construction at the following locations: Ballyloughan, Lough Atalia, Renmore Lough, east and west of the causeway and at an agreed control site to record macrofaunal assemblages and sediment granulometry at High, Mid and Low water levels on the shoreline. Sampling should incorporate quadrates, cores and photography (including Sediment Profile Imagery). Post-completion, the additional 1 year's data can be reviewed to see if seasonal sampling is still required or if it can be reduced to once a year.

5.9.2 Subtidal benthos

Annual benthic sampling should be commenced pre-construction at the following sites: south of Ballyloughan Beach, Lough Atalia, Renmore Lough, west of the causeway, south of Mutton Island and at an agreed control southwest of the Margaretta using a 0.1 sqm grab and a 1 mm sieve. 3 faunal samples a 1 sediment sample should be collected and analysed using the same techniques as were used in the EIS. Sediment Profile Imagery should also be incorporated into the monitoring methodologies. The sampling should continue for at least 3 years post-completion.

5.9.3 Salmon Smolts

The acoustic tagging study that was carried out as part of the EIS will be repeated post the construction period to document changes in patterns of migration routes of smolts.

5.9.4 Marine Mammals

A Marine Mammal Watch Plan including marine observers will be employed during the construction phase, prior to and during blasting and pile driving. The use of acoustic deterrent devices will be employed if required.

Monitoring of harbour seal populations prior to, during and for at least two years post construction will be completed as part of ecological monitoring of the development. This will follow a similar methodology to that employed as part of the baseline surveying, using similar techniques and haul out locations to allow for comparative analysis with baseline information.

Survey for otter holt sites will be completed immediately prior to construction phase and on two occasions post construction phase, following a similar methodology to that employed as part of baseline surveys. During the construction phase, observation surveys for otter activity will be made and notes from marine observers and bird surveyors will also be included as part of the dataset.

5.9.5 Birds

Monitoring of bird populations prior to, during and for at least two years post construction will be completed as part of ecological monitoring of the development. This will follow a similar methodology to that employed as part of the baseline surveying, using similar techniques and point count locations to allow for comparative analysis with baseline information.

5.9.6 Marine chemistry

As the proposed development has the potential to alter salinity regimes in the area, *in situ* monitoring of salinity will be commenced prior to construction at the following sites: at the mouth and within Lough Atalia, Renmore Lough, off Ballyloughan, south of Mutton Island and southwest of the Margaretta. This monitoring will continue for at least two years post-construction.

5.9.7 Marine physics

As the proposed development has the potential to alter current velocities and wave heights in the area, appropriate measuring devices should be deployed pre-construction to measure current speeds and wave heights at the following sites: south of Ballyloughan, east of the existing shipping channel, south of Mutton Island and southwest of the Outer Margaretta buoy.

Underwater Noise

Annual seasonal sampling will commence one year pre-construction, during and for one year post-construction at the following locations:

1. Mid-channel on the lower section of the River Corrib at Nimmo's Pier
2. Approximately 100m south of the head of Nimmo's pier
3. Mid-way between Rabbit and Hare Islands
4. Mid-way between the Leverets and Mutton Island
5. An agreed control site

Post-completion, the monitoring will be reduced to once a year.

6 MANAGEMENT STRUCTURE AND RESPONSIBILITIES

6.1 PROJECT ORGANISATIONAL STRUCTURE

In order to deliver this project, Galway Harbour Company has appointed a team of project managers, and specialist consultants, initially to assess the potential environmental impact of the proposed development as compiled in the EIS. As part of the assessment process they have liaised with Galway Harbour Company during the development of the EIS and the associated design team. They have also carried out consultations with a variety of stakeholders and prescribed bodies, as part of this process. In due course, contractors will be procured to construct the project works. During that construction project, the environmental framework, to meet the environmental standards described in the EIS, herein and in the Planning Permission, will be established in the contract between the Galway Harbour Company and the Contractors, and will be closely monitored for compliance with the standards set down. An Independent Environmental Consultant will be appointed to monitor compliance with those requirements, and to see that adequate controls are put in place to manage continuous compliance.

6.2 PROJECT MANAGEMENT

Galway Harbour Company will have the overall responsibility for the project. The overall management and implementation will be delegated to an assigned Project Manager, Consultant Team and appointed Contractors who will have their respective allocated responsibilities. Critical to the successful implementation of the EMP is the recognition and active acceptance by the Contractor of its responsibilities as the main implementer of the EMP.

6.2.1 Contractor Responsibilities

- All contractors must prepare and implement an EMP in accordance with this Environmental Management Framework.
- All contractors shall execute the EMP through the contractor's environmental officer on-site and report to the Environmental Manager and coordinate with the Consultants Team.
- All contractors shall allocate the necessary funds to implement all the EMP requirements as far as reasonably practicable
- All contractors should provide a detailed plan for individual elements of work in the form of an Environmental Implementation Plan (EIP) stating how they intend to meet the requirements of the EMP. This will be reviewed and amended where necessary by the consultant team to verify inclusion of all environmental implications associated with the project.
- All contractors should ensure staff members, sub-contractors and suppliers understand and adhere to the EMP.
- All sub-contractors must appoint their own individual Environmental Officers who will be taking the same responsibilities as that of the Environmental Officer(s) of the Main Contractor.

6.2.2 Environmental Manager

The Environmental Manager / Officer has the most critical roles for implementation of the EMP and as such shall be required to prepare an initial implementation programme and procedures for ensuring compliance and to provide regular detailed reports demonstrating compliance i.e. weekly during the works. The onus shall be on the Environmental Manager to immediately report non-conformances so that immediate corrective action is taken. The key tasks and responsibilities of the Environmental Manager are set out in Table 18.

Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Water Quality	Suspended solids sampling to be carried out in accordance with best practice Water sampling to be done at Ballyloughan Beach and at seaward side of lagoon for visual monitoring and comparison	Submission of the laboratory results to environmental consultant within 3 days with proper explanation for occurrence of any incidence of exceedance Daily log on the record book for the monitoring of the observation of SS	A complete water quality test shall be conducted for baseline survey and / or as needed for ecological surveys
Airborne Noise	Airborne noise monitoring will be carried out at each stage or process of construction, e.g. • TSHD dredging • Cutter Suction dredging • Backhoe dredging • pile-driving • blasting • Rock transport and placement • General construction activity Noise monitoring locations at Ballyloughan Beach, Liam Mellows Park, Dún Aengus Apartments and Grattan Road to be monitored during both day and night operation. A noise complaint handling procedure will be put in place	Routine noise monitoring will be carried out at beginning of each stage/process (with the exception of general construction) and at a minimum quarterly basis unless specific activities warrant more frequent monitoring during the construction stage. When dredging, pile-driving and rock placement stages are complete monitoring to revert to six monthly periods unless specific activities warrant more frequent monitoring. Monitoring of Air overpressure will be carried out for each of first 6 blasts. If noise levels are not in compliance with planning permission conditions/limits verbal notification is to be given to the environmental consultant immediately and appropriate remedial measures taken. Noise monitoring reports to be submitted to the environmental consultant within 3 days.	

Table 18 - Key Tasks & Responsibilities of Environmental Manager

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Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Underwater Noise	Underwater noise monitoring at different tidal stages will be carried out on sites at lower River Corrib, South of head of Nimmo's Pier, mid-way between Rabbit and Hare Island and mid-way between the Leverets and Mutton Island on a quarterly basis during construction. Underwater noise monitoring will be carried out at the commencement of each stage or process of construction, e.g. • TSHD dredging • Backhoe dredging • pile-driving • blasting • Rock transport and placement • General construction activity This monitoring can be substituted for a round of quarterly monitoring where appropriate. Cetacean monitoring and seal surveys to be carried out by a suitably qualified ecologist on a quarterly basis for 1 year prior to construction, during construction and for 2 years post construction	Routine noise monitoring will be carried out at beginning of each stage/process (with the exception of general construction) and at a minimum quarterly basis unless specific activities warrant more frequent monitoring during the construction stage. When dredging, pile-driving and rock placement stages are complete monitoring to revert to six monthly periods unless specific activities warrant more frequent monitoring If noise levels are not in compliance with planning permission conditions/limits verbal notification is to be given to the environmental consultant immediately and appropriate remedial measures taken. Noise monitoring reports to be submitted to the environmental consultant within 3 days. Marine mammal monitoring reports to be submitted to the National Parks and Wildlife Service within one month of completion	Any change in underwater noise levels sufficient to warrant corrective action will be brought to the attention of the environmental consultant and appropriate remedial measures will be undertaken immediately Any significant change in marine mammal use of the area will be notified to the National Parks and Wildlife Service as soon as the environmental consultant becomes aware it.

Table 18 contd/. - Key Tasks & Responsibilities of Environmental Manager

Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Vibration	Vibration monitoring locations at Cold Chon tank farm, Enwest oil terminal, Leeside Oil Terminal, Liam Mellows Park, Dún Aengus Apartments and Grattan Road will be monitored during each blast for first 6 blasts. Subsequently each oil terminal will be monitored in addition to one of the other 3 locations in rotation unless otherwise warranted	If vibration levels are not in compliance with planning permission conditions/limits verbal notification is to be given to the environmental consultant immediately and appropriate remedial measures taken. Vibration monitoring reports to be submitted to the environmental consultant within 3 days.	Vibration is only likely to be an issue during blasting
Air Quality - Dust	Dust deposition monitoring will be carried out on a continuous basis for the full construction period at the east, north and west site boundaries. Dust control suppression sprays will be deployed as required during construction. A wheel-wash facility will be installed at the site entrance for all vehicles exiting the site. Road sweepers will be employed as required during construction on all surfaced areas. A dust complaint handling procedure will be put in place	Dust monitoring reports to be submitted to the environmental consultant within 3 weeks of the end of each month.	

Table 18 contd/. - Key Tasks & Responsibilities of Environmental Manager

Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Air Quality - Odour	A fully automatic weather station will be maintained for the duration of construction. Daily weather data including wind speed, wind direction, precipitation and sunshine hours will be logged. Odour monitoring transects will be established on the site boundary for the duration of the TSHD dredging phase and filling of lagoons. Daily logs of subjective odour observations at the site boundaries will be maintained for the duration of TSHD activity and filling of lagoons. TSHD material placement will be carried out in limited areas with odour suppressant sprays deployed as required An odour complaint handling procedure will be put in place	Daily weather observations and subjective odour assessments will be logged on site and made available to the planning authority when requested. Documented procedures for corrective action taken as a result of noted elevated levels or odour complaints will be maintained on site and made available to the planning authority when requested.	

Table 18 contd/. - Key Tasks & Responsibilities of Environmental Manager

Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Other attributes: Site and Work Management, , Light, Traffic & Security, Waste Management, Emergency Management, Supply of Materials and Storage, Ecological Concerns	Regular implementation and monitoring of the tasks specified for each attribute	Reports should be included in the regular monthly report to the consultant	Check sheets should be made for each of the attributes identified
Construction Progress Monitoring	Dredger operation monitoring which includes volume of dredged spoil and daily log of the location of dredger	Daily reports from the contractor should be obtained and filed for inclusion in the monthly report	Bathymetric surveys must be done before and after the dredging works and as required during dredging cycles to monitor progress
Recording & Reporting	Maintain records of the Health and Safety incidents, accidents, emergency situations; records and schedules of equipment, backhoe, trucks, dozers / sources of emissions, waste disposal records and disposal, maintenance of dredger and floating pipelines.	Incidences of breaches of standard limits or any form of emergency situation or accident must be all reported as soon as possible to the Galway Harbour Company / environmental consultant to include full details of the incident, extent of damage / impact (quantifiable and unquantifiable), proposed solution / countermeasures and remediation plan	Records should be kept regularly updated

Table 18 contd/. - Key Tasks & Responsibilities of Environmental Manager

Key Tasks & Responsibilities of Environmental Manager			
Item	**Tasks**	**Reports**	**Additional Notes**
Communication	Maintain regular communication with environmental consultant, coordination and regular meetings with the authorities, nearby development projects and the public whenever necessary; participation to regular meetings with stakeholders and conduct of regular meeting with his team	Minutes during meetings should be properly documented for references	Monthly Meeting with Harbour Board; Weekly Health and Safety Team Meeting (internal), Weekly Productivity Meeting
Other Management and Administrative Tasks	Dispatching regular team inspection at the site, management system audit for environmental performance, planning and scheduling of regular tasks	Inspection and audit check sheets, environmental appraisal sheets, schedule and job assignment tables must be generated	

Table 18 contd/. - Key Tasks & Responsibilities of Environmental Manager

6.2.3 Independent Environmental Consultant

The key responsibilities of external independent environmental consultant will be as follows:

- Confirming compliance with each condition and procedure contained within the planning approval documentation;
- Confirmation of compliance with each key action contained in the EMP;
- Identification of all non-compliances and non-conformances and description of the required corrective and preventative actions taken in relation to each non-compliance or non-conformance;
- Review of the effectiveness of all corrective and preventative actions taken

Other responsibilities of the environmental consultant include:

- Conducting periodic cross-checking site visits (at least one visit per week or as necessary to ensure that the contractor adheres to all requirements addressed in the EMP)
- Monitor / oversee the collection of field measurements e.g. sediment samples, noise, dust and water samples etc.
- Preparing and submitting monthly reports
- Meeting with stakeholders and preparing the Minutes of Meetings.

6.3 ENVIRONMENTAL MONITORING SCHEDULE

Sample Monitoring Schedule	
Item	Frequency
Monitoring	
SS Sampling	every day during the dredging operations
Noise Monitoring	once a month
Emissions & Dust Monitoring	once a month
Underwater Noise Monitoring	Quarterly
Health & Safety (OHS, Security, Traffic, Waste Mgt, Emergency)	2X a week
Ecological Monitoring	pre/interim/post
Report	
Fortnightly Health and Safety Report	
Monthly Report on all parameters	
Annual Report on all parameters	
Completion Report	after completion

Table 19 – Sample Monitoring Schedule

Reports on monitoring / sampling prepared on a monthly / quarterly basis as defined, are to be submitted to:-

- Environmental Consultant – all reports
- EPA as National Regulatory Body
- Galway City Council for Planning Compliance
- Other relevant Bodies as appropriate or as required.