ABERDEEN HARBOUR
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CHAPTER 5: ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

5. THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

5.1 Introduction

This chapter describes the key stages in the Environmental Impact Assessment (EIA) process, including the principles of EIA, and the approach taken to identify baseline conditions and to evaluate the potential environmental impacts and effects associated with construction and operation of the proposed Aberdeen Harbour Expansion Project.

5.2 Legislative Background

Developments listed under Annex 1 of the EC Environmental Impact Assessment Directive (85/337/EEC, as amended by Directives 97/11/EC, 2011/92/EU and 2014/52/EU) require a mandatory EIA. The Aberdeen Harbour Expansion falls under Annex 1 (section 8b) of the EIA directive: “Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1,350 tonnes”, meaning an EIA must be undertaken. The EIA has been undertaken according to the following legislation:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;
- The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended); and
- The Harbours Act 1964.

The proposed harbour development requires the following primary consents before construction can commence:

- Planning permission under the Town and Country Planning (Scotland) Act 1997 (as amended by the Planning (Scotland) Act 2006);
- Marine Licences under the Marine (Scotland) Act 2010 for construction and capital dredging and disposal; and
- A Harbour Revision Order (HRO) under the Harbours Act 1964.

Applications under these consenting regimes must be supported by information on the proposed development and its likely environmental effects. The EIA Directive and all subsequent amending Directives requires developers of qualifying projects to submit relevant information within an Environmental Statement (ES) and supporting documents. In order to streamline the application and assessment process, all applications, encompassing both marine and terrestrial works, will be assessed under a single EIA. Further information on the legislative frameworks is provided in Chapter 4: Policy, Legislation and Guidance.

5.3 Guidance and Best Practice

The assessment follows legislative requirements and draws on a number of established guidance documents and best practice publications. In particular, the methodology follows the guidelines of the Institute of Ecology and Environmental Management (IEEM) and the Institute of Environmental Management and Assessment (IEMA) to determine the levels of significance of identified effects upon

receptors. This includes clear and transparent determination of the magnitude of impacts of the proposals, the sensitivities and resilience of the receptors, and the impact receptor pathways. This is key to a successful and clearly auditable EIA process supporting statutory decision making.

The main impact assessment guidance documents relevant to this project are:

- Guidelines for Ecological Impact Assessment in Britain and Ireland (Terrestrial, Freshwater and Coastal) (IEEM, 2006);
- Guidelines for Ecological Impact Assessment in Britain and Ireland (Marine and Coastal) (IEEM, 2010);
- Guidelines for Environmental Impact Assessment (IEMA, 2004);
- The State of Environmental Impact Assessment Practice in the UK (IEMA, 2011);
- Planning Circular 3 2011. The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (Scottish Government, 2011);
- A User's Guide to the Environmental Impact Assessment (Scotland) Regulations 2011 (Scottish Government, 2011);
- Planning Advice Note 58. Environmental Impact Assessment. (Scottish Government, 1999);
- Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide (BSI, 2015)
- Explanatory Memorandum to the Marine Works (Environmental Impact Assessment) Regulations 2007. (Defra, 2007);
- Draft Marine Scotland Licensing and Consents Manual (MS-LOT, 2012);
- Survey, Deploy and Monitor Licensing Policy Guidance (Marine Scotland, 2012);
- A Handbook on Environmental Impact Assessment. Guidance for competent authorities, consultees and others involved in the Environmental Impact Assessment Process in Scotland (Scottish Natural Heritage, 2013);
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (EC, 1999);
- Cumulative Impact Assessment Guidelines - Guiding Principles For Cumulative Impacts Assessment In Offshore Wind Farms (RenewableUK, 2013)
- Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and IEMA, 2013);
- Design Manual for Roads and Bridges - Cultural Heritage (Highways Agency, 2007); and
- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (Seafish, 2012).

For certain topics, other guidance on EIA methodology may be relevant. Such guidance is identified within the specific topic chapter.

5.4 Overview of the EIA Process

The EIA process is an iterative series of assessments that are undertaken to ensure environmental issues are captured and considered throughout all stages of the project development, from initial plans through to construction and operation (as illustrated in Figure 5.1). Wherever possible, assessments have used an evidence-based approach that is systematic and auditable to evaluate and interpret the potential marine, terrestrial and socio-economic impacts of the construction and operational of the proposed Aberdeen Harbour Expansion Project on physical, biological and anthropogenic receptors.

EIA is an effective tool to determine mitigation measures for project-specific impacts and effects. The views and concerns of stakeholders consulted have formed an important part of the recommendations. This EIA has followed all relevant best practice throughout the process, and the EIA team has worked closely with Aberdeen Harbour Board's (AHB) environmental and engineering teams to ensure appropriate mitigation recommendations have been developed to minimise the development's adverse effects and to maximise positive environmental effects wherever possible.

The aim of the EIA process is to reduce or eliminate potential adverse impacts or effects wherever possible. It is an iterative process that is informed by the best understanding of the baseline environment and the corresponding body of scientific knowledge, and is focussed on identifying the most effective mitigation solutions, and subsequently reassessing the potential residual environmental effects. Detailed explanations of the EIA terminology are provided in Section 5.10.3, and outline information on mitigation is provided in Section 5.11.

Regulator and stakeholder consultation has been a key factor in determining important data sources, the survey scope and design of the supporting technical studies, and the recommendation of mitigation measures. Consultation has also been crucial to understanding the limitations of the existing body of science and knowledge within relevant topics. Consultation was carried out with the regulatory authorities (Transport Scotland, Marine Scotland and Aberdeen City Council) and all other statutory consultees throughout the EIA process. Summaries of topic-specific consultations are presented within the individual ES chapters.

The first stage in the EIA process is the preparation and submission of a Scoping Report. Consultation with regulators and stakeholders is also undertaken at this stage to ensure the widest (reasonable) scope of the EIA.

Following receipt of the EIA Scoping Opinion from regulators, the process of collecting baseline data commenced. This describes the current environment, heritage and social conditions within and around the development site and provides the baseline against which the impact assessment is based. The baseline description for the Aberdeen Harbour Expansion Project was developed using desk-based assessments of existing information and extensive field studies designed in accordance with the Scoping Opinion.

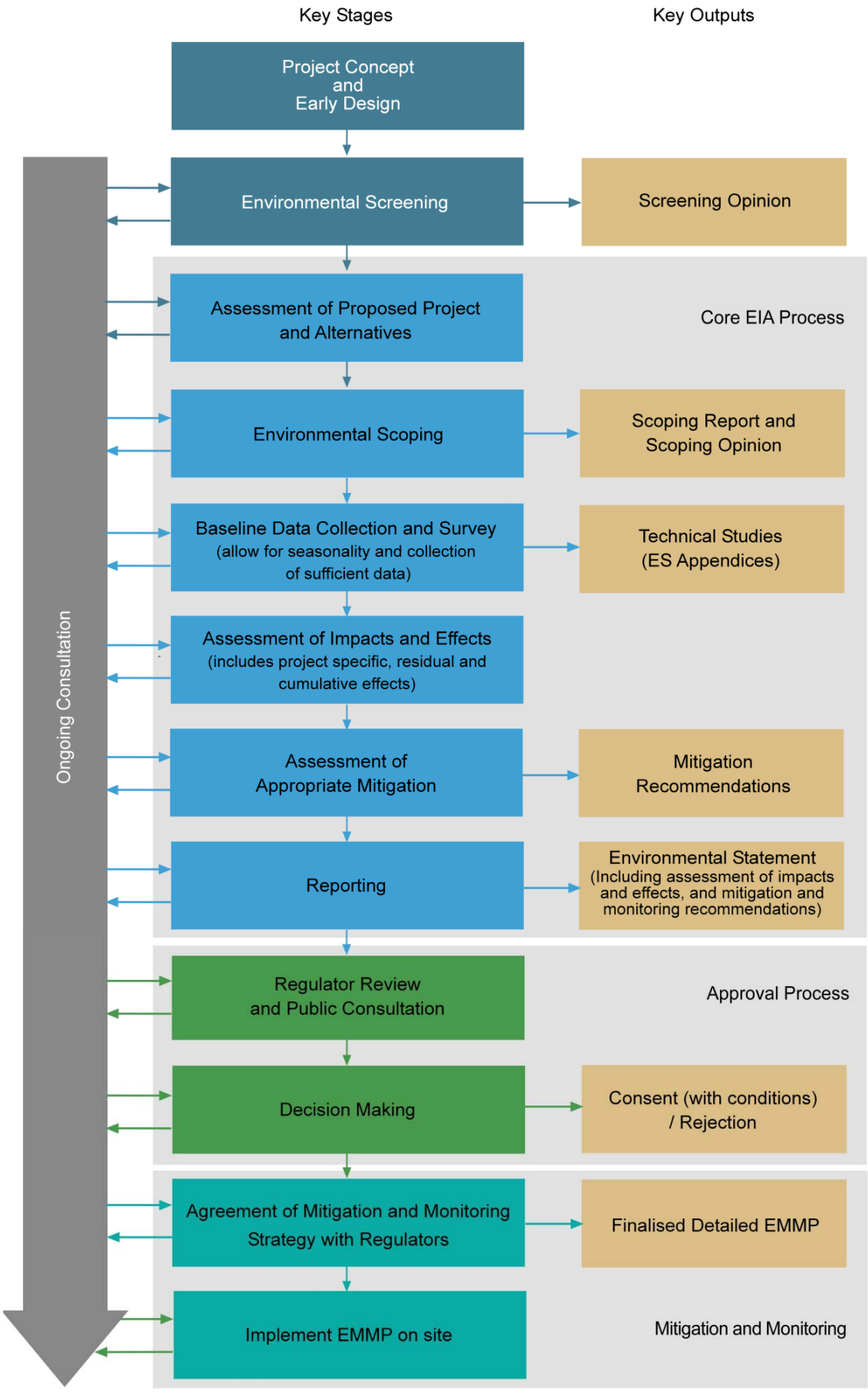

Figure 5.1: Key stages and outputs of the EIA process

Once the baseline was defined, impacts and effects arising as a result of the development alone, and cumulatively through interactions with other developments, were assessed. Cumulative effects are discussed in more detail in Section 5.12, and include the assessment of effects arising as a result of interactions with other projects that may also affect the same receptors considered in this ES. Once those effects have been assessed and their significance evaluated, mitigation and monitoring measures are applied, where necessary.

On submission of the consent applications and the supporting documentation (including the ES), the applications are considered by the relevant consenting authorities who may, after a period of public consultation, grant the application (with or without conditions) or refuse it.

5.5 EIA Scoping Stage

An EIA Scoping Report (Appendix 1-C) for the Aberdeen Harbour Expansion Project was produced in July 2013 setting out the details of the proposed development, the site, and the suggested scope of the EIA to be undertaken. The Scoping Report was submitted to the Competent Authorities listed in Table 5.1 according to the relevant legislation, and a formal Scoping Opinion was requested.

Table 5.1: The Competent Authorities consulted during the EIA Scoping stage

Competent Authority	Relevant Legislation
Transport Scotland	The Harbours Act 1964
Aberdeen City Council	Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011, Regulation 14
Marine Scotland	Marine Works EIA Regulations 2007 (as amended 2011), Regulation 13 and Schedule 4

Transport Scotland, acting as the lead for the competent authorities, coordinated the EIA scoping process and consulted with a range of statutory and non-statutory stakeholders to ensure the widest (reasonable) scope of the EIA:

- Aberdeen City Council;
- Dee District Salmon Fisheries Board;
- Historic Scotland;
- Maritime and Coastguard Agency;
- Marine Scotland (including Compliance, Planning and Policy and Science);
- Northern Lighthouse Board;
- Royal Society for the Protection of Birds (Scotland);
- Royal Yachting Association (Scotland);
- Scottish Environment Protection Agency;
- Scottish Natural Heritage;
- Transport Scotland (including Ports and Harbours Branch); and
- Whale and Dolphin Conservation.

A total of 12 responses were received by Transport Scotland as part of the scoping process, and a formal Scoping Opinion was provided in January 2014 which identified several key environmental matters that have been assessed in the relevant chapters of this ES. The Scoping Report was subsequently updated in April 2014 (Appendix 1-D). Tables summarising scoping responses and how they have been addressed are included in all relevant chapters.

5.6 Design and Build Contract

The construction of the Aberdeen Harbour Expansion Project will be let under a Design & Build (D&B) contract. AHB have defined Minimum Performance Specifications (MPS) the completed harbour would need to meet (as described in Chapter 3: Description of the Development), in respect of a number of aspects such as minimum draft, length of solid-faced quayside, and protection from overtopping of the breakwaters (waves breaking over the top of the breakwaters). Under the terms of the contract, D&B contractors are free to employ the methods and technologies of their choosing to meet the MPS, within the parameters of the assessed Rochdale Envelope (see Section 5.7), and in accordance with any consent conditions.

AHB will not appoint a contractor until consent for the development has been granted. For this reason it is not possible to say with complete certainty at the time of writing what methods the chosen contractor will use. As such, the assessments and mitigation recommendations in this ES have been made employing the Rochdale Envelope approach, described in Section 5.7. If alternative methodologies are proposed that are not included in the Rochdale Envelope, contractors will be required to demonstrate that their design is 'Not Environmentally Worse Than' (NEWT) the residual impacts set out in this ES. Detailed mitigation measures and strategies will be agreed with the regulators, should consent be granted, and once a successful contractor has been appointed.

5.7 Rochdale Envelope

For the purposes of the EIA the applicant has adopted the established principle of a 'Rochdale Envelope' approach when assessing the likely impacts arising from the proposed Aberdeen Harbour Expansion Project. The 'Rochdale Envelope' approach allows for a project's description to be broadly defined, within a number of agreed parameters, for the purposes of preparing and submitting a consent application (Scottish Government, 2013). However, for permissions to be granted, the EIA must include sufficient detail of the proposed project and assess all potential impacts through a robust EIA. The 'Rochdale Envelope' arises from two cases dealing with outline planning applications for a proposed business park in Rochdale. The main proposals relevant to this ES arising as a result of the cases are (The Planning Inspectorate, 2012):

- Applications for Planning Permission in Principle should acknowledge the need for the details of a project to evolve over time, within clearly defined parameters;
- The ES should take account of the need for such evolution within those parameters, and should detail the range of likely significant effects of such a flexible project in the ES; and
- The level of information should be sufficient to enable a proper assessment of the range of likely significant effects predicted, and to describe appropriate mitigation measures for that range of predicted effects.

By adopting the Rochdale Envelope approach it is possible to define a realistic worst case scenario which allows determining authorities to consider the acceptability of the environmental effects of the project. This ES seeks to ensure that all the realistic and likely worst case variations of the Aberdeen Harbour Expansion Project have been properly considered, and the likely significant effects have been adequately assessed, for each receptor. The assessments within each ES chapter have been undertaken considering the realistic worst case scenario for each receptor. All mitigation recommendations within this ES are based upon these realistic worst case scenarios, ensuring that all measures described are adequate to ameliorate the range of predicted effects.

5.8 Stakeholder Engagement and Regulator Consultation

Following receipt of the Scoping Opinion, the relevant Competent Authorities were approached to discuss and agree the scope of assessments to be undertaken as part of the EIA. Key regulators and stakeholders (including Aberdeen City Council, Marine Scotland, Scottish Natural Heritage and the Scottish Environment Protection Agency) were contacted to agree the scope of desk-based assessments, survey design and sample analyses, modelling studies and impact assessments to be undertaken. Further consultation was ongoing throughout the development of the ES to ensure all publicly available data sources were identified and incorporated. Details of the consultations with the relevant competent authority are summarised in the relevant chapters of this ES.

5.9 Climate Change

Climate change aspects have been considered where relevant to individual impact assessments. Whilst not relevant to all topics, climate change is of particular importance to certain chapters, including Chapter 6: Marine Physical Environment; and Chapter 8: Flood Risk and Surface Water. Relevant details of the breakwater specification with regard to climate change are provided in Chapter 3: Description of the Development.

5.10 Impact Assessment Methodology Framework

The methodology defined in this chapter is an overarching framework to provide a consistent approach and terminology to individual topics and assessments of all disciplines, including:

- The physical environment;
- The biological and ecological environment:
  - Marine and coastal;
  - Terrestrial;
- The human environment:
  - Socio-economic; and
  - Cultural and heritage.

This framework accepts that a one-size-fits-all approach may not be appropriate for all topics, and therefore any necessary deviations from this framework will be detailed in individual chapters. For instance, it may not be necessary to follow every step in Figure 5.2 for all receptors or topics.

5.10.1 Describing and Valuing the Baseline

A thorough understanding of the environment and the receptors that are likely to be affected by the proposed project is essential for making predictions of potential impacts and effects, and for making appropriate mitigation recommendations. It is important to describe the presence or absence of relevant receptors, their current condition, natural variability, and any other characteristics relevant to impact assessments. Valuations of receptors are also included, and details of the valuation methodology employed are provided in Section 5.10.8.

The description of the baseline incorporates both desk-based research and field survey data. Topic specific baselines are described and assessed individually in the relevant ES chapters, and the survey methods and study techniques are specific to each topic assessed. The details of these methods are provided in individual chapters and their supporting technical studies, which are provided as appendices.

Before commencing surveys or technical studies, guidance and agreement was sought from regulators regarding appropriate data sources, desk-based assessments, survey design and sample analyses, modelling studies and appropriate stakeholder consultation, as described in Section 5.8. The scope of surveys and technical studies considered the nature of project activities and the corresponding zones of influence of the development, the sensitivities of likely receptors, and potential pathways for project activities to affect receptors. Formal analysis of potential pathways is known as source-pathway-receptor analysis, and a full description is provided in Section 5.10.4.

5.10.1.1 Data Gaps and Uncertainty

It is never possible to measure every component or aspect of the natural or anthropogenic environment. Good survey design recognises this, and strives to obtain and record data that are as representative of local populations, communities and the wider environment as possible. However, practical limitations, and the challenging nature of working in the natural environment (particularly the marine environment), mean it is not always possible to collect as much data as preferred. This is not only an issue for project-related surveys, but also for the wider scientific community as well. The scale and extreme nature of the open seas mean that there are many aspects of the marine environment that are not well understood by the scientific community.

During the EIA process, it is important to identify potential data gaps or uncertain datasets and acknowledge limitations of datasets, and to attempt to fill those gaps or find alternative datasets to support the impact assessment. Where alternatives cannot be found, it is important for the assessment to characterise any uncertainty within the supporting data or the underlying body of scientific knowledge, and to recognise and communicate any corresponding uncertainty in predictions of impacts and effects.

5.10.2 Defining Impacts and Effects

The terms ‘Impact’ and ‘Effect’ are frequently used interchangeably in ESs and in much governmental guidance. The EIA Directive requires the “assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment”. This Directive and all subsequent amending Directives all stipulate the requirement for EIAs to describe and assess the “direct and indirect significant effects” of projects. In particular, Article 5 requires:

- A description of the likely significant effects of the project on the environment; and
- A description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment.

Therefore in this ES, 'Impacts' are defined as measurable changes to the environment as a direct result of project activities (e.g. m^2 losses of habitat, or mg/l increases in a substance concentration). 'Effects' are defined as the consequences of those impacts upon receptors of concern, and these are subject to assessments of significance. The nature and characteristics of impacts and effects differ according to the topic, and will be described in more detail in relevant chapters.

5.10.3 EIA Terminology

This section defines terms that are relevant to the overall EIA methodology framework. However, where necessary, clear alternative definitions are provided for specific topics and receptors in relevant ES chapters. Figure 5.2 provides a visual representation of the overall impact assessment methodology. It should be noted that some technical studies may use topic-specific terminology that differs from these definitions but, where necessary, ES chapters will correctly interpret relevant terms used and will follow the terminology provided here.

- **Baseline:** the pre-existing state of the environmental, socio-economic or cultural domain prior to project construction or operation. The baseline incorporates the specific area of the project and the surrounding and interconnected areas and components of the environment.
- **Receptor:** a specific component of the baseline environment or socio-economic domain that will be, or is 'likely' to be, affected by the impacts or effects of the project. This could be a single entity such as a species or community, or a conceptual grouping such as a population or subset of an ecosystem. A receptor may be affected only by the specific project proposed, or by the proposed project and other relevant projects in combination.
- **Source:** the source of an impact. This will be an aspect of the project, and will typically be a project-related activity, or a direct result of the development.
- **Pathway:** a mechanism or series of interactions that results in an impact upon a receptor. Pathways may be physical, chemical, biological or ecological processes or interactions, and may include intermediate stages.
- **Source-Pathway-Receptor Analysis:** a formal approach to assessing the flow of changes and consequences from a source of impact to all final receptors. Analysis incorporates the best current scientific understanding of the processes involved, logical cause-and-effect, and considers the relevant characteristics of all receptors and interactions.
- **Likely:** likelihood refers to a possibility or potential risk, and does not imply that something is necessarily probable or certain. However, all likely impacts and effects must be considered in the EIA process.
- **Impact:** the predicted change in environmental conditions as a direct result of a project-related activity. Impacts are frequently constrained to the physical and chemical domains, but may also include biological aspects. Changes should be measurable, quantified or estimated in relevant units where possible, and defined as positive or negative. Predictions should be relative to the baseline, and incorporate any natural variability:

- **Positive:** a positive impact will cause an increase to the baseline condition of a receptor, such as an increase in the number of jobs in a given area;
- **Negative:** a negative impact will cause a decrease to the baseline condition of a receptor, such as a decrease in the area of a given habitat;
- **Direct:** an impact that is the direct result of a project-related activity. Direct impacts are likely to be spatially or temporally concurrent;
- **Indirect:** an impact that is an indirect or secondary result of a project-related activity. Indirect impacts are likely to be spatially or temporally removed from the direct impacts.

- **Effect:** the environmental, ecological, socio-economic or cultural consequence of project-related impacts upon receptors of concern. Consequences are defined as beneficial or adverse. Predictions should be relative to the baseline, and incorporate any natural variability:
  - **Beneficial**: a beneficial effect is one that improves the baseline conditions of receptors of concern e.g. increases in populations of rare or protected species, increases in the area or quality of habitats, or increases in local and regional economic activity;
  - **Adverse**: an adverse effect is one that worsens the baseline conditions of receptors of concern, e.g. decreases in populations of rare or protected species, reductions in the area or quality of important or protected habitats or sites, or decreases in local and regional economic activity;
  - **Direct**: an effect that is the direct consequence of a project-related impact;
  - **Indirect**: an effect that is an indirect or secondary consequence of a project-related impact. Indirect effects are likely to be spatially or temporally removed from the direct impacts.
- **Interacting Effects:** multiple effects upon a single receptor may interact in a number of ways including:
  - **Additive Effects:** the sum of all effects e.g. multiple impacts which would individually cause a population reduction, add together to produce a larger population reduction;
  - **Synergistic Effects:** an interaction of effects upon a single receptor that causes an overall effect that is greater than the sum of the individual effects;
  - **Antagonistic Effects:** an interaction of effects upon a single receptor that causes an overall effect that is less than the sum of the individual effects;
- **In Combination Effects:** effects arising from an individual development in combination with effects from other plans or projects. The term has a specific meaning under Article 6(3) of the Habitats Directive in relation to the integrity of European sites, but may be used more generally within EIA.
- **Cumulative Effects:** the incremental effects caused by the combined effects of past, present or reasonably foreseeable activities and the development itself. This includes the combined effects of this project in combination with other projects and activities generating similar effects both temporally and spatially. Predictions should be relative to the baseline, and incorporate any natural variability.

- **Value:** the intrinsic worth or importance of a receptor. This may be characterised by different factors according to the receptor considered e.g. species rareness or legal protection, financial worth, aesthetic beauty, or historic importance.
- **Sensitivity:** the sensitivity of a receptor is the degree to which it may be affected by project-related impacts or effects. Sensitivity is a component characteristic that will determine the magnitude of effects, and is independent of value or legal status;
- **Magnitude:** the degree and importance of the change to the baseline conditions, and subsequent effects. Assessment of magnitude must consider all the relevant ecological, socio-economic or other aspects of the receptors concerned, including the legal aspects.
- **Mitigation:** measures to avoid, cancel, reduce, ameliorate or abate adverse project impacts or effects. Restoration or reinstatement activities may also be classified as mitigation. Subcategories include:
    - **Avoidance:** avoidance is the process of eliminating possible project impacts at source, either through designing them out or through implementation of alternative methods. Also known as built-in mitigation;
    - **Minimisation:** minimisation is conceptually similar to avoidance, but aims to reduce project impacts at source where eliminating them may not be possible. Again, this may be through design considerations or through alternative methods;
    - **Offset:** where project-specific mitigation is not possible or is unlikely to be effective, compensation through measures to improve other sites may be undertaken; and
- **Residual Effect:** the remaining effect after mitigation measures have been applied to reduce predicted project-related effects.

5.10.4 Source-Pathway-Receptor Analysis

Determining which receptors may be affected by project-related activities relies on Source-Pathway-Receptor (SPR) analysis for the identification of impacts and consequential effects (Figure 5.2). SPR considers all potential routes and mechanisms for impacts to affect all potential receptors along predicted pathways. Pathways are processes or series of interactions that result in an impact upon a final receptor.

The term ‘source’ describes the origin of the potential impacts (e.g. the impacts of ground preparation and construction activities) and the term ‘pathway’ as the means (e.g. deposition of sediment, chemical reactions, or airborne noise) by which the impact reaches the affected ‘receptor’ (e.g. benthic organisms, terrestrial habitats or nearby residential properties). Pathways may be physical, chemical, biological, ecological or socio-economic processes or interactions, and may include intermediate stages.

In some cases, receptors affected by project-related sources may themselves have effects upon other receptors, for example where there are effects on food webs or predator-prey relationships. SPR analysis should also identify all pathways and receptors when considering complex interactions where several inter-related receptors may be affected. In these cases, receptors may be affected in different ways and to different extents. For this reason assessment of effects may need to be an iterative

process, identifying several ultimate receptors, each with differing magnitudes of effects (as illustrated in Figure 5.2).

It is possible that a low value receptor may be a vital component of a complex system that will result in an effect upon a high value receptor. For example, an effect that may cause a reduction in a prey species of low conservation value may have a major adverse effect upon a species of high conservation value.

If no likely pathway can be demonstrated, then potential receptors can be scoped out, regardless of any intrinsic sensitivity or value.

5.10.5 Differentiating and Assessing Magnitudes of Impacts and Effects

Impacts are defined as measurable changes to the environment as a direct result of project activities (e.g. km^2 losses of habitat, or mg/l increases in a substance concentration). Impacts are frequently constrained to the physical and chemical domains, but may also include biological aspects.

Effects are defined as the environmental, ecological, socio-economic or cultural consequences of project-related impacts upon receptors of concern. The significance of effects is what is legally subject to assessment.

In many cases the characteristics that define the magnitude of impacts will also define magnitude of effects upon receptors (Table 5.2). However, in some cases the magnitude of an impact and associated effects may be different.

An impact such as a change or loss of habitat may be permanent, but the effect on a final receptor such as a species that utilises that habitat may only be temporary, or be of a lower magnitude. For this reason, magnitudes of effects are considered separately to magnitudes of impacts, and it is important to note that magnitudes of effects are used when assessing the significance of effects (as illustrated in Figure 5.2).

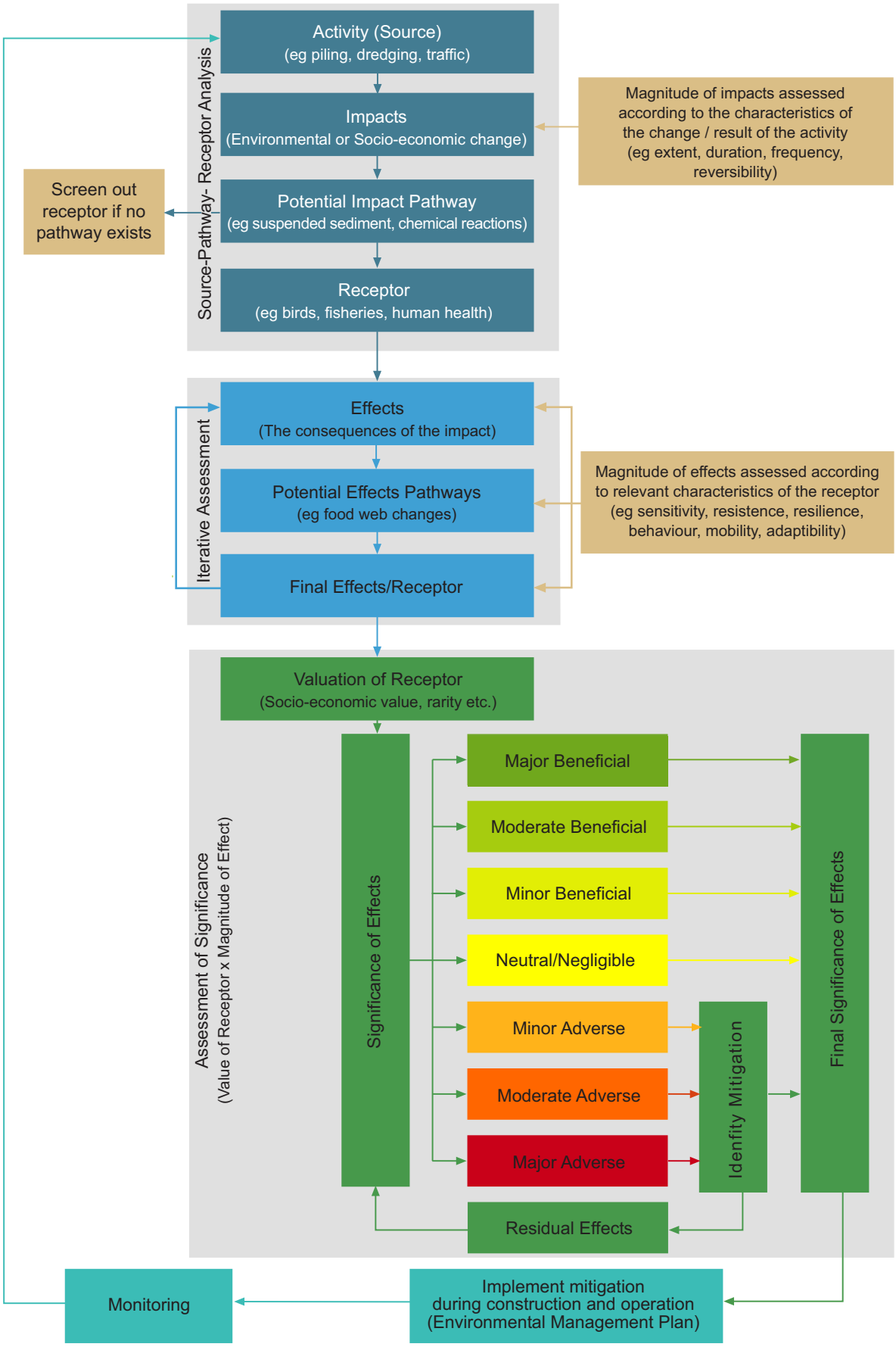

Figure 5.2: Source-Pathway-Receptor analysis, assessment of significance of effects, and implementation of mitigation and monitoring measures

5.10.6 Characterising and Assessing the Magnitude of Impacts

Impacts are defined as predicted changes in baseline conditions as a direct result of a project-related action, and are typically physical or chemical. Predictions are made relative to the baseline, and should be measurable, and quantified or estimated where possible. The characterisation and assessment of the magnitude of impacts are made according to the receptors affected, and require receptor-specific context. Therefore, threshold values for specific factors such as area, frequency or duration are not presented in this section but are provided within the relevant ES chapters. However, there are a number of factors that are common to characterising and assessing impacts, therefore impacts are likely to be described and quantified according to some or all of the characteristics defined in Table 5.2.

Table 5.2: Characteristics determining impact magnitude

Impact Characteristic	Definition
Permanence	The change to the baseline will be permanent.
Reversibility	The change to the baseline can be reversed to the pre-existing baseline conditions. The reversal may be by natural processes or through mitigation measures.
Recoverability	The change to the baseline can recover. Recovery is by natural processes only, and recovery may not be to pre-existing conditions. Recovery could be to an alternative stable state that may differ to the baseline.
Area	The spatial extent over which the impact occurs.
Relative change	The change relative to baseline conditions.
Duration	The time for which the impact is expected to last before recovery to pre-existing baseline conditions.
Frequency	How often the impact is likely to occur.

5.10.7 Characterising and Assessing the Magnitude of Effects

Generic magnitude categories are provided in Table 5.3. These magnitude categories are equally applicable to the classification and assessment of both impacts and effects, if necessary. Where appropriate to individual impact assessment topics, alternative categories and definitions are provided in relevant ES chapters.

Table 5.3: Classification of magnitude of effect (or impact)

Category	Definition
Negligible	No detectable change, or change is within the natural variation.
Minor	Small temporary or tolerable change from the baseline.
Moderate	Partial loss or change to one or more key components of the baseline condition which may be temporary or permanent.
Major	Near complete loss or major change to one or more key components of the baseline condition which is permanent.
Severe	Permanent loss of one or more components of the baseline condition.

The magnitude of potential environmental effects for each receptor should be assessed independently of its value or designated status. Even where high value receptors utilise the site, the magnitude of the effect upon those receptors may be relatively low if the habitat affected is relatively unimportant to them. Examples where the magnitude of effects upon high value receptors may be low include:

- Loss/reduction of habitats of receptors that are a very small proportion of their foraging range;
- Loss/reduction of habitats of receptors whose ranges are increasing;
- Loss/reduction of habitats of receptors that are of very poor quality;
- Loss/reduction of habitats not used the purposes of breeding, sheltering or overwintering; and
- Loss/reduction of habitats of receptors that have many alternatives sites.

The sensitivity of each receptor must be considered when assessing the likely magnitude of the effect. Ecological sensitivity is defined as the relative change of a system or population in relation to the level of disturbance or perturbation (Miller et al., 2010). The sensitivity of socio-economic and socio-ecological systems may be defined in a similar manner (Holling, 2001).

Effect magnitude also considers the duration of effects upon individual receptors, and their potential permanence or reversibility. The ecological resilience of individual receptors is assessed, considering the ecology, behavioural ecology (including feeding, foraging, breeding etc.), seasonality, life history strategy, and population biology of the receptor in question. Ecological resilience is defined as the capacity of a system or population to respond to disturbance or perturbation by resisting damage or recovering (Peterson et al., 1998). Ecological resilience is independent of ecological sensitivity, e.g. a receptor may be sensitive to a disturbance, but may recover quickly. The resilience of many aspects of socio-economic and socio-ecological systems may be defined in a similar manner (Walker et al., 2004).

5.10.7.1 Characteristics Influencing Magnitude of Effects

The magnitude of ecological effects will be a product of the project-specific impacts and the receptor-specific characteristics that make those receptors sensitive or responsive to the relevant impacts. Definitions for topic-specific characteristics will be provided in individual chapters, and will incorporate any receptor specific guidelines and best practice.

A selection of ecological, socio-economic, land/seascape and heritage and cultural characteristics relevant to assessing the magnitude of effects are provided in this section as examples, but are not intended to be exhaustive. All relevant characteristics are defined within the individual impact assessment chapters.

Ecological Characteristics

- Sensitivity;
- Resilience;
- Adaptability;
- Behavioural ecology, including but not limited to:
  - Feeding behaviour;
  - Foraging behaviour;
  - Breeding behaviour;
- Life history strategy;

- Population biology; and
- Seasonality.

Socio-economic Characteristics

- Current levels of local unemployment;
- Skill-level of local employment pool;
- Local transportation infrastructure; and
- Local and regional tourism and leisure opportunities.

Landscape and Seascape Characteristics

- Sensitivity of the land/seascape (in terms of character as a whole and the individual elements contributing to character) and of visual amenity. Sensitivity is comprised of judgements about:
  - The susceptibility of the receptor to the type of change arising from the specific proposal; and
  - The value attached to the receptor.

Heritage and Cultural Characteristics

- Sensitivity; and
- Receptor properties: e.g. age, type, rarity, survival and/or condition, fragility and/or vulnerability, associations, scientific potential and outreach potential.

5.10.8 Valuation of Receptors

The next stage is to determine the nature conservation, socio-economic or heritage value of the affected receptor. The methods and criteria for assigning value are specific to individual receptors and are detailed in relevant ES chapters where they differ from the examples provided in Table 5.4. The methodology for assigning value to receptors incorporates valuation methods and guidance from the following sources:

- A Nature Conservation Review (Ratcliffe, 1977);
- Handbook of Biodiversity Methods Survey, Evaluation and Monitoring (Hill et al., 2005);
- Guidelines for Ecological Impact Assessment in Britain and Ireland - Terrestrial, Freshwater and Coastal (Institute of Ecology and Environmental Management, 2006);
- Identification and Gap Analysis of Key Biodiversity Areas: Targets for Comprehensive Protected Area Systems (Langhammer et al., 2007);
- Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal (Institute of Ecology and Environmental Management, 2010);
- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (Seafish, 2012); and
- Design Manual for Roads and Bridges - Cultural Heritage (Highways Agency, 2007).

Additional receptor-specific guidance is detailed in relevant chapters.

Table 5.4: Determining nature conservation, socio-economic and heritage value

Nature Conservation, Socio-economic or Heritage Value	Selected Examples
Very High	• An internationally designated site or candidate site e.g. SPA, SAC, Ramsar Site, Important Bird and Biodiversity Areas (IBA), Biosphere Reserves, World Heritage Site, etc. • A regularly occurring, globally threatened species (e.g. IUCN Red listed) or species listed on Annex 1 of the Bern Convention. • A site or habitat essential for maintaining populations of globally threatened species. • A regularly occurring, nationally significant population of any internationally important species. • A site or habitat essential for maintaining internationally- or nationally-significant populations of internationally important species. • Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. • A site or habitat essential for maintaining populations of rare or threatened UK species. • An area of a major fishery supporting national/international fleets. • Major international shipping lane. • Areas licenced to other sea users such as renewable energy or aggregate extraction. • Internationally designated or recognised land/seascape of exceptional quality and distinctive intact character with a large number of features and strong sense of place, and uninterrupted views (visual amenity). • World Heritage Site or other cultural heritage asset of International importance.
High	• A nationally designated site e.g. SSSI, MPA, or a discrete area which meets the published selection criteria for national designation. • A viable area of a habitat of principal importance for the conservation of biodiversity (Nature Conservation (Scotland) Act 2004), or of smaller areas of such habitat that is essential to maintain the viability of a larger whole. • A viable population of a species of principal importance for the conservation of biodiversity (Nature Conservation (Scotland) Act 2004). • Species and habitats of principal importance for the conservation of biodiversity. • Other features identified as wildlife corridors or migration routes for nationally or internationally important species. • An important local fishery area with no nearby alternatives. • A recognised shipping lane or military practise and exercise area (PEXA). • Nationally designated or recognised land/seascape of high quality and distinctive character, with a strong sense of place, and susceptible to change which would permanently alter key characteristics and elements of the landscape (National Parks and AONBs). Partial or interrupted views (visual amenity). • Cultural heritage asset of National importance.

Table 5.4: Determining nature conservation, socio-economic and heritage value continued

Nature Conservation, Socio-economic or Heritage Value	Selected Examples
Medium	• A locally designated site e.g. Local Nature Reserve (LNR). • A viable area of a North East Scotland Local Biodiversity Action Plan priority habitat or of smaller areas of such habitat that is essential to maintain the viability of a larger whole. • A viable population of a North East Scotland Local Biodiversity Action Plan priority species. • Features of conservation interest present, that do not qualify for national designation e.g. patches of biogenic reef-forming organisms that do not qualify as a reef. • Areas of key habitat identified as being of regional value and integrity. • Viable areas of key habitat identified in the region or smaller areas of such a habitat which are essential to maintain the viability of the larger whole. • Significant populations of a regionally important species. • Other features identified as wildlife corridors or migration routes for locally important species. • Areas of regional importance for fisheries or other sea users, but with nearby alternatives. • Locally designated or recognised land/seascape with some distinctive character and features in reasonable condition. Capable of tolerating low levels of change without affecting key characteristics and elements (e.g. Local Green Space). Partial or interrupted views (visual amenity). • Cultural heritage asset of regional importance.
Low	• Areas without features of conservation interest, but otherwise diverse and productive natural communities. • Provides local foraging or nursery habitats but not essential to maintain the viability of the larger whole. • Areas of low intensity anthropogenic use, not essential to supporting local communities. • Areas of low commercial shipping intensity or low-moderate recreational vessel use. • Undesignated land/seascape of defined character type, but of low quality. Capable of tolerating moderate levels of change/improvement/enhancement. Views lack distinctive characteristics and/or are of low quality (visual amenity). • Cultural heritage asset of Local importance.
Negligible	• No site designation. • Areas of low biodiversity and productivity. • Species present are common and widespread. • Areas of no discernible employment opportunities or other socio-economic benefits. • Poor quality land/seascape, not representative of a wider type within the local area and capable of accommodating high levels of change/improvement/enhancement, with few or no views (visual amenity). • Feature with no discernible cultural heritage importance.
Adapted from Ratcliffe, 1977; Hill et al., 2005; IEEM, 2006; Langhammer et al., 2007; Highways Agency, 2007; IEEM, 2010; Seafish, 2012	

5.10.9 Assessment of Significance of Effects

The significance of each effect is determined by scoring the value of the ecological, socio-economic or heritage feature against the magnitude of the predicted effect (Table 5.5). This methodology is applied individually with respect to the specific ecology, socio-economic or heritage characteristics of each receptor.

Table 5.5: Determining significance of effects

Magnitude of Effect	Nature Conservation Value, Socio-economic Value or Heritage and Cultural Value				
	Negligible	Low	Medium	High	Very High
Negligible	Negligible	Negligible	Negligible	Negligible	Minor
Minor	Negligible	Minor	Minor	Minor	Moderate
Moderate	Minor	Minor	Moderate	Moderate	Major
Major	Minor	Moderate	Moderate	Major	Major
Severe	Moderate	Major	Major	Major	Major

Significance categories are defined in Table 5.6. Significance criteria are generally consistent for all ES topics; however, alternative criteria may be defined on a receptor specific basis in individual ES chapters.

Table 5.6: Effect significance categories

Category	Definition
Negligible	An effect that is found to be not significant in the context of the stakeholder and/or regulator objectives, or legislative requirements.
Minor	An effect considered sufficiently small (with or without mitigation) to be within accepted standards. No further action is required if it can be controlled by adopting normal good working practices.
Moderate	A significant effect that exceeds accepted limits and thresholds, but is less serious than a ‘major adverse effect’. Moderate adverse effects may include a reduction in the integrity or quality of a protected site or habitat, or a reduction in a local population of a protected species. Predicted moderate adverse effects require mitigation recommendations.
Major	A serious effect of the highest significance where an acceptable limit or threshold is likely to be exceeded. Major adverse effects would include a major or permanent loss of a protected habitat or a local population of a protected species. Predicted major adverse effects require mitigation recommendations.

5.10.10 Environmental Risk Assessment

It is also important to consider the likelihood that a potential effect could occur as predicted. Therefore, once the significance of an effect has been determined, the probability of the effect occurring will be categorised as ‘Certain’, ‘Near Certain’, ‘Probable’, ‘Unlikely’ or ‘Extremely Unlikely’. Table 5.7 shows the risk matrix used to assess environmental risk in this ES.

The reason for including 'Extremely Unlikely' in the matrix is that while some potential effects may be very improbable, they may also be extremely serious should they occur, resulting in major adverse effects on some receptors. These cases will require contingency plans to be put into place. Where doubt exists between two categories within the scale of probability, a precautionary approach will be taken and the more conservative category selected.

For accidental events, where it may not be possible to reduce the magnitude of potential impacts or effects, the overall environmental risk may be decreased by reducing the likelihood of an adverse event occurring through designed-in mitigation measures (Gormley et al., 2011), such as the implementation of an oil spill management plan. Further risk management strategies include managing or breaking receptor pathways, and/or protecting receptors (Royal Society of Chemistry, 2013). Mitigation measures or strategies to reduce environmental risk will be addressed for relevant activities, and their subsequent influence on residual effects will be assessed for relevant receptors.

Table 5.7: Environmental risk matrix (from Gormley et al., 2011)

Magnitude of Effect	Likelihood				
	Extremely Unlikely	Unlikely	Probable	Near Certain	Certain
Negligible	Low risk	Low risk	Low risk	Low-med risk	Medium risk
Minor	Low risk	Low risk	Low-med risk	Medium risk	Med-high risk
Moderate	Low risk	Low-med risk	Medium risk	Med-high risk	High risk
Major	Low-med risk	Medium risk	Med-high risk	High risk	High risk
Severe	Medium risk	Med-high risk	High risk	High risk	High risk

It should be noted that an environmental risk assessment approach is not suitable for every ES topic. For example, the assessment methodology used in Chapter 21: Shipping and Navigation and the associated technical study differs in its consideration of risk for impact assessment purposes. The differences in terminology and methodology are clearly described in Chapter 21.

With regards cultural heritage, it is not possible to predict the presence of unknown, buried receptors and therefore pre-emptively assess the likelihood of negative impacts and adverse effects occurring to them. As a complementary approach to the Environmental Risk Assessment, known and potential receptors have been highlighted in Chapter 24, Archaeology and Cultural Heritage, and a judgment on potential for encountering receptors is made based on baseline conditions (Appendix 24-A: Historic Environment Desk-Based Assessment, Section 5.2).

5.11 Mitigation Measures and Residual Effects

The term ‘mitigation’ is used in general to cover all efforts used to reduce the magnitude of potential impacts (and consequently, the significance of effects). These may include design changes, alteration of proposed methods, or other activities in addition to the core project-related activities to reduce or ameliorate impacts. Mitigation is often used as a catch-all term that also includes avoidance, minimisation, mitigation and offsets or compensatory measures.

The level of effect significance is used to determine the use and level of mitigation measures. Where a potential effect is assessed as 'moderate' or 'major', this is considered 'significant' in EIA terms. So far as practicable, mitigation (including offsetting) should be identified that reduces the potential magnitude or significance of effects, or the likelihood of significant effects. Minor adverse and negligible effects would not usually require any action beyond standard good management practices.

Mitigation measures are usually applied at the source of the impact, with the intention of reducing the level of residual effects upon the receptors in question. However, mitigation may also be applied directly at the receptor-level, with the intention of reducing effects, without any influence on the source or the impact.

All the mitigation recommendations described within this ES are based upon the realistic worst case scenarios within the Rochdale Envelope, ensuring that all measures described are appropriate to ameliorate the range of predicted effects. Mitigation recommendations may be revised during the detailed design stage.

5.12 Cumulative Effects

Cumulative effects are those caused by the combined effects of past, present or reasonably foreseeable activities and the development itself. Assessment of in-combination effects considers other marine and terrestrial projects and activities generating effects over similar temporal and spatial extents. Assessment of cumulative effects considers all potential interacting effects. As with other project-related effects, cumulative effects are considered with regard to natural variability in the baseline. Assessment of cumulative effects draws upon established guidelines and methodologies including the *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (EC, 1999) and the *Cumulative Impact Assessment Guidelines - Guiding Principles For Cumulative Impacts Assessment In Offshore Wind Farms* (RenewableUK, 2013).

Factors considered in scoping other projects in or out for assessment of cumulative effects include connectivity, effects pathways, species distribution and foraging ranges. An initial matrix of potential projects was drawn up, informed by regulator responses in the Scoping Opinion, and considering zones of influence for important receptors. Consultation with Marine Scotland, Scottish Natural Heritage and Aberdeen City Council was undertaken at this stage to confirm the selection of projects included was complete, and that the approach to the assessment of cumulative effects was correct. It is important to scope in developments and plans at an appropriate spatial and temporal scale and with sufficient data to enable quantitative assessments of likely effects. The following bullet points outline the approach taken:

- A screening process to identify potential projects or activities that may have a cumulative effects alongside the development and operation of the development;
- Identification of potential receptors affected by impacts and effects arising from these developments in combination with those arising from the development;
- Identification, through a matrix approach, of those projects that have potential to have a significant effect on receptors; and
- Assessment of cumulative effects on a receptor-specific basis.

At the screening stage the following types of projects and activities have been considered:

- Existing completed projects;
- Approved/consented projects that have not yet commenced;
- On-going activities;
- Plans or projects for which an application has been made and which are under consideration by the consenting authorities; and
- Plans and projects which are reasonably foreseeable, i.e. projects for which a screening or scoping report has been submitted, or a Pre-Application Notice has been submitted, and for which sufficient information is available to assess the likelihood of cumulative effects.

The boundaries for cumulative spatial and temporal interactions were set at appropriate receptor-specific levels. Details regarding the rationale for considering cumulative effects are provided within the relevant ES chapters.

Table 5.8 and Table 5.9 provide lists of marine and terrestrial projects (respectively) that have considered and subsequently been screened in or out according to the methods and criteria described above, and Figure 5.3 and Figure 5.4 show the locations of those marine and terrestrial projects(respectively). The projects in these lists have been screened in or out on a receptor, topic or chapter-specific basis, and full details of the rationale for those projects have been provided in the relevant ES chapters.

Table 5.8: List of major marine infrastructure developments and activities to be screened in or out for assessment of cumulative Effects. Screening in or out is determined on a receptor by receptor basis according to individual receptor characteristics

Development	Description	Location	Distance [km]	Planning Status
Aberdeen Maintenance Dredging	Harbour maintenance dredging	Existing harbour	2	On-going
European Offshore Wind Deployment Centre	Offshore wind demonstrator	Aberdeen	10	Consent approved. Under legal challenge
Kincardine Offshore Wind Farm	Floating offshore wind farm	Aberdeen	12	Application
Peterhead Carbon Capture and Storage Project	Subsea pipeline	Peterhead to Goldeneye Field	42-138	Application
Peterhead Harbour Masterplan	Port Development	Peterhead	44	Application
Hywind Scotland Pilot Park Offshore Wind Farm	Floating offshore wind demonstrator	Offshore Peterhead	51	Application
Seagreen Alpha Round 3 Wind Farm	Round 3 offshore wind farm	Outer Firth of Forth	64	Consent approved. Under judicial review
Seagreen Bravo Round 3 Wind Farm	Round 3 offshore wind farm	Outer Firth of Forth	64	Consent approved. Under judicial review
Inch Cape STW Wind Farm	Scottish Territorial Waters Offshore Wind Farm	Outer Firth of Forth	65	Consent approved. Under judicial review
Neart na Gaoithe STW Wind Farm	Scottish Territorial Waters Offshore Wind Farm	Outer Firth of Forth	95	Consent approved. Under judicial review
Moray Firth Eastern Development Area (Telford, Stevenson and MacColl)	Round 3 offshore wind farm	Outer Moray Firth	130	Consent approved
Moray Firth Western Development Area	Round 3 offshore wind farm	Outer Moray Firth	130	Concept
Forthwind (Methil) Offshore Wind Demonstrator	Offshore wind demonstrator	Firth of Forth	131	Application
Beatrice STW Offshore Wind Farm	Scottish Territorial Waters Offshore Wind Farm	Outer Moray Firth	135	Consent approved
Port of Ardersier	Port Development	Inner Moray Firth	197	Consent approved

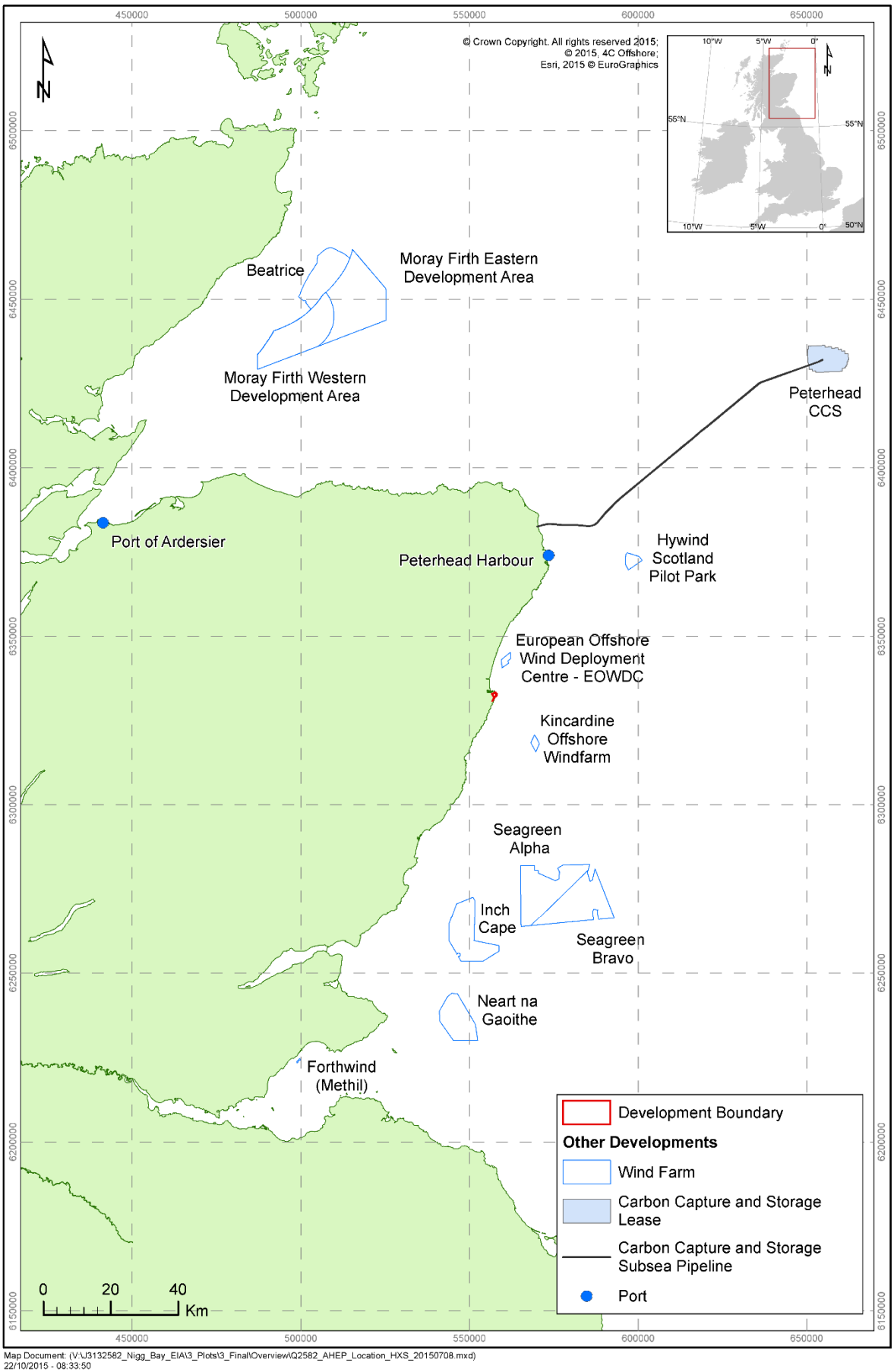

Figure 5.3: Map of other major marine infrastructure projects considered for assessment of cumulative effects

Table 5.9: List of other terrestrial infrastructure developments and activities to be screened in or out for assessment of cumulative effects. Screening in or out is determined on a receptor by receptor basis according to individual receptor characteristics

Development	Description	Location	Distance [km]	Planning Status
Ness Solar Farm	Solar electricity generation	Greg Ness	0.5	LDP Allocated
SITA Waste Recycling Facility	Waste recycling facility	Altens	1.2	Pending
Energy from Waste Facility	Energy from Waste Facility	East Tullos	1.2	LDP Allocated
Haudagain Roundabout Improvements	Haudagain Roundabout A90/A96	Haudagain	6.4	Approved
The 3rd Don Crossing	New bridge over River Don	North Aberdeen	5.5	Under Construction
Aberdeen Western Peripheral Route (AWPR)	Aberdeen By-pass	Aberdeen	11	Under Construction

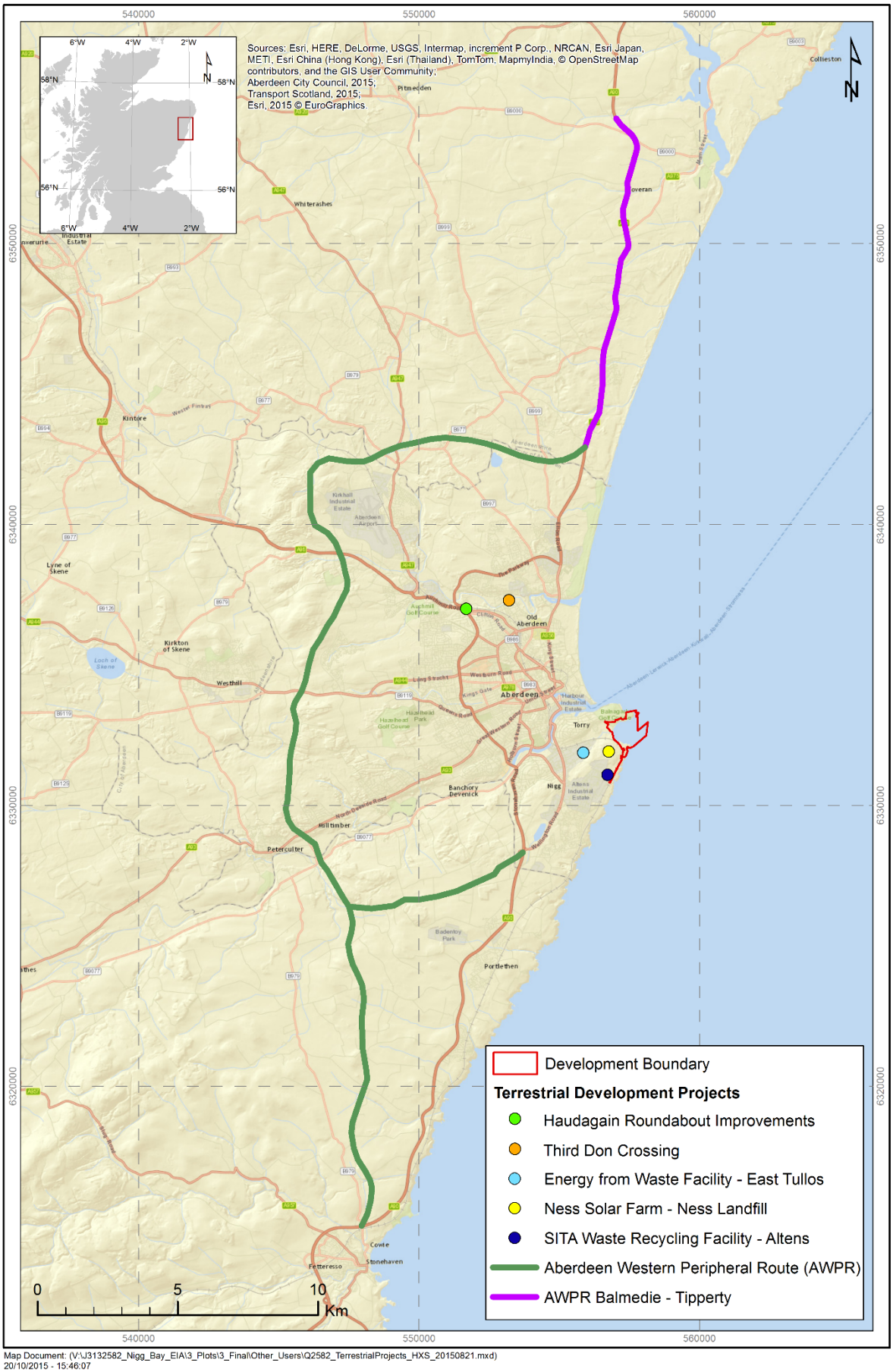

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Figure 5.4: Map of other major terrestrial infrastructure projects considered for assessment of cumulative effects

5.13 Habitats Regulations Appraisal

Under the Habitats Directive (EC Directive 92/43/EEC) and the transposing Habitats Regulations, competent authorities are required to carry out an appropriate assessment (AA) of any project likely to have a significant effect (LSE) on European protected sites (either alone, or in combination with other plans or projects). The Competent Authorities for this project are Transport Scotland, Marine Scotland and Aberdeen City Council. The consenting process is known as Habitats Regulations Appraisal (HRA). Further information on the implementing legislation is provided in Chapter 4: Planning and Legislation.

The factors considered in scoping other projects in or out for assessment of cumulative effects e.g. connectivity, effects pathways, species distribution and foraging ranges etc. were also applied to scoping Natura 2000 sites in or out of the HRA. The selection of Natura 2000 sites for consideration within the HRA was informed by the advice provided in the EIA Scoping Opinion, and through consultation with Scottish Natural Heritage and Marine Scotland. The list of sites is provided in Volume 4: Habitats Regulations Appraisal. Whilst full details are provided within Volume 4 to inform the Competent Authority's appropriate assessment, the ES and the HRA have been written in parallel to provide a coordinated read-across between both documents.

5.14 Environmental Management Plan (EMP)

Receptor-specific mitigation and monitoring recommendations to be employed during construction and/or operation of the project are detailed in relevant ES chapters. Chapter 26: Outline Environmental Management Plan captures the mitigation and monitoring recommendations set out in the ES, based on the project Rochdale Envelope. This draft EMP will form part of the D&B tendering documents.

Final mitigation and monitoring measures will be agreed with regulators post-consent and once construction method statements have been produced by the appointed D&B contractor. A detailed EMP will then be produced prior to construction commencing.

5.15 Decommissioning

The operation life span of the project is anticipated to be 50 years for the quaysides and 100 years for the breakwaters, and therefore decommissioning is not considered within this ES. Decommissioning activities would be subject to a separate EIA.

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