

Kinmel Bay Coastal Defence Improvements Scheme Environmental Statement

Volume 1: Main Text

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LD&A DESIGN

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Contract

This report describes work commissioned by Amey Consulting, on behalf of Conwy County Borough Council, JBA Consulting carried out this work.

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Purpose

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EIA Quality Mark

This Environmental Statement, and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

The EIA Quality Mark is a voluntary scheme, operated by IEMA, through which EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in the following areas:

- *EIA Management*
- *EIA Team Capabilities*
- *EIA Regulatory Compliance*
- *EIA Context & Influence*
- *EIA Content*
- *EIA Presentation*
- *Improving EIA practice*



To find out more about the EIA Quality Mark please visit: <http://www.iema.net/eia-quality-mark/>

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H Outline Construction Environmental Management Plan

Abbreviations

CEMP	Construction Environmental Management Plan
CCBC	Conwy County Borough Council
CIEEM	Chartered Institute of Ecology and Environmental Management
CPAT	Clwyd Powys Archaeological Trust
DDA	Disability Discrimination Act (1995)
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HGV	Heavy Goods Vehicle
HER	Historic Environment Record
HMWB	Heavily Modified Water Body
HRA	Habitat Regulations Assessment
IEMA	Institution of Environmental Management and Assessment
JBA	Jeremy Benn Associates
LNR	Local Nature Reserve
LVIA	Landscape and Visual Impact Assessment
MAGIC	Multi-Agency Geographical Information for the Countryside
MCA	Marine Character Area
NPPF	National Planning Policy Framework
NTS	Non-Technical Summary
NRW	Natural Resources Wales
PRoW	Public Right of Way
RCAHMW	Royal Commission of Ancient and Historic Monument Wales
SAC	Special Area of Conservation
SMP	Shoreline Management Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WAT	Welsh Archaeological Trust
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WIMD	Welsh Index for Multiple Deprivation

1 Introduction

1.1 Background

The coastal community of Kinmel Bay is currently threatened by increasing flood risk. Conwy County Borough Council (CCBC) is proposing to construct coastal flood protection works along the coastline at Kinmel Bay to enhance coastal defences along the coastline. The interventions are collectively referred to as the proposed scheme.

There are several existing flood defences built along the 2.3km stretch of coastline which are composed of rock revetments, cobbled beaches, sea walls and floodgates. However, as a consequence of climate change, the number of properties and critical infrastructure at risk of flooding is increasing. In 2021, the number of properties at risk from a 1 in 200-year flood event was 892, this will increase to 3,335 properties in 2121.

The objectives of the Kinmel Bay Coastal Defence Improvement scheme, as stated in the (Outline Business Case) are as follows:

- Reduce flood damages to residential and non-residential properties.
- Ensure community and stakeholder 'buy-in' for the Scheme.
- Develop a scheme that is deliverable within the engineering time constraints.
- Develop a scheme that is adaptable to change; and
- Sustain and /or improve the tourist and amenity benefits through continued operation of the beach and the North Wales Coastal route.

The proposed scheme will encompass raising the level of the existing sea wall, replacing the flood gate, and enhancing and extending rock armour to protect the residential and commercial properties, including critical infrastructure, along this section of the coastline. The design life of the scheme is 100 years.

Environmental Impact Assessment (EIA) is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects¹ undertaken by the developer where the characteristics and/or location of a proposed scheme project would result in likely significant effects on the environment². The findings of the EIA process are documented in this Environmental Statement (ES) report, which forms part of the planning application and marine licence application for the development proposals. The circumstances under which the development project has been subject to the EIA process and the way in which the ES has been prepared, are a statutory requirement.

The findings of the EIA process are documented in this Environmental Statement (ES), which forms part of the planning application and Marine Licence application for the development proposals. One Environmental Statement has been produced for both planning routes. The circumstances under which the development project has been subject to the EIA process and the way in which the ES has been prepared, are a statutory requirement. A non-technical summary of the outcomes of the EIA has been prepared to summarise the findings reported in the ES. Information used to describe each of the sites and the existing defences has been obtained from background information documents provided by Amey and Conwy County Borough Council (CCBC).

1.2 Site description and history

The study area comprises the coastal frontage at Kinmel Bay, approximately 0.8km west of Rhyl on the North Wales coast. The permanent footprint of the proposed scheme will include

¹ Sadler B. & Fuller K. (2002). UNEP Environmental Impact Assessment Training Resource Manual. 2nd Edition.

² GOV.UK (2020) Guidance: Environmental Impact Assessment. [Online] Available at: <https://www.gov.uk/guidance/environmental-impact-assessment>

2.3km of the frontage, and an area of approximately 35,111m². The existing coastal defences comprise a combination of rock revetments, cobbled beaches, sea walls and floodgates.

CCBC plans to deliver the Kinmel Bay Coastal Defence Improvements Scheme as this stretch is subject to frequent wave over-topping of the primary defences, which is flooding nearby homes and local infrastructure. This risk is expected to increase as the effects of climate change are realised.



Figure 1-1: Site location plan.

1.3 Legislative basis of the Environmental Statement

The requirement for assessment of the effects of certain public and private projects on the environment is set out in European and UK law. European Council (EC) Directive No. 85/337/EEC as amended by EC Directive No. 97/11/EC³, EC Directive No. 2011/92/EU⁴ and EC No. Directive 2014/52/EU⁵ (hereafter collectively referred to as 'the EIA Directive') under Article 5(1): *'Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report.'*

The EIA Directive is transposed into UK law through the EIA Regulations and continues to apply following the UK's exit from the European Union. These are a series of statutory instruments that set out regulations for implementing the EIA Directive through specific consenting regimes. The development proposals require consent under the Town & Country Planning Act 1990 and the Marine & Coastal Access Act 2009, and therefore fall within the

³ EC Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment. Official Journal of the European Union No. L 073, 14/03/1997.

⁴ EC Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of effects of certain public and private projects on the environment. Official Journal of the European Union L 26, 28/1/2012.

⁵ EC Directive 2014/52/EU of 6 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Union No. L 124/1, 25/4/2014.

requirements of both the Town & Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (SI 2017/567 (W136)), and the Marine Works (Environmental Impact Assessment) Regulations 2007 (SI 2007/1518) (as amended 2011, 2015, 2017).

Regulation 5 of the 2017 Town & Country Planning EIA Regulations sets out the provisions relating to screening EIA Development, and Regulations 7 and 8 of the 2007 Marine Works EIA Regulations set out in the requirement for screening of EIA Directive Annex I and Annex II Projects.

A screening opinion request was made by CCBC to CCBC Development & Building Control Section on the 18th February 2021. It was determined on 19th March 2021 that the proposed scheme would be EIA development. A scoping opinion request was prepared and submitted to the CCBC on the 29th November 2021 and received on the 20th of January 2022. Further detail on the outcome of EIA Screening & Scoping are provided in section 3.1.1.

A screening and scoping opinion request was made to Natural Resources Wales on the 29th November 2021. It was determined on 10th February that the proposed scheme falls within the Schedule A2 of The Marine Works Regulations 2007. The response also contained scoping opinion responses, included in section 3.2.

1.4 Scope and Content of the Environmental Statement

The EIA screening opinion and scoping opinion considered the potential for likely significant effects associated with the emerging development proposals. An appropriate scope for assessing the likely significant effects was set out, and through the Scoping Request, was used as a basis for seeking the views of the Statutory Environmental Consultees. As well as EIA scope, the EIA Screening and Scoping Report set out a proposed content and structure of the ES, which is summarised in the following sections. The full EIA Screening and Scoping Report, based on the OBC extent of the scheme, is provided in Appendix A.

In accordance with Regulation 18(3)/17(3) of the aforementioned Town & Country Planning EIA Regulations, and Regulation 12(2) of the Marine Works EIA Regulations, the ES contains:

- *(a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development*
- *(b) a description of the likely significant effects of the proposed development on the environment*
- *(c) a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment*
- *(d) a description of the reasonable alternatives studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment*
- *(e) a non-technical summary of the information referred to in sub-paragraphs (a) to (d) and*
- *(f) any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.*

A Non-Technical Summary (NTS) that summarises the proposals, its likely significant environmental effects, and the proposed mitigating measures in non-technical language has been prepared and is submitted as a separate document. It is intended to inform those who have an interest in the development but who are not concerned with the detail of the technical assessment provided in the ES. A NTS will be provided in a stand-alone document. The NTS provided in this document is also available as a stand-alone document in an electronic format.

The ES reflects the environmental topic basis set out in the Scoping Report and the Scoping Opinions received from consultees. For each environmental topic, a brief overview of the legislative and planning policy context is provided as required to set the context of the topic chapter. The topic-specific baseline conditions have been collected and used to inform the assessment. Furthermore, the potential impacts and likely significant effects of the proposed scheme on the environment have been determined for each of the scoped in environmental issues. Mitigation measures are proposed to reduce the significance of effects where possible, and the resulting residual effect is reported. The approach to EIA is iterative, whereby the assessment and ongoing consultation with stakeholders influence the design evolution of the development proposals. Further detail on the EIA process is provided in section 3.1.

The ES will be provided in three volumes;

- Volume 1 – Technical Report
- Volume 2 – Figures, appendices, and technical reports
- Non-Technical Summary

For consistency and ease of cross reference, each environmental topic chapter presented in the ES are structured with the following headings:

- Introduction
- Legislative and Planning Policy Context
- Baseline Conditions
- Assessment Methodology and Significance Criteria
- Potential Impacts & Significant Effects
- Mitigation Measures
- Residual Effects
- Summary

Table 1-1: Structure of the ES

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1.3	Legislative basis of the Environmental Statement
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Chapter 3	Environmental impact assessment methodology
3.1	The EIA process
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Chapter 4	Ecology
Chapter 5	Landscape and Visual

ES section	Section title
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Chapter 7	Hydrology and hydrogeology
Chapter 8	Cultural Heritage
Chapter 9	Contaminated Land
Chapter 10	Socio-Economic
Chapter 11	Traffic and Transportation
Chapter 12	Noise and Vibration
Chapter 13	Other construction related effects
Chapter 14	Cumulative and in-combination effects
Chapter 15	Conclusions
14.1	EIA outcomes
14.2	Concluding remarks
14.3	Mitigation and monitoring

1.5 Related Technical Information

1.5.1 The following technical reports form part of the proposed scheme planning application and are referred to in the ES. These are as follows and found in Volume 2:

- Heritage Desk Based Assessment
- Habitat Regulations Assessment
- Landscape and Visual Impact Assessment
- Water Framework Directive Assessment
- Phase 1 Contaminated Land Desk Based Assessment
- Flood Consequences Assessment

2 The Proposed Scheme

2.1 Planning Policy Context

This section provides a summary of relevant planning policy context, highlighting where the proposed scheme accords with, or potentially conflicts with, specific policy requirements.

2.2 National Planning Policy Wales

Planning Policy Wales (PPW) is the Welsh Government's primary statement of planning policies, with Edition 11 published on 24th February 2021.

The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental, and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation.

PPW makes it clear that the purpose of planning is to achieve sustainable development (Section 1), and that design (Section 2) and effects on the natural environment (Section 6) are important components of this.

Table 2-1: National Planning Policy Wales: Summary Table

National Planning Policy Wales	
Paragraph 1.22	This paragraph sets out that in determining applications for development this means that developments which accord with an up-to-date development plan should be approved.
Section 2	This section sets out considerations in 'People and Places: Achieving Well-being Through Placemaking' and notes that 'in areas recognised for their particular landscape, townscape, cultural or historic character and value it can be appropriate to seek to promote or reinforce local distinctiveness. In those areas, the impact of development, the existing character, the scale and siting of new development, and the use of appropriate building materials (including where possible sustainably produced materials from local sources), will be particularly important.'
Section 6.1	This section states that 'Conservation area designation introduces control over the total or substantial demolition of unlisted buildings within these areas, but partial demolition does not require conservation area consent. Procedures are essentially the same as for listed building consent. When considering an application for conservation area consent, account should be taken of the wider effects of demolition on the building's surroundings and on the architectural, archaeological, or historic interest of the conservation area as a whole. Consideration should also be given to replacement structures. Proposals should be tested against conservation area appraisals.
Section 6.4	This section recognises the planning system's role in helping to reverse the decline in biodiversity and increasing the resilience of ecosystems, at various scales, by ensuring appropriate mechanisms are in place to both protect against loss and to secure enhancement. Addressing the consequences of climate change should be a central part of any measures to conserve biodiversity and the resilience of ecosystems.
Section 6.5	This section deals with coastal areas. The main planning principles for coastal places, reflect the principles of Integrated Coastal Zone Management. These principles are 'to support urban and rural development, whilst at the same time being aware of, and appropriately responsible to, the challenges resulting from the dynamic interaction of natural and development pressures in coastal areas.
Paragraph 6.6.22	This section deals with Development and Flood Risk. The plan states that Government resources for flood and coastal defences are directed at protecting existing developments and are not available to provide defences in anticipation of future development. New or improved flood defences in coastal and/or riverside locations should be carefully planned, ensuring all potential environmental effects, both on and offshore, and relevant SMP policies are considered. Flood defence works can provide

National Planning Policy Wales	
	opportunities to achieve wider social, economic, and environmental benefits, which should be maximised where possible. Coastal defences can potentially influence sediment supply by transferring the risks of erosion to elsewhere. The PPW states that it is 'not appropriate for development in one area to adversely add to the impacts of physical change to the coast in another location'.
Section 6.7	This section considers noise: planning authorities and developers must seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes in relation to new development.

2.2.1 Technical Advice Notes

Technical Advice Notes (TANs) provide targeted advice and should be read alongside PPW. The TANs relevant to this scheme are:

- TAN 5 – Nature Conservation and Planning
- TAN 11 – Noise
- TAN 12 – Design
- TAN 13 – Tourism
- TAN 14 – Coastal Planning
- TAN 15 – Development and Flood Risk
- TAN 16 – Sport, recreation and open space
- TAN 18 – Transport
- TAN 20 – Planning and the Welsh Language
- TAN 23 – Economic Development
- TAN 24 – The Historic Environment

TAN 14 and 15 are of particular relevance to this scheme because they provide advice on recreation development, heritage coasts and non-statutory coastal groupings, Shoreline Management Plans (TAN 14) and development advice maps to determine flood risk, assessing the flooding consequences of proposed schemes and development plans and development control to mitigate flood risk (TAN 15).

2.2.2 Future Wales: The National Plan 2040

Future Wales is the Welsh Government's national development framework and forms part of the development plan, providing guidance for national and regional spatial issues up to 2040.

The plan covers key national priorities including the economy, housing and environment. It shows where nationally significant developments should take place, where growth should happen, what infrastructure and services are needed and how Wales can help fight climate change.

Future Wales builds on PPW and the Natural Resources Policy by setting out specific policies that:

- safeguard areas for the purposes of improving the resilience of ecological networks and ecosystems services, to identify areas for the provision of green infrastructure and to secure biodiversity enhancement (net benefit);
- ensure resilient location and design choices by promoting a sustainable growth strategy, as well as ensuring the consideration of natural resources and health and well-being form part of site and design choices; and

- facilitate the decarbonisation of the economy, including energy and transport choices, and promote the principles of a circular economy.

Policy 8 – Flooding supports flood risk management that contributes to sustainable strategic growth and regeneration in National and Regional Growth Areas – such as the north of Wales. The Welsh Government will collaborate with Flood Risk Management Authorities and developers for new and improved infrastructure. As part of these infrastructure projects, opportunities for social, economic and environmental benefits are to be maximised, but there should not be any adverse impacts on designated sites or the features for which they have been designated.

2.2.3 National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in Wales (2020)

Under the Flood and Water Management Act 2010 the Welsh Government was required to develop the National Strategy for Flood and Coastal Risk Management in Wales ⁶. The Strategy sets out a framework to help communities, the public sector, and other organisations to work together to manage flood and coastal risk management, making sure that risks are managed in a co-ordinated way across Wales. This includes the development of Local Flood Risk Management Strategies by Local Flood Authorities.

The National Strategy sets out four main objectives for managing flood a coastal erosion risk:

- Reducing the consequences for individuals, communities, businesses and the environment from flooding and coastal erosion;
- Raising awareness of and engaging people in flood and coastal erosion risk;
- Providing an effective and sustained response to flood and coastal events; and
- Prioritising investment in the most at-risk communities.

2.2.4 Welsh Minister’s Written Statement – Flood and Coastal Erosion Risk Management Programme for 2020-2021

The Welsh Minister’s Written Statement on Flood and Coastal Erosion Risk Management Programme for 2020-2021 identifies the unprecedented changes as a result of COVID-19 but emphasises that it is crucial that flood and coast risk continues to be managed. The flooding Wales suffered in February 2020 was the worst in a generation and brought into sharp focus the importance of our flood and coastal risk management programme in protecting lives, homes, and businesses. In addition to announcing the Government’s flood and coastal risk management programme for 2020-21, it states there will be additional support to Local Authorities and Natural Resources Wales and that the programme will bring forward more flood defence projects and develop a stronger pipeline of future schemes while increasing grant support for scheme preparation, coastal works and natural flood management.

2.2.5 Welsh National Marine Plan

The Welsh Government published the Welsh National Marine in November 2019⁷. This plan is directly informed by High Level Marine Objectives set out in the Marine Policy Statement (2011). These objectives align with the West Government’s Well-being Goals and principles for sustainable development and the direction provided in the EU Directive on Marine Spatial Planning 89/2014.

The plan objectives, relating to supporting policy objectives (i.e., in the Marine Policy Statement), of relevance to the scheme include:

⁶ UK Government (2010) Flood and Water Management Act 2010. [Online] Available from: <https://www.legislation.gov.uk/ukpga/2010/29/contents>

⁷ Welsh Government (2019). Welsh National Marine Plan. [Online] Available from: https://gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan-document_0.pdf

- Plan Objective 7: Support enjoyment and stewardship of our coasts and seas and their resources by encouraging equitable and safe access to a resilient marine environment, whilst protecting and promoting valuable landscapes, seascapes and historic assets.
- Plan Objective 8: Improve understanding and enable action supporting climate change adaptation and mitigation.
- Plan Objective 9: Support the achievement and maintenance of Good Environmental Status and Good Ecological Status.
- Plan Objective 10: Protect, conserve, restore and enhance marine biodiversity to halt and reverse its decline including supporting the development and functioning of a well-managed and ecologically coherent network of Marine Protected Areas (MPAs) and resilient populations of representative, rare and vulnerable species.
- Plan Objective 11: Maintain and enhance the resilience of marine ecosystems and the benefits they provide to meet the needs of the present and future generations.

2.2.6 Wellbeing of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 (WBFGA) is legislation requiring Welsh public bodies to put long-term sustainability at the forefront of their thinking, and work to prevent and tackle problems. Public bodies must work towards Seven Well-being Goals and enact the five Ways of Working for a more sustainable Wales.

The Seven Well-being Goals are;

- 1: A prosperous Wales
- 2: A resilient Wales
- 3: A healthier Wales
- 4: A more equal Wales
- 5: A Wales of cohesive communities
- 6: Wales of vibrant culture and thriving Welsh language
- 7: A globally responsible Wales

The five Ways of Working are;

- 1: Prevention – How acting to prevent problems occurring or getting worse may help public bodies meet their objectives.
- 2: Integration – Considering how the well-being objectives may impact upon each of the well-being goals, on the other objectives, or on the objectives of other public bodies.
- 3: Involvement - The importance of involving people with an interest in achieving the well-being goals and ensuring that those people reflect the diversity of the area which the body serves.
- 4: Collaboration – Acting in collaboration with any other person (or different parts of the body itself) that could help the body meet its well-being objectives.
- 5: Long Term - The importance of balancing short-term needs with the need to safeguard the ability to also meet long-term needs.

The Act also sets a requirement on Public Bodies in Wales to set and publish well-being objectives, that are designed to maximise their contribution to achieving each of the well-being objectives. For the sake of the practice of this Act, Conwy and Denbighshire have merged to form Conwy and Denbighshire Public Services Board and have published a set of 3 Priorities and 4 Additional Principles. These are:

- People – Good Mental Well-being for All Ages;

- Community – Community Empowerment; and
- Place – Environmental Resilience.
- To address inequalities and treat everyone equally;
- To support and promote the Welsh Language;
- To support access to appropriate accommodation; and
- To avoid duplication.

2.2.7 Welsh Government Active Travel Guidance 2020-2021

Active travel is a key priority in the Welsh Transport Strategy and is identified at the top of the sustainable transport hierarchy that guides all our transport activities. The Active Travel Guidance sets out a vision of walking and cycling to be the natural mode of choice for short everyday journeys, or as part of a longer journey in combination with other sustainable modes, along with five-year priorities to achieve this.

To assist local authorities to develop schemes that are ambitious and meet the vision of Active Travel, the following design principles relevant to Prestatyn Coastal Defence Scheme include:

- Develop proposals using the five ways of working, collaborating with key stakeholders and involving communities.
- Facilitate independent walking, cycling and wheeling for everyone, including an unaccompanied child of secondary school age or a less experienced cyclist;
- Design infrastructure that seeks to exceed, rather than just meet, minimum design standards;
- Ensure access for all and equality of opportunity in public space;
- Ensure all proposals are developed in a way that is evidence-led;
- Schemes should prioritise people walking, cycling and wheeling over private motor vehicles by considering the following hierarchy during scheme design:
- Separation of pedestrians from cyclists and motor traffic through provision of segregated off-carriageway infrastructure; if necessary, through reallocation of road space;
- Separation of pedestrians and cyclists from motor traffic through the provision of shared-use off-carriageway infrastructure; and
- Improve on-road conditions to encourage an increase in cycle use within existing highway, for example by reducing traffic volumes and speeds.

2.2.8 Shoreline Management Plan

The Shoreline Management Plan (SMP) is a non-statutory, high level policy document for coastal flood and erosion risk management planning that was formally adopted in August 2016. It provides a large-scale assessment of the risks associated with coastal processes and helps to reduce these risks to people and the environment by identifying the most sustainable policies for managing flood and coastal erosion risks in the short-term (0-20 years), medium-term (20-50 years) and long-term (50-100 years). SMPs form an important part of the Department for Environment, Food and Rural Affairs (Defra) and Welsh Assembly Government (WAG) strategy for managing risks due to flooding and coastal erosion.

The Shoreline Management Plan (SMP) currently states that the section of coastline at Kinmel Bay continues to provide protection over this period through maintaining and improving/raising/widening the existing defences. The policy for this stretch of coastline is Hold the Line.

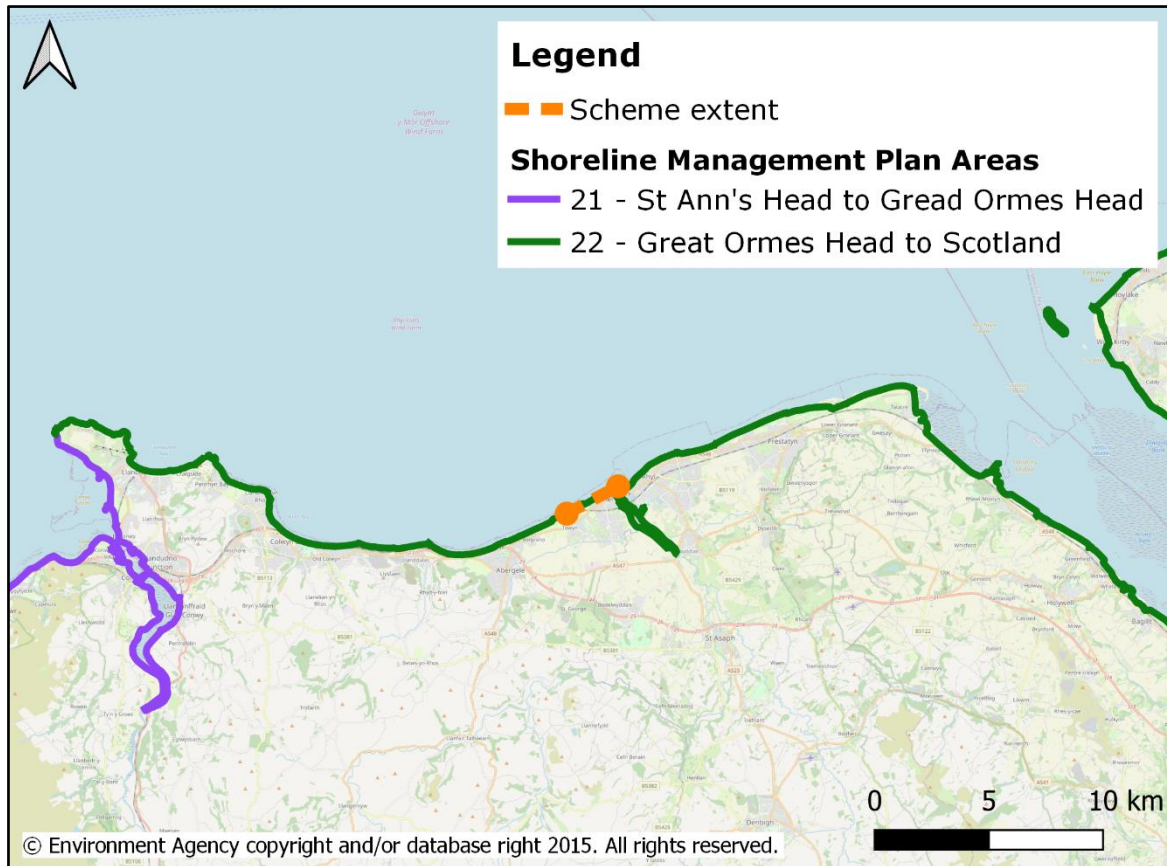


Figure 2-1: Location of the scheme within Shoreline Management Plan.

2.2.9 Environment (Wales) Act 2016

The Environment Act requires (under Schedule 6 (1) and 6 (2)) public bodies to maintain and enhance biodiversity to promote the resilience of ecosystems (Welsh Gov., 2016). In complying with this, five key areas must be considered (Welsh Gov., 2016):

- Diversity;
- Connectivity;
- Scale/ extent;
- Condition; and
- Adaptability.

The State of National Resources Report, the National Natural resources Policy 2017, the Area Statement will help decision-making take into consideration.

2.3 Local Planning Policy

2.3.1 Local Development Plan

CCBC adopted the current Plan in October 2013 and is currently carrying out a full review. The Plan is composed of a Written Statement and a proposal map and covers the period 2007 to 2022. Its policies relate to the part of CCBC that lies outside of Snowdonia National Park, equating to an area of 1,130 sq. km and an estimated population of 111,700.

Table 2-2: Local Planning Policy Summary

Local Planning Policy - Conwy County Borough Council – Local Development Plan	
Priority issues	
Overcoming High Levels of Constrained Land	It is noted that the potential for development is hindered by the high levels of flood risk along the coast.
Encouraging Sustainable Tourism.	The coastal resort is recognised as key economic drivers, and CCBC wish to sustainably safeguard and encourage more year-round tourism by harnessing potential related to the built and natural environment.
Encouraging Sustainable Transport	There is an emphasis on decreasing car dependency within Conwy by encouraging non-car modes and developing an integrated transport system.
Promoting High Quality Design.	Quality and innovation design is to be leveraged to sustain the character of Conway while also attracting and retaining the younger population to help address Conwy's age imbalance.
Protecting Conway's Cultural Heritage	The richness of Conwy's built heritage is to be protected, maintained, and, where appropriate, improved upon, by new development.
Protecting and Enhancing Conwy's Natural Environment.	Biodiversity, habitats, and species should be enhanced and protected by new development.
Spatial Objectives	
SO1	To accommodate sustainable levels of population growth
SO2	To promote the comprehensive regeneration of Colwyn Bay, Abergelge, Towyn and Kinmel Bay to broaden economic activity, address social exclusion and reduce deprivation through the Strategic Regeneration Area Initiative.
SO8	Assist tourism through the protection and enhancement of coastal and rural based tourism attractions and accommodation and further exploit the potential to develop, strengthen and encourage an all-year-round tourism industry.
SO10	Ensure that good, sustainable, inclusive design is delivered which includes the opportunity to design out crime, to develop strong, safe and locally distinctive communities and encourage the younger population to remain and return to the area.
SO12	Safeguard and enhance the character and appearance of the undeveloped coast and countryside, sites of landscape/conservation importance, features of archaeological, historic, or architectural interest and ensure the conservation of biodiversity and protected species.
SO13	To protect and improve accessibility to essential services and facilities, including open space, allotments, health, education, and leisure.
SO14	To promote the prudent use of resources through the minimisation of waste and assist in providing an integrated network of waste management facilities consistent with the needs of the area and the waste hierarchy.
Development management policies	
Policy DP/1 – Sustainable Development Principles	Proposed scheme must accord with sustainable development principles, including sequential approach to development, efficient and effective use of land, addressing flood and pollution risk etc.
Policy DP/3 – Promoting Design Quality and Reducing Crime	Design of developments should be high quality, sustainable, usable, safe, durable, and adaptable. It should protect local character and distinctiveness of the natural and built environment.
Policy DP/4 – Development Criteria:	A list of requirements for development should be met, including the provision of enhancement of cycling and pedestrian infrastructure.
Policy DP/6 – National Planning Policy and Guidance:	National planning policy and guidance must be followed.

Local Planning Policy - Conwy County Borough Council – Local Development Plan	
Policy TOU/1 – Sustainable Tourism:	Proposals for new high quality all-year round sustainable tourism development is supported, as well as improvements to the Wales Coastal Path.
Policy NTE/1 – The Natural Environment:	Development will be regulated to conserve and, where possible, enhance the Plan Area's natural environment, countryside, and coastline.
Policy NTE/3 – Biodiversity:	Biodiversity is to be conserved and, where possible, enhanced by new development with sensitive siting, layout, and design, and with other proactive measures. All proposals must be accompanied by a Biodiversity Statement.
Policy NTE/4 – The Landscape and Protecting Special Landscape Areas:	The attributes of identified Special Landscape Areas must be considered in development proposals to integrate into the landscape.
Policy NTE/5 – The Coastal Zone:	Development in the Coastal Zone will only be permitted where specific criteria are met, including requiring a coastal location, not interfering with natural coastal processes, not impeding the function of existing coastal defence structures etc.
Policy NTE/6 – Energy Efficiency and Renewable Technologies in New Development:	Several methods for improving efficient use and conservation of natural resources are supported, including minimising use of new materials in construction, incorporating sustainable drainage, waste recycling areas/storage etc.
Policy NTE/8 – Sustainable Drainage Systems:	Sustainable Drainage Systems are required where reasonably practicable.
Policy NTE/10 – Water Conservation	All developments must incorporate water conservation methods where practicable, and proposals larger than 1,000m ² should include a Water Conservation Strategy.
Policy CTH/2 – Development Affecting Heritage Assets:	Development must preserve or, where appropriate, enhance Conservation Areas, Conway World Heritage Site, Historic Landscapes, Parks and Gardens, Listed Buildings, Scheduled Ancient Monuments, and sites of archaeological importance.
Policy CTH/5 – The Welsh Language:	A 'Community and Linguistic Impact Assessment' should accompany a commercial, industrial or tourist development on unallocated sites with an area of 2,000m ² or more. Features such as bilingual signs and the retention of traditional Welsh names are encouraged.
Policy STR/1 – Sustainable Transport, Development and Accessibility:	Footways, cycle infrastructure and public transport should exist or be provided where appropriate. Walking and cycling is particularly promoted; improvements to make these means of transport safer and more accessible is encouraged to aid a transition in travel behaviour.
Policy STR/2 – Parking Standards:	Car parking and secure cycle storage should be provided in accordance with the Council's standards.
Policy STR/3 – Mitigating Travel Impact	Undesirable effects of travel such as noise, pollution, impact on amenity and health, and other environmental impacts, must be mitigated. A Transport Assessment and Travel Plan may be required where proposals may have significant transport, social, environmental implications.
Policy STR/4 – Non-Motorised Travel	Development proposals should minimise distances between trip origins and destinations, provide adequate safe and secure cycle parking, and encourage cycle use and walking with designs and layouts.
Policy STR/5 – Integrated Sustainable Transport System	One of the transport schemes to be safeguarded and promoted is the Wales Coastal Path Improvement Programme and Conway Rights of Way Improvement Plan. This scheme improves accessibility to the coast and countryside for local communities and visitors.
Policy MWS/1 – Minerals and Waste	Sufficient provision of mineral resources and waste management facilities is provided while safeguarding the natural environment. Permitted reserves of hard rock are safeguarded, including reserves at Llanddulas. A landfill buffer zone around Llanddulas manages development in this area.

Local Planning Policy - Conwy County Borough Council – Local Development Plan	
Policy MWS/3 – Safeguarding hard rock and sand and gravel resources	The permitted reserves at Llanddulas Quarry are included within this designation. Planning permission will not be granted for development that directly or indirectly harms the long-term viability of working these resources unless need for development outweighs need to protect the mineral resource, or other criteria are met.
Policy MWS/4 – Quarry Buffer Zones	There is a presumption against inappropriate development within quarry buffer zones.
Policy MWS/8 – Landfill Buffer Zone	There is a presumption against inappropriate development within landfill buffer zones.

2.3.2 Supplementary Planning Guidance Documents

Supplementary planning guidance (SPG) is provided for a range of subjects. This proposal has been particularly influenced by guidance given about Natural Environment. The following documents were consulted:

- **LDP5 Biodiversity:** The conservation of habitats and species is promoted, and advice is provided on how to reduce development effects on biodiversity as much as possible.
- **LDP24 Renewable Energy:** This document gives guidance on how to include renewable sources of energy into the development. It also includes advice on incorporating sustainable materials into the construction process.
- **LDP27 Coastal Flood Risk Protocol:** Controls on and constraints to development within the coastal flood risk area of the North Wales Coast is presented in this document.

Regard has also been given to guidance about Sustainable Transport, focused on Parking Standards. This document gives advice about design and provision of car and cycle parking.

2.4 Alternatives and Design Evolution

2.4.1 Long-list options development

The Outline Business Case (OBC) identified a long list of options which ranged from 'soft' measures such as shingle or sand engines to hard options such as wall raising and groynes. These options were considered for each Coastal Management Unit (CMU). The key works associated with each option, along with their merits and main issues were discussed to identify which options are feasible and which options should not be considered further. The performance of the long list of options considered constructability, cost, environmental impacts, and other key issues.

2.4.2 Short-list options

A short-list of options was developed to take forward to an economic appraisal. These are as follows:

- Option 1 – Walkaway
- Option 2 – Business as Usual
- Option 3 – Soft Engineering Option
- Option 4 – Hard Engineering Option
- Option 5 – Mixed Engineering Option, which is a combination of Option 3 and 4.

Walkaway (Option 1) – this option assumes that flooding continues at its current frequency and that no maintenance or improvements are carried out on the defences. Therefore, there will be a significant risk of the defences breaching with no further work to repair any breach after it has occurred. It also assumes that no property level protection is in place and that

there is no intervention carried out by either the householders or the local authority to limit the extent and impact of any flood.

Business as Usual (Option 2) – this option assumes that defences are maintained to their current defence standard by regular monitoring and maintenance, with appropriate actions carried out as they become apparent, such as the repair of any breached defence.

Soft Option (Option 3) – this option promotes a 'soft engineering' approach to flood defence by maximising the use of beach recharge to protect the area with the support of hard structures where the beach recharge alone would not be sufficient for the required protection. With the implementation of this option the amenity value of the site would be largely promoted.

Hard Option (Option 4) – this option adopts a 'hard engineering' approach by using more hard structures to protect the frontage from risk of flooding and coastal erosion. This option intends to minimise the need for ongoing maintenance over the lifetime of the scheme.

Mixed Option (Option 5) – this option proposes a mixture of the two previous approaches, minimising the amount of maintenance while providing amenity benefit.

The Short List of Options identified in the OBC have been assessed against the Investment Objectives and Critical Success (CSF) Factors as shown in Table 2-3. Based on the results of the table below, the Walkaway and Business as Usual Options have been discounted and will not be considered further.

Table 2-3: Short list screening assessment

Option	Walkaway	Business as Usual	Option 1	Option 2	Option 3
Objective 1 – Reduce the risk					
Objective 2 – Ensure the community engagement and buy in					
Objective 3 – Develop a scheme that is adaptable					
Objective 4 – Deliver a scheme that is deliverable					
Objective 5 – Deliver multiple benefits (environment/ tourist)					
CSF 1 – Strategic Fit and Business Needs					
CSF 2 – Value for Money					
CSF 3 – Supplier Capacity and Capability					
CSF 4 – Potential Affordability					
CSF 5 – Potential Achievability					
CSF 6 – Maintain existing amenity					

Although the Soft Option provided a significant reduction in flood risk, it did not perform as well against the Investment Objectives and CSF compared to the Hard and Mixed Options. For this reason, the Soft Option was discounted.

Appraisal in the scheme OBC, showed that the performance of the Hard and Mixed options was very similar in reducing flood risk, however, the Mixed Option performed slightly better. However, the cost of delivering the Mixed Option would be considerably higher, resulting in reduced value for money. For this reason, the Mixed Option was discounted.

The preferred option was selected as Option 4 – Hard Defences. The reason for this included:

- The preferred option has the greatest cost: benefit ratio
- The preferred option has the lowest present value cost
- The preferred option has the lowest present value maintenance cost
- The preferred option meets Critical Success Factors.
- The preferred option can improve the amenity of the seafront, acting as a catalyst for regeneration of the wider area.

The key mitigation or enhancement opportunities associated with these options are as follows:

- Community will be exposed to less frequent and severe flooding, resulting in an enhanced ability to respond and recover.
- Greater potential to improve amenity value of the most extensive placing walkways, bicycle parking racks, birdwatching or fishing facilities atop them.
- Potential improvements in amenity value by segregating the cycle and pedestrian paths in some areas.
- Opportunity to incorporate aspects of Abergele Place Plan.

2.4.3 Revised scheme extent

The OBC outlined a series of interventions along a 12km stretch of coastline from Llanddulas to Kinmel Bay.

Detailed design modelling was undertaken at the Full Business Case (FBC) stage (September 2022) to verify that the outline design delivered the same benefits of reduced flood risk to properties in Kinmel Bay, Towyn, Pensarn, Abergele and Llanddulas.

This detailed design modelling showed that the risk of flooding was not as high as originally thought. Some locations:

- Were not at risk until the future so interventions can be delayed;
- Are still at risk of flooding but for not as many properties as originally thought;
- Are not at risk now and in the future so interventions are not required.

Working with Welsh Government, this new information allowed the business case to be refreshed and focus on the locations where there was most benefit and value for money now. This means that all the proposed interventions to the west of the Towyn Revetment have been removed from the application and the coastal defence proposals will focus on Kinmel Bay only.

2.5 Description of the proposed Scheme

The preferred option intends to minimise the need for ongoing maintenance over the lifetime of the scheme. The proposed scheme has been divided by Coastal Management Units (CMU).

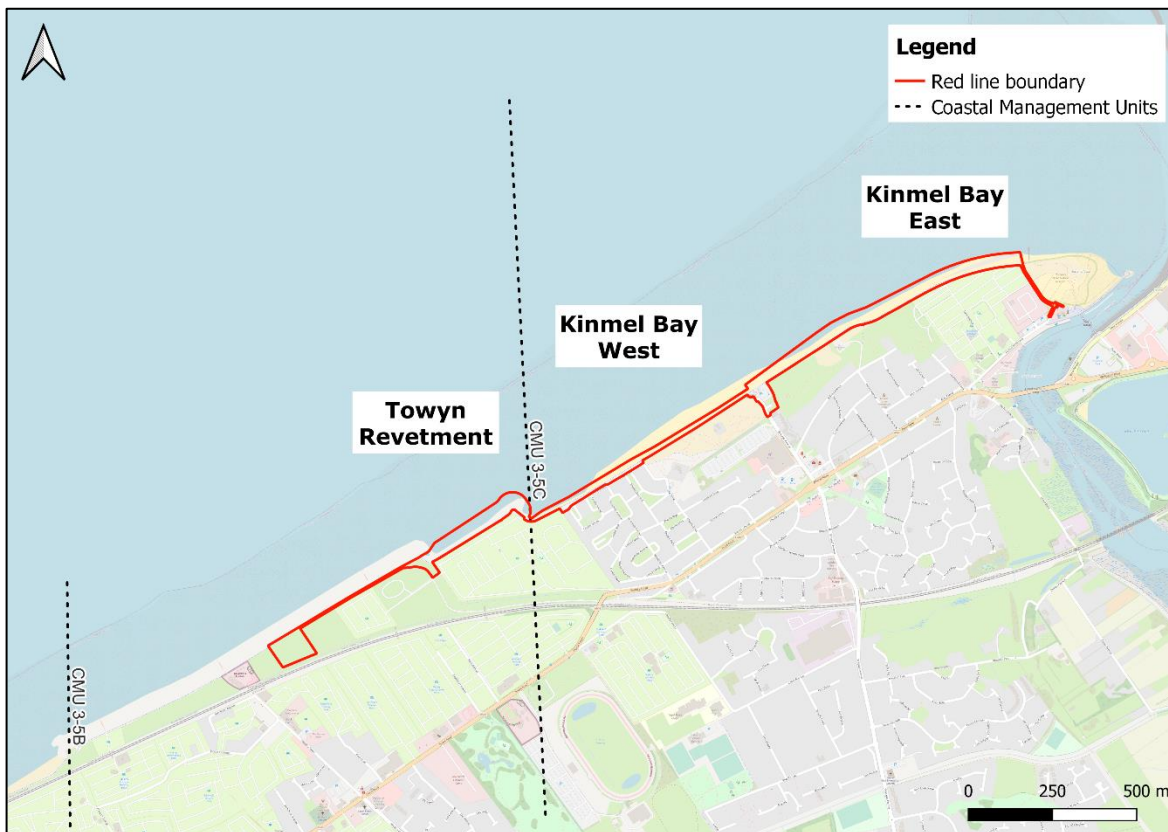


Figure 2-2: Proposed scheme within Coastal Management Units

2.5.1 CMU 3-5B: Towyn Revetment

The proposed upgrade in CMU3-5B will increase the level of coastal flood protection offered by the current rock armour unit. The new design will keep the 1 in 4 slope angle of the current rock armour unit but increase the crest width and height so that a Standard of Protection (SoP) of 1 l/s/m is achieved for a 1 in 200-year event up to the year 2041. The new design will reuse and repurpose the current rock armour material. The existing sea wall will be raised by 0.75m, up to 8mOD and the new rock armour will be raised to a height of 7.2mOD (the height of existing sea wall) to a crest width of 6m.

Additional to the coastal flood protection offered by the new rock armour design, there has also been considerations to the environmental benefit of the upgrade. This will involve the creation of artificial striation and cores in the rock surface to encourage colonisation of the material by marine invertebrates. The rocks with surface texture will be located within the Mean High-Water Spring (MHWS) of the rock armour.

The public realm proposals for the Towyn revetment are:

- Enhancement of the areas of existing coastal grassland
- A proposed parklet (a small seating area) at the eastern end of the Towyn Revetment. The parklet will comprise of:
 - Lounging seats
 - Picnic tables
 - Decorative paving
 - Cycle parking

- Improvement will be made to the existing access points adjacent to the Golden Sands Caravan Park.

2.5.2 CMU 3-5C: Kinmel Bay Beach (East and West)

The coastal defence upgrade along this section requires several actions comprising an increase in the height of the seawall along the entire CMU by 0.5m, and upgrade/replace flood gate at the St Asaph Avenue car park to match the new sea wall level. The level of the new seawall crest will provide improved wave overtopping flood protection to Kinmel Bay, accounting for Sea Level Rise up to 2041.

The proposed works also includes re-profiling the level of the entrance to the St Asaph Avenue car park. This localised change in elevation will provide flood protection landwards by preventing water entering the main town. Any flood water will be returned to the sea through the flood gates.

The existing rock armour at the eastern end of Kinmel Bay Beach will be enhanced and upgraded. The existing seawall behind the rock armour will be raised by 0.5 m and the rock armour in front will be reprofiled and raised. The new rock armour profile will have the same crest level as the raised wall, a crest width of 5.6 m and a slope angle of 1 in 3. The length of the new rock armour unit will be approximately 420 m, terminating at the sand dunes east of Kinmel caravan park.

Re-instate sand dunes where necessary along the stretch to the east of the car park at the end of St Asaph Avenue, where gaps exist along the landward side of the foot/cycle path.

Maintenance involving periodical recharge will be required at the western end downdrift the enhanced revetment at Towyn, where downdrift erosion may reach the seawall.

The reduction of the overtopping of this CMU is characterised by the enhancement of the existing revetment at the eastern end.

Kinmel Bay is where most of the public realm enhancements are proposed, these are as follows:

- A parklet at Kinmel Bay West which includes:
 - Cycle parking
 - Cycle maintenance and charging facilities
 - Lounge seating
 - Informal play equipment
 - Shelter for informal use
 - Decorative paving
- Widening the footpath to 4.5m between Sandy Cove and Baysville Grill.
- The existing St Asaph Avenue car park will be enhanced to act as a beach side hub for the community incorporating:
 - Enhanced car park with rain gardens and electric car charging points
 - A new toilet facility building
 - A shelter where Oriel Mor⁸ can programme art installations
 - Cycle parking, maintenance and charging facilities
 - Oriel Mor signage
 - Picnic tables and benches
 - Play climbing equipment

⁸ Oriel Môr – Conwy Culture. [Online] Available at: https://conwyculture.com/content/files/Oriel_M%C3%B4r.pdf

- Lawn planting with two proposed trees.
 - Decorative paving
- Beach Access Improvements for Kinmel Bay Beach include:
 - Retention of 1 flood gate access point
 - 3 enhanced access points to be fully accessible and DDA compliant
 - 6 enhanced access points with stepped access.
 - 10 access points in total: 1 retained, 9 enhanced.
- Informal rest area near Baysview Grill providing:
 - Bench
 - Litter Bin
- Upgrade to the existing pedestrian crossing.

2.6 Outline construction methodology

An outline construction methodology has been prepared for the proposed works, as summarised below. Where specific details are not yet available, such as types of construction machinery, assumptions have been made based on experience gained on similar schemes and professional judgement. The outline construction programme for the scheme is provided in Table 2-4 below.

The construction of the sea defence elements of the programme are subdivided into key locations as follows:

- Towyn Revetment
- Kinmel Bay East & West

The preferred method for excavation and placing rock armour involves the excavator to be situated at the top of the crest facing the rock armour below. However, there will also be a need to enable access to each work site from the north to handle and manage excavated material, geotextile and armour.

It is expected that construction activities will take place between 8:00am to 6:00pm between Monday to Friday, and 8:00am to 12:00pm on Saturdays. There will be no construction on Sundays and Public Holidays.

There will be approximately 30 operatives and 10 office staff present on-site, however this depends on the number of sites open at any one time.

Towyn Revetment (CMU3-5B)

Towyn Revetment proposed construction sequence:

1. Stockpile rock armour and sea wall prefabricated sections
2. Carry out initial excavation to form the crest
3. Install sheet piles for beach accesses and provide fill between piles
4. Install geotextile and sufficient depth of stone along the length crest to provide a running surface / access track for plant movement
5. This will be constructed in line with permanent construction specification but used as a temporary access platform.
6. The temporary imported stone will be reused within the permanent works
7. Construct rock armour embankment using long reach excavator situated on crest
8. Construct sea wall vertical extension
9. Complete crest construction
10. Ecological enhancements
11. Remove temporary fill between beach access sheet piles
12. Construct beach accesses

Kinmel Bay (CMU 3-5C)

The proposed construction sequence at Kinmel Bay:

1. Stockpile rock armour and sea wall prefabricated sections
2. Carry out initial excavation to form the crest
3. Install sheet piles for beach accesses and provide fill between piles
4. Install geotextile and sufficient depth of stone along the crest to provide a running surface/ access track for plant movement
5. This will be constructed in line with permanent construction specification but used as a temporary access platform
6. Temporary imported stone will be reused.

2.6.2 Construction programme

Table 2-4 outlines the proposed construction programme across the different elements of the Kinmel Bay Coastal Defence Improvements Scheme. This construction programme provided below is indicative and reliant on the planning application process.

Table 2-4: Outline construction programme

Site	Start of construction	Finish of construction
Coastal Defences		
Towyn Revetment	13/06/2023	12/12/2023
Kinmel Bay East	13/12/2023	01/07/2024
Car parks		
Kinmel Bay Car Park	02/07/2024	10/09/2024
Structures		
Shelters	25/07/2023	21/08/2023
Toilet Block	27/06/2023	19/09/2023
Beach Accesses	30/05/2023	20/02/2024

Site	Start of construction	Finish of construction
Kinmel Bay Sea Walls	30/05/2023	20/02/2024
Flood Gate	21/02/2024	27/02/2024
Accommodation work – Fence and Wall reconstruction	21/02/2024	19/03/2024
Public Realm		
Promenade widening & upgrades	21/02/2024	17/05/2024
Parklets	30/05/2023	24/07/2023
Ecological enhancements	02/07/2024	27/08/2024
Lighting – Kinmel Bay Car Park	28/08/2024	24/09/2024
Electrical connections (DNO)	30/05/2023	26/06/2023
Car & Cycle Charging units	28/08/2024	24/09/2024
Demobilisation		
Site Compounds	25/09/2024	08/10/2024

2.6.3 Construction access

The proposed red-line boundary encompasses the proposed works, construction access routes from the public highway and construction compounds. The proposed access arrangements are based on obtaining access from existing highways.

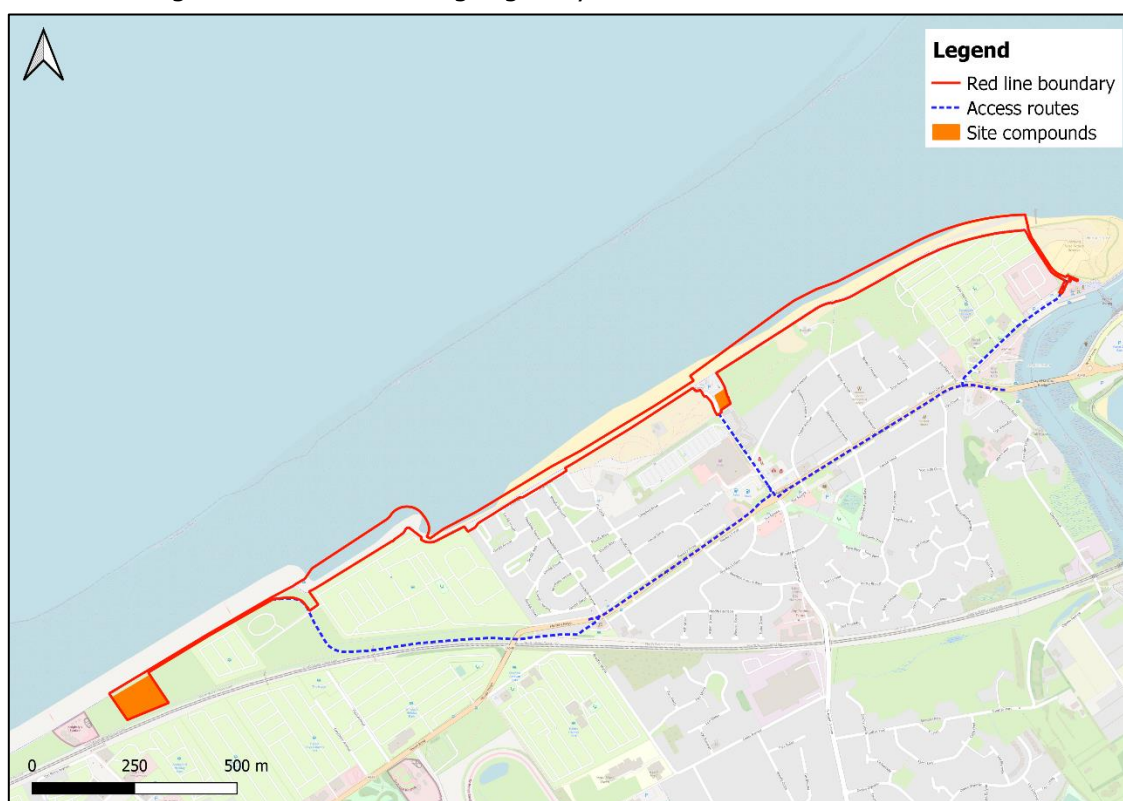


Figure 2-3: Construction compounds and access routes.

2.6.4 Construction materials

The figures below are calculated from design models of the scheme and subject to change, dependent upon site conditions.

Table 2-5: Construction material volumes

Construction Material Volumes			
Location	Geotextile (m2)	Rock Armour (m3)	Excavation Volume (m3)
Towyn Revetment	8,569	25,534	8,375
Kimmel Bay East	8,602	26,716	0
Total	17,171	14,9061	8,375

It is proposed that any excavated material will retain on site. However, if off-site disposal is required the following will occur:

- Material testing to classify the material
- Development of a material management plan under the CL:AIRE Code of Practice.
- Allocating suitable storage areas to process and dry out materials

2.6.5 Construction Plant

Due to the large tidal range the use of barges would not be practical, therefore it is proposed that land-based plant should be employed. Table 2-6 below provides a list of the key plant proposed.

Table 2-6: Main Construction Plant and Machinery

Type of Plant	Associated works
40t Tipper	Required for the construction of rock armour
36t Excavators	Required for the construction of rock armour
20t Road Wagons (Concrete and Rock)	Required for the construction of rock armour, sea wall, car parks, coastal path widening, and beach accesses.
10t Tipper	Required for the construction of, rock armour, and sea wall.
3t Tipper	Required for construction of, sea wall, car parks and beach accesses.
1.5t Tipper	Required for coastal path widening.
15t Excavator	Required for the construction of car parks, embankment, sea wall and beach accesses.
5t Excavator	Required for coastal path widening.
Asphalt Spreader	Required for car parks and coastal path widening.
Sheet Piling Rig	Required for beach accesses.
Vibrating Roller	Required for coastal path widening.

Sheet piling will be installed using the Giken (or similar) vibration free piling method. No hammer piling will take place.

2.7 Operational requirements and decommissioning

The operational design life for the proposed coastal defence improvements of the proposed schemes is 100 years. It is anticipated that the maintenance of the rock revetments will be very minimal, however, if a large storm event occurs some of the rock may get expelled from the revetment onto the beach. In this event, the rock may need to be moved back to its original location.

The proposed sea walls are unlikely to incur any maintenance unless damage occurs. Flood gates may require some maintenance, however, this will be specified by the gate supplier.

The different elements the public realm enhancements have different maintenance requirements:

- Rain gardens will need tidying, weeding and removal of litter throughout the year;
- Coastal wildflowers will need annual cut and tidying;
- Furniture and play equipment will require annual inspection and treatment;
- Shelters will require annual inspection and annual cut of sedum roof.

It is not within the scope of the works to decommission any elements of the permanent works.

3 Environmental Impact Assessment Methodology

3.1 The EIA Process

The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017 require an EIA to be carried out in support of an application for consent for categories of project listed in Schedule A1 and Schedule A2 of the regulations. The regulations set out the minimum information to be included within the Environmental Statement, set out in Schedule 3, summarised in section 1.4.

Regulation 4 of the Town & Country Planning (Environmental Impact Assessment) (Wales/Scotland/NI) Regulations 2017 sets out that the Environmental Impact Assessment is a process consisting of

(1) (a) the preparation of an environmental statement by the person seeking or initiating planning permission...

(2) The environmental impact assessment must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of proposed development on the following—

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC(1) and Directive 2009/147/EC(2);

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape; and

(e) the interaction between the factors listed in sub-paragraphs (a) to (d).

EIA is defined as 'a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects'^{Error! Bookmark not defined.}. Online Government guidance^{Error! Bookmark not defined.} defines the aim of Environmental Impact Assessment 'to protect the environment by ensuring that a local planning authority, when deciding whether to grant planning permission for a project which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision-making process' and 'to ensure that the public are given early and effective opportunities to participate in the decision making procedures'.

The EIA process is closely aligned with the design process (Figure 3-1)⁹. This effectively begins with EIA Screening, whereby the developer makes the decision whether EIA is required for the project in question. Suitable environmental alternatives (primary mitigation) should be considered at this early stage, but if it is decided that the potential likely significant effects on the environment cannot be avoided through mitigation measures, an EIA Screening Opinion should be sought from the appropriate authority by the developer. As well as outline design some environmental information is required to undertake EIA Screening, and so baseline surveys may be required to inform the EIA Screening Request.

It is often appropriate where EIA Screening is likely to return an outcome where statutory EIA is required, that EIA Scoping is undertaken at the same time. This combined approach makes use of the environmental baseline information collated for the EIA Screening Opinion request, to consider the scope of further detailed environmental impact assessment work required. Through the submission of an EIA Scoping Report, the developer requests that the relevant authority provide an EIA Screening Opinion in order to seek confirmation from the Statutory Environmental Consultees on the level of scope of EIA required.

⁹ IEMA (2016) *Environmental Impact Assessment Guide to Shaping Quality Development*.
https://www.iema.net/assets/uploads/iema_guidance_documents_eia_guide_to_shaping_quality_development_v7.pdf

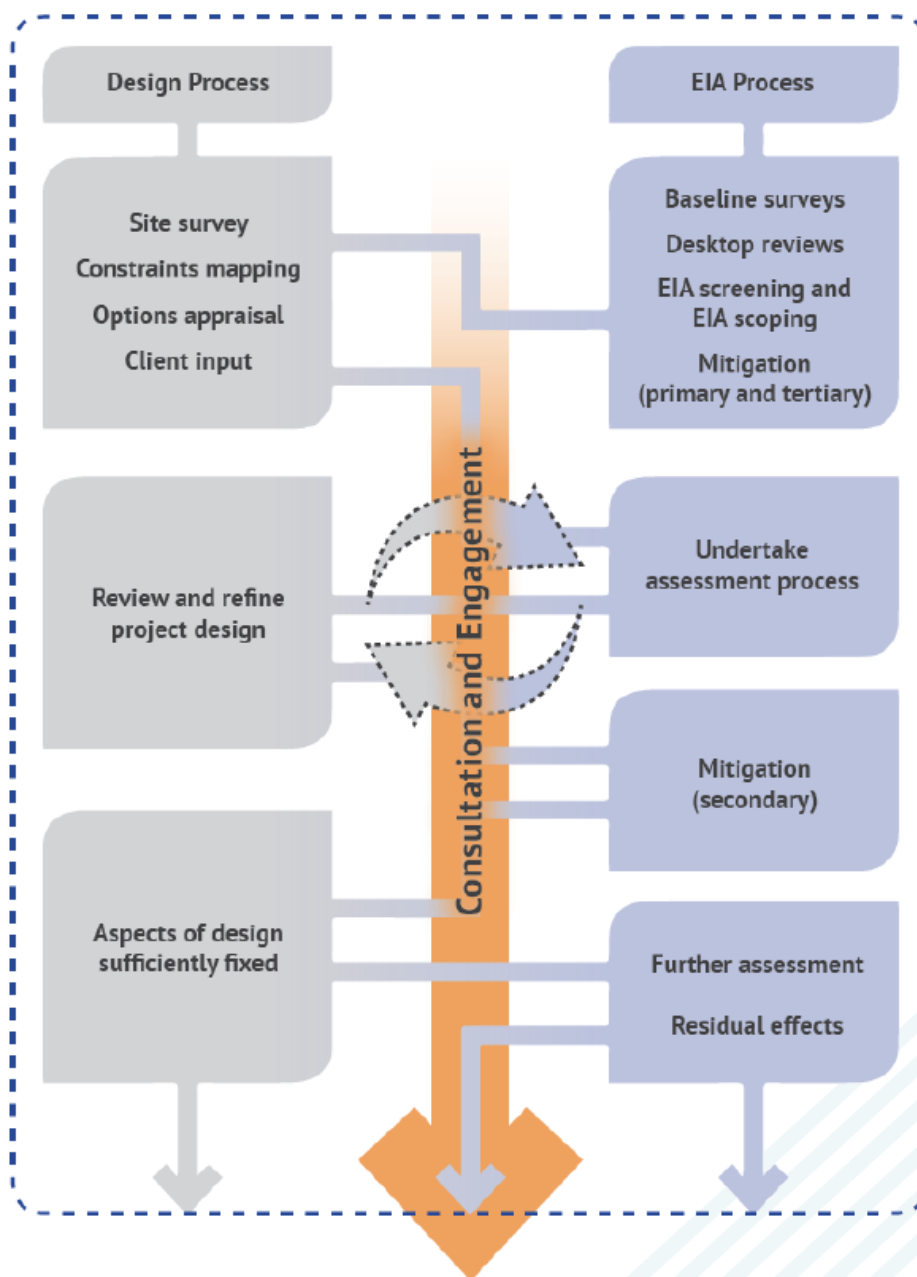


Figure 3-1: The interaction of design and EIA processes

On the basis of the EIA Scoping Opinion response, further detailed baseline information was collected to inform the detailed impact assessments. The assessments involve firstly characterising the potential impacts and then the assessment of likely significant effects. At this stage Embedded, Secondary and Tertiary Mitigation can be recommended to reduce or eliminate significant effects. This is an iterative process, whereby impact assessment process and design of the development process interact with one another to produce a mutually acceptable solution. This can also involve stakeholder engagement of the emerging design, to further minimise environmental effects. The results of the EIA process are documented in the Environmental Statement (ES), which should be well structured, proportionate and concise document. The ES is supplemented with a Non-Technical Summary in printed and digital format, which intended to make the findings of EIA publicly accessible.

Secondary and Tertiary Mitigation recommendations and commitments reported in the ES topic chapters often require separate environmental management plans in order to achieve the desired outcome. These are usually prepared during discharge of planning conditions or during pre-construction stage of the approved development, but can be prepared in draft at the planning stage to demonstrate that commitments in the ES will be followed up.

With reference to IEMA Guidance a summary of the steps involved in the EIA process is set out as follows:

- Identify aspects of environment likely to be significantly affected (preliminary baseline)
- Propose primary mitigation (impact avoidance measures)
- Define impact assessment methodology
- Collect environmental baseline
- Assess likely significance of the effects
- Propose secondary mitigation (iterate design to reduce or eliminate effects)
- Report residual effects (in the relevant ES chapter)
- Set out follow up measures (tertiary measures and environmental management plan)

3.1.1 EIA Screening and Scoping

3.1.2 EIA Screening Opinion Request

The scheme falls within Schedule 2 of the Town & Country Planning Environmental Impact Assessment Regulations (Wales) 2017 section 10(m) Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works – All development. Under Regulation 5(8) of the EIA Regulations the proposals must therefore be screened for EIA development by the Local Planning Authority. Given that the proposals would affect an area below Mean High Water Spring (MHWS), the proposals also fall within Regulation 8(1) of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

Habitats Regulations Assessment (HRA) Screening is undertaken in coordination with the EIA, in accordance with Regulation 27 (1)/ 26 (1)/ 15A of the aforementioned EIA Regulations.

An EIA Screening Opinion was requested from Conwy County Borough Council in February 2021. The EIA Screening Opinion request letter is provided in Appendix A.

3.1.3 EIA Scoping Opinion Request

The objective of EIA Scoping is to consider the scope and level of detail of the information to be provided in the ES (Regulation 14(1)). The EIA Scoping Report (provided in Appendix B) sets out a proposed methodology for the assessment of likely significant effects on the basis of reasonably accessible environmental baseline information, and proposes an appropriate structure for the ES. Although it is not a statutory requirement to undertake EIA Scoping, it allows agreement on approach to be sought from the statutory environmental consultees at an early stage in the EIA process. Early engagement through EIA Scoping also encourages an iterative approach to design development, whereby any environmental concerns raised during consultation can be used to inform the emerging design proposals and mitigate any significant environmental effects.

The EIA Scoping Report provides an overview of the potential for likely environmental impacts and effects of the proposed scheme. Based upon this, a professional judgement was made on which topics or particular aspects of them can be 'scoped in' and those that can be 'scoped out' of the EIA.

Environmental issues that are 'scoped in', would require further detailed technical studies undertaken to inform the ES. Where environmental issues are 'scoped out' these would not be considered further unless there is a material change in the outline scheme proposals.

3.1.4 EIA Screening and Scoping Opinion Response

An EIA Screening and Scoping response was received on the 10th February 2022 from Natural Resource Wales. This confirmed that the proposals are considered EIA Development, requiring the preparation of an ES. A summary of the comments raised by the statutory environmental consultees is provided in Appendix A.8. As a consequence of the reduced scheme extent, some of the scoping comments raised are no longer relevant to the proposed scheme, therefore, these have been noted as not applicable (N/A) in the table.

A Scoping Opinion response was also received from Conwy County Borough Council summarising the responses received from all statutory environmental consultees.

3.2 EIA Method of Assessment

Regulation 18(3)/ 17(3) of the EIA Regulations requires that:

'An environmental statement is a statement which includes at least—

(a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development;

(b) a description of the likely significant effects of the proposed development on the environment;

(c) a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

(d) a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment;

(e) a non-technical summary of the information referred to in sub-paragraphs (a) to (d); and

(f) any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.'

The requirements of information for inclusion in Environmental Statements is set out in Schedule 4 of the EIA Regulations. Where information about the proposals is not sufficiently known to inform these requirements, the premise of the Rochdale Envelope is employed (referring to a judgement made on the planning law case *R. v Rochdale MBC ex parte Milne* in 2000). This follows that the more detailed the proposal, the easier it will be to ensure compliance with the Regulations, but where such detail is unavailable, 'appropriate parameters' would need to be defined for the purpose of EIA.

Section 55 of the Town and Country Planning Act of 1990 defines development as 'the carrying out of building, engineering, mining or other operations in, on, over or under the land, or the making of any material change in the use of any buildings or other land'. Case law provided by *Parkes vs Secretary of State for the Environment* (1978) follows that the first half, 'operations', comprises activities which result in some physical alteration to the land which has some degree of permanence in relation to the land itself. The second half 'use' comprises activities which are done in, alongside or on the land, but do not interfere with the actual physical characteristics of the land. Operation and use are therefore material planning considerations and will need to be set out in sufficient detail in the ES for the purpose of informing Planning Consent.

As noted above Regulation 18(4)(b)/ 17(4)(d) states that the ES must 'include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment'. Reference is made to the current EIA practice guidance, primarily:

- Online Government Guidelines.
- Guidelines for Environmental Impact Assessment & 2006 Updates¹⁰.
- IEMA (2011) State of Environmental Impact Assessment Practice in the UK. Special Report¹¹.
- IEMA (2016) Environmental Impact Assessment Guide to Shaping Quality Development¹².

Other environmental topic-specific guidance is detailed in the methodology section of each ES chapter.

3.2.1 Statement on Competent Expertise

As noted above Regulation 18(5)/17(4)(b) requires that the ES must set out a 'statement by or on behalf of the applicant or appellant describing the expertise of the person who prepared the environmental statement'.

The JBA Consulting EIA Policy Statement requires that the appropriately qualified and experienced competent experts have the authority to technically review and approve EIA deliverables forming part of statutory ES reports coordinated by JBA. The EIA has been prepared by a multi-disciplinary team of environmental specialists as set out in Table 3-1. Overall coordination of the ES was overseen and technically reviewed by Dorian Latham BA PhD CEnv FCIEEM.

Table 3-1: EIA team & qualifications.

EIA Topic Chapter	EIA Chapter Author	EIA Chapter Reviewer
Coastal processes	Linley Hastewell BSc (Hons) PhD CGeog(Geomorph) FRGS	Anne-Marie Moon BSc MSc CEng MICE
Ecology	Jonathan Harrison BSc MSc	Steven Heathcote BA (Hons) CEcol DPhil MCIEEM
Socioeconomics	Thomas Bromley MSc BA	Helen High BSc PhD FRGS CGeog
Cultural heritage	Dorothy Graves McEwan PhD, MSc, BA	Fiona Lee Bsc MSc MCIfS
Hydrology & Hydrogeology	Parvaneh Aghajani MSc, MSc, BSc	Tim Stubley MSc BSc (Hons) FGS Michael McDonald BSc MSc PhD CGeol, FGS
Contaminated Land	Parvaneh Aghajani MSc, MSc, BSc	Tim Stubley MSc BSc (Hons) FGS Michael McDonald BSc MSc PhD CGeol, FGS
Landscape & visual effects	Shamia Khan BA, MA, ALI	Ruth Knight BA, PGDip, MA, CLI
Air Quality, Noise and Vibration	Paul Horsley MloA	Della Adams MSc HND MRTPI
Traffic and Transportation	Oliver Brown CEng MCIHT	Sonia Smith CEng, MCIHT
Other construction related effect	Lydia Price MSc BSc	Dorian Latham BA PhD CEnv FCIEEM

¹⁰ IEMA (2004). Guidelines Environmental Impact Assessment. 2006 Updates.

¹¹ IEMA (2011). State of Environmental Impact Assessment in the UK. IEMA Special Report.

¹² IEMA (2016). Environmental Impact Assessment Guide to Delivering Quality Development.
<https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf>

EIA Topic Chapter	EIA Chapter Author	EIA Chapter Reviewer
Cumulative effects	Lydia Price MSc BSc	Dorian Latham BA PhD CEnv FCIEEM

3.2.2 Defining the temporal & spatial scope of EIA

Regulation 18(3)/17(3)/12(2) states that the ES includes at least (a) '*a description of the proposed development comprising information on the site, design, size and other relevant features of the development...*'

The temporal scope of the EIA is considered in terms of the following principal stages of development:

- existing conditions (baseline);
- construction
- operation (including maintenance) of the development; and
- future decommissioning of the development.

The spatial scope of the EIA is considered based on:

- the physical extent of the proposed works, as defined by the limits of land to be acquired or used (temporarily or permanently);
- the nature of the existing baseline environment, including the location of sensitive receptors;
- the geographical extent of impacts beyond the site, e.g. effects on traffic, or watercourses that might extend some distance from the development site; and
- the geographical boundaries of the political and administrative institution and authorities, which provide the planning and policy context for the project.

3.2.3 Defining impacts and effects

With reference to the selection criteria for screening Schedule 2 development as set out in Schedule 3 of the EIA Regulations, the requirement for EIA is based on a preliminary assessment of the following:

1. the characteristics of the development;
2. the location of the development; and
3. the types and characteristics of the potential impact.

Paragraph 1 of the above considers the nature of the development being proposed. Paragraph 2 considers the environmental sensitivity of geographical areas likely to be affected by the development. Paragraph 3 considers the likely significant effects of the development on the environment [as specified in regulation 4(2)] in relation paragraphs 1 and 2 considering the following:

- (a) the magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);
- (b) the nature of the impact;
- (c) the transboundary nature of the impact;
- (d) the intensity and complexity of the impact;
- (e) the probability of the impact;
- (f) the expected onset, duration, frequency and reversibility of the impact;
- (g) the cumulation of the impact with the impact of other existing and/or approved development;
- (h) the possibility of effectively reducing the impact.

The requirement for EIA is therefore based on the characteristics of the development proposals that could impact on the environment as set out in paragraph 1, the value, sensitivity or importance the environment as defined in paragraph 2, and likely significant effect quantified by the characteristics of the potential impact as set out in paragraph 3. Distinction is drawn between characteristics of the 'potential impacts' and the significance of any resultant 'likely effects'. This is because not all potential impacts identified using paragraphs 1 and 2 will necessarily have a likely significant effect on the environment when assessed against the criteria set out in paragraph 3.

For the purpose of EIA, impacts and effects may be further distinguished from one another using the following definitions:

- *Impacts* are the predicted changes to valuable, sensitive or important aspects of the baseline environment which are attributable to the development proposals;
- *Effects* are the consequences of the changes to the baseline environment resulting from the types and characteristics of the potential impact attributable to the development proposals.

A matrix approach is often used in EIA to assist with the quantification of likely significant effect [on the factors specified in regulation 4(2)], as illustrated in Table 3-2. The matrix approach assists in the judgement of the scale of significance, by enabling a direct comparison to be made between the scale of magnitude, intensity, irreversibility etc. of potential impacts, and the scale of the value, sensitivity or importance of the impacted environmental resource or receptor. The matrix-based approach helps to provide consistent significance scoring terminology by pre-defining the relationship between significance scoring terms. For consistency throughout the ES these significance scoring terms will be used where possible, with any topic specific scoring terminology set out in individual ES chapter methodologies where this deviates from the general approach. Where significance scores derived using the matrix approach fall between terms (i.e. slight or moderate; moderate or large), then a professional judgement is made by the assessor upon which score should reasonably apply.

Significance of environmental effects is assessed herein on the basis of the magnitude, intensity or irreversibility of impacts versus the value, sensitivity or importance of the impacted environmental resource or receptor. Where applicable will be used to assist in the judgement of significance. This matrix-based approach helps to provide consistent significance terminology throughout the ES and improves the judgement of significance scoring by pre-defining the relationship between impacts and effects. For consistency, the significance of environmental effects assessment scores will be described using these terms where possible, with topic specific terminology set out in individual ES chapters where guidelines deviate from the standard approach. Table 3-2 will be used to assist in the judgement of significance. This matrix-based approach helps to provide consistent significance terminology throughout the ES and improves the judgement of significance scoring by pre-defining the relationship between impacts and effects. For consistency the significance of environmental effects assessment scores will be described using these terms where possible, with topic specific terminology set out in individual ES chapters where guidelines deviate from the standard approach.

Table 3-2: Matrix of significance of effect scoring terms

		Magnitude, intensity or irreversibility of impact			
		No Change	Minor	Moderate	Major
Magnitude, intensity or irreversibility of impact	Low	Not Significant or Neutral	Slight	Slight or Moderate	Moderate
	Medium		Slight or Moderate	Moderate	Moderate or Large
	High		Moderate	Moderate or Large	Large

Examples impact magnitude criteria are given as follows:

- **Major** – complete loss or the intensive alteration to an aspect of the baseline, which may be irrecoverable, slow to recover or if negative cannot be easily mitigated.
- **Moderate** – some loss or change to the baseline situation that occurs over a period of time and has limited potential to recover or if negative to be mitigated.
- **Minor** – a small change in the baseline situation that may not be immediately obvious, but which would have a perceptible impact on the receptor, and may be fully recoverable or if negative easily mitigated.

No Change or Negligible – no perceptible change in the baseline situation. Receptors would not require mitigation for negative impacts but may be positively enhanced.

Examples receptor importance and sensitivity criteria are given as follows:

- **High** – a receptor of national or international importance, or which is of particular or unique value, and which has no little or no resilience to change which could result in loss of the characteristics that make the receptor valuable.
- **Medium** – a receptor of regional importance, or which is of value to wider value, and which has some limited resilience to change without the complete loss of the characteristics that make the receptor valuable.
- **Low** – a receptor of local importance, which is common but of some value, and which has resilience to changes in the characteristics that make the receptor valuable.

Schedule 4 of the EIA Regulations, sets out the requirements for information to be included in the ES includes 'a description of the factors specified in regulation 4(2) likely to be significantly affected by the development... The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development...'

These types of effect are defined herein for the purpose of this EIA using the following terms:

- *Direct effects* – arise from the impact of activities that form an integral part of the project;
- *Indirect or secondary effects* – arise from the impact of activities that do not form part of the project, but are a consequence of it;
- *Cumulative effects* – result from multiple impacts or effects on a particular environmental resource or receptor, which would otherwise not occur or would be less severe
- *Short-term, medium-term or long-term effects* – refer to the temporal scale of an effect;
- *Permanent effects* – result from an irreversible change to the baseline environment or which persist for the foreseeable future;
- *Temporary effects* – persist for only a limited period or which may disappear due to natural recovery of the environment or assimilation into it;
- *Positive effects* – have a beneficial influence on environmental receptors and resources; and
- *Negative effects* – have an adverse influence on receptors or resources.

Consideration of transboundary effects are also a requirement of Schedule 4, which in the UK are considered regarding the geographical boundaries of the political and administrative institution and authorities, which provide the planning and policy context for the project (refer to section 3.2.2).

3.2.4 Mitigation, enhancement and reporting of residual effects

Schedule 4 of the EIA Regulations sets out the requirement for inclusion in the ES: 'A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases'.

Mitigation measures should be both reasonable and practicable, taking account of the following criteria:

- current best practice guidance;
- precedents set by similar projects;
- the effectiveness of different technical solutions;
- their feasibility in construction and operational terms; and
- their incremental costs.

When identifying the best possible design measures available to achieve the required mitigation within a scheme, the principles of the hierarchy of mitigation should be employed as follows (in order of preference):

- *Avoidance* – making changes to the project's design to avoid or prevent adverse effects on an environmental feature;
- *Reduction* – where avoidance is not possible, adverse effects can be reduced through sensitive environmental treatments/design;
- *Remediation* – where adverse effects are unavoidable, management measures can be introduced to limit their influence;
- *Compensation* – where avoidance or reduction measures are not available, it may be appropriate to provide compensatory measures to seek to offset the adverse effect with a comparable positive one.

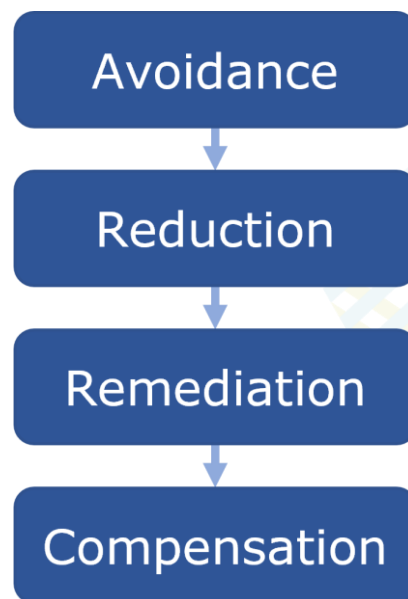


Figure 3-2: Mitigation hierarchy

Consideration to mitigation should be undertaken from the earliest possible design stage, after the baseline data has been collected, and throughout the EIA process. EIA mitigation can also therefore be characterised depending on the stage of the assessment when it is considered.

- *Embedded* – Changes made in the pre-application phase of the development, that modify the location or design of the development. This mitigation has the greatest ability to avoid impacts. They are the most effective when applied as early as possible, as it is often difficult to act on primary mitigation measures as the design begins to stabilise.
- *Secondary* – Actions that require activity to achieve a desired mitigation. These can be imposed in the ES to achieve planning consent.
- *Tertiary* – Actions that would have been undertaken regardless of the EIA process, due to other legislative requirements or standard practices. This mitigation is the least flexible – either the legislation exists to create the mitigation or does not (i.e. Protected Species Licencing).

Where positive effects can be voluntarily introduced without the requirement to mitigate an effect, this is termed 'enhancement'.

Any environmental effects that remain significant after mitigation are termed 'residual effects'. Residual effects are a convenient way of reporting the overall significance of environmental effects of a proposed scheme and would therefore be reported in the ES conclusion and non-technical summary.

3.2.5 Limitations and Assumptions

The following overarching assumptions and limitations are relevant to the ES:

- An outline construction programme was available, but a detailed construction methodology was not. As a result, temporally-reliant construction impacts in specialist chapters were based upon assumptions of the occurrence of certain aspects of works at certain times.
- At this stage, a construction contractor has not yet been appointed. Assumptions have been made regarding construction details based on experience gained on similar schemes and professional judgement. This limitation means that descriptions of construction methodologies and assessments completed in specialist chapters were based on assumptions.

Topic chapter specific limitations and assumptions are set out in in the methodology section of the relevant topic chapter.

3.3 The Environmental Statement

With reference to Regulation 17(3) of the Town & Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017/ Regulation 12(2) Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended), the ES must contain the information specified in Schedule 4/ Schedule 3 '*relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected*'. **Error! Reference source not found.** sets out the sections of the ES in which this information is addressed.

Table 3-3: Requirement of Schedule 4/ Schedule 3 and where the requirements are addressed in the ES

Paragraph No.	Requirement	Where addressed in the ES
1	A description of the development, including in particular:	Section 1.2; section 2.5

Paragraph No.	Requirement	Where addressed in the ES
	(a) A description of the location of the development; (b) A description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases; (c) A description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; (d) An estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced during the construction and operation phases.	
2	A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Section 2.4
3	A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	Section 2.3.2; & within of each topic chapter
4	A description of the factors specified in regulation 4(2) likely to be significantly affected by the development:	
	population, human health	Socioeconomics and human health topic chapter; hydrology & water quality/coastal processes topic chapter; other construction effects topic chapter
	biodiversity (for example flora and fauna)	Ecology topic chapter
	land (for example land take), soil (for example organic matter, erosion, compaction, sealing), air, material assets	Other construction effect topic chapter
	water (for example hydromorphological changes, quantity and quality)	Hydrology & Hydrogeology, and Coastal processes topic chapter
	climate (for example greenhouse gas emissions, impacts relevant to adaptation)	Other Construction Related Effects chapter and within each topic chapter.
	cultural heritage, including architectural and archaeological aspects	Cultural heritage topic chapter
	landscape	Landscape & visual effects topic chapter

Paragraph No.	Requirement	Where addressed in the ES
5	A description of the likely significant effects of the development on the environment resulting from, inter alia: (a) The construction and existence of the development, including, where relevant, demolition works; (b) The use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources; (c) The emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste; (d) The risks to human health, cultural heritage or the environment (for example due to accidents or disasters); (e) The cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources; (f) The impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change; (g) The technologies and substances used. The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term or long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project, including in particular those established under Council Directive 92/43/EEC(a) and Directive 2009/147/EC(b).	Within each topic chapter; cumulative effects topic chapter
6	A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical difficulties or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	Chapter 0 & within each topic chapter
7	A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Section 2.4 & within each topic chapter
8	A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned.* Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.	Section 2.5; other construction effects topic chapter; and within each topic chapter

Paragraph No.	Requirement	Where addressed in the ES
	<i>*Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU(c) of the European Parliament and of the Council or Council directive 2009/71/Euratom(d) or UK environmental assessments may be used for the purpose provided that the requirements of this Directive are met.</i>	<i>Not applicable.</i>
9	A non-technical summary of the information provided under paragraphs 1 to 8.	Non-technical summary
10	A reference list detailing the sources used for the description and assessments included in the environmental statement.	As footnotes throughout the ES

4 Ecology

4.1 Introduction

The approach to this assessment follows the principles set out in the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for EcIA¹³. This report has been produced following CIEEM Guidelines for Ecological Report Writing¹⁴ with reference to the British Standards Institution (BSI) BS 42020:2013 - Biodiversity: Code of Practice for Planning and Development¹⁵.

This report identifies and describes all potentially significant ecological effects associated with the proposed scheme and will also identify appropriate mitigation measures where these are required and details how these could be secured. The significance of any residual effects has also been assessed. Appropriate enhancement measures have been identified, and any post-construction monitoring required detailed.

4.2 Baseline Conditions

Phase 1 habitat maps are found in Appendix B.2, B3, and B.4.

4.2.1 Designated Sites

Statutory designated nature conservation sites

The Statutory Ecological Designations associated with the proposed scheme are shown below in Figure 4-1 and described in Table 4-1. The offshore area to the north of the proposed scheme is designated as Liverpool Bay (Bae Lerpwl) Special Protection Area (SPA). At Kinmel Bay West bordering the scheme boundary lies Kinmel Dunes, a Local Nature Reserve (LNR).

¹³ CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. [Online] Available from: <https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf>

¹⁴ CIEEM (2017) Guidelines for Ecological Report Writing. [Online] Available from: <http://www.ieem.net/ecia-guidelines-terrestrial-#:~:text=EcIA%20Guidelines%20These%20guidelines%20provide%20practical%20advice%20for,developments%20in%20terrestrial%2C%20freshwater%2C%20marine%20and%20coastal%20environments.>

¹⁵ British Standards Institution (2013) BS 42020:2013 Biodiversity - code of practice for planning and development.

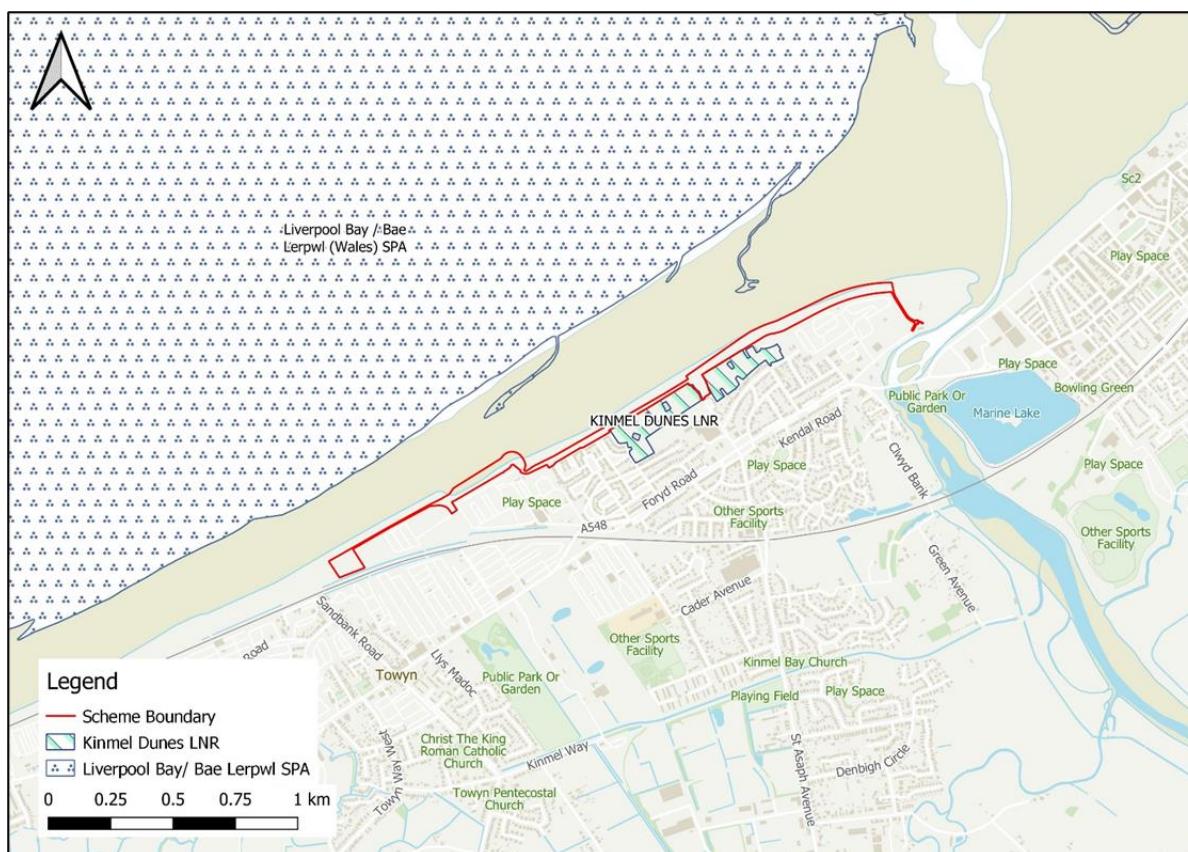


Figure 4-1: Statutory Ecological Designations.

Table 4-1: Site designations

Designation	Site Name	Area	Designated features
SPA	Liverpool Bay / Bae Lerpwl	54,145 ha	Inter-tidal sands exposed calcareous rocks, limestone reefs, mobile sands, Red Throated Divers, Common Scoters.
LNR	Kinmel Dunes	6.7 ha	The LNR is one of the last remaining areas of sand dunes.

4.3 Habitats

4.3.1 Intertidal Sand

For the most part the foreshore in front of the proposed scheme consists of clean, medium to fine sand, with no coarse sand, gravel or mud present.

Fine sand shores can support a range of species including amphipods and polychaetes, and bivalves may also be present in varying numbers on the lower shore and where sediments are more stable.

On fine sand shores such as those found in Kinmel Bay there is the potential for seasonal changes, with sediment accretion during calm periods and beach erosion during more stormy winter months. There may be a change in sediment particle size structure, with finer sediment grains washed out during winter months, leaving behind coarser sediments.

A marine biotope survey was carried out by JBA Consulting along the entire frontage of the proposed scheme. This survey identified low numbers of polychaete worms and amphipods. For the most part the areas surveyed were highly mobile and as a result supported few

macrofaunal species with large areas consistent with the biotope **LS.LSa.MoS - Barren or amphipod-dominated mobile sand shores**.

At the top of the shore a strandline with a community of talitrid amphipods has developed where decaying seaweed accumulates. The strandline is relatively small; it is possible that the local council regularly clears this strandline.

4.3.2 Intertidal Rock Habitat

In a number of places rock armour has already been placed in front of the existing sea wall. The majority of the existing rock armour is located at the upper end of the foreshore and consists of the biotope **LR.FLR.Eph.Ent Enteromorpha spp. on freshwater-influenced and/or unstable upper eulittoral rock**. The habitat is influenced by freshwater runoff and was dominated by a dense mat of *Enteromorpha* spp. No other species were recorded within this zone.

At the lower end of the beach the base of these rocks has become colonised by a number of species associated with exposed intertidal rocky conditions. The fauna present in these areas is similar to those found on sand-abraded eulittoral rock with the barnacles *Semibalanus balanoides* and *Elminius modestus*, the limpet *Patella vulgata*, the wrinkle *Littorina littorea* and Dogwhelk *Nucella lapillus* all present in the cracks and crevices beneath the boulders and a large number of Dog Whelk eggs were recorded during the survey. The Beadlet Anemone *Actinia equina* was common in a number of cracks with a few *Snakelocks Anemone Anemonia viridis* individuals also present. For the most part this habitat will be undisturbed.

The reef worm *Sabellaria alveolata* was not recorded during the surveys, however, it has been recorded to the east of the proposed scheme and there is the potential that if conditions become favourable to the species that recruitment will be rapid and there is the potential for reefs to form.

4.3.3 Rocks Above High Tide Mark

A line of rock armour, forming part of the existing coastal defences, stretches along the length of the survey area, in front of the sea wall, these rocks are above the high tide mark. In a few places lichens associated with the infra littoral zone have colonised, however, the majority of the rocks are clean.

4.3.4 Sea wall

There is an existing sea wall that extends from east to west along the majority of the site. For the most part the sea wall remains dry at high tide and does not support species associated with littoral rock.

4.3.5 Open Dune

There are pockets of open dune present in front of the existing sea wall and promenade at Kinnel Bay. The dunes in this area are mostly pioneer dunes and consist predominantly of Marram grass with some Sand Sedge being the most common. In some areas where sand accretion has slowed and the dune has become more stable other grass species are present, predominantly Red Fescue. The Kinnel Bay LNR, designated for sand dune habitats, is located immediately adjacent to the proposed scheme and proposed site compounds may encroach into these habitats.

4.3.6 Amenity Grassland

There are a number of small areas of amenity grassland along the sea front, associated with well-managed public open spaces. The areas of amenity grassland within the site are dominated by Perennial Rye-grass *Lolium perenne*.

4.3.7 Semi-improved Grassland

There are areas of semi-improved grassland within the scheme area around the Golden Sands Holiday Park, these areas of grassland are heavily managed and trampled but still support some species typical of coastal grassland.

4.3.8 Vegetated Grassland

There are isolated pockets of vegetated shingle located throughout the length of the proposed works. For the most part these areas consist of areas where shingle has accumulated against the wall during storm events and consist of plants including Sea Beet, Yellow-horned Poppy and Curled Dock. A larger area of vegetated shingle is located to the east of the sand dunes at the eastern extent of the scheme, however, this area will not be impacted upon by the proposed scheme.

4.3.9 Hardstanding

The majority of the proposed scheme site consists of the existing coastal path and associated infrastructure. This is mostly concrete and tarmacked walking areas.

4.3.10 Protected and notable species and species groups

The data search returned numerous records of protected and notable species and species groups within 2km of the proposed works location. Those of relevance to the habitats within the site are listed in Table 4-2 below. Historic records (those preceding the year 2000) have been excluded. In addition to these records there were numerous returns of common and widespread bird species as well as the bird species that are features of the Liverpool Bay SPA- Red-throated Diver, Common Scoter, Little Gull and Common Tern, and these species are all likely to be present adjacent to the site boundary. Full data search results can be provided on request.

Table 4-2: Records of protected and notable species within 2km

Common name	Scientific Name	Proximity to Site
Birds		
Starling	<i>Sturnus vulgaris</i>	Within the site
Oystercatcher	<i>Haematopus ostralegus</i>	Within the site
Curlew	<i>Numenius arquata</i>	Within the site
Cormorant	<i>Phalacrocorax carbo</i>	Within the site
Peregrine	<i>Falco peregrinus</i>	Within the site
Gannet	<i>Morus bassanus</i>	Within the site
Linnet	<i>Carduelis cannabina</i>	Within the site
Barn Owl	<i>Tyto alba</i>	380m SE
Amphibians and Reptiles		
Common Frog	<i>Rana temporaria</i>	Within 1km
Common Lizard	<i>Zootoca vivipara</i>	1km S
Great Crested Newt	<i>Triturus cristatus</i>	1.5km SE
Common Toad	<i>Bufo bufo</i>	1.4km S
Smooth Newt	<i>Lissotriton vulgaris</i>	1.5km SE

Common name	Scientific Name	Proximity to Site
Palmate Newt	<i>Lissotriton helveticus</i>	2km SE
Mammals		
Otter	<i>Lutra lutra</i>	Within the site
Hedgehog	<i>Erinaceus europaeus</i>	Within the site
Water Vole	<i>Arvicola amphibius</i>	400m E
Badger	<i>Meles meles</i>	1km S
Polecat	<i>Mustela putorius</i>	1.3km S
Weasel	<i>Mustela nivalis</i>	2km S
Invertebrates		
Grayling Butterfly	<i>Hipparchia semele</i>	200m SW
Cinnabar	<i>Tyria jacobaeae</i>	750m SE
Plants		
Sea Holly	<i>Eryngium maritimum</i>	Within the site
Marram	<i>Ammophila arenaria</i>	Within the site
Spiny Restharrow	<i>Ononis spinosa</i>	Within the site
Bluebell	<i>Hyacinthoides non-scripta</i>	1.2km SE

4.3.11 Invertebrates

The foreshore provides habitat for a range of benthic invertebrate species. A benthic invertebrate survey carried out immediately adjacent to splash point on 20th June 2018 by JBA Consulting identified low numbers of polychaete worms and amphipods. However, sediments located within the scheme footprint do not hold high value for macroinvertebrate species. A small amount of *Sabellaria alveolata* has been recorded to the east of the scheme, however, the species was not recorded within close proximity to this proposed scheme. There is the potential for it to colonise the scheme area before construction takes place. A survey will be undertaken prior to works being undertaken in the littoral zone to ensure that the species is not present.

The Small Heath butterfly has been recorded within the dunes located to the east of the scheme and has potential to support other priority invertebrate species such as Grayling, Wall and Garden Tiger, as suitable habitats and plant species are present on site.

4.3.12 Birds

Wintering Bird Species

The foreshore at Kinmel Bay provides potential foraging habitat for a range of wildfowl and wading bird species, some of which are features of the local European protected site. At high tide there is also the potential for diving or other fish-eating species to use the intertidal areas.

A wintering bird survey was carried out between September 2021 and April 2022 along the scheme length and extending to Llanddulas Beach by JBA Consulting to inform the potential constraints for the coastal defence scheme.

The foreshore was utilised predominantly by wading and gull species with a total of 32 species recorded during the survey. These were usually in low numbers and generally concentrated at the eastern extent of the study area. Peak numbers of birds were recorded on falling tides when the receding tide provided the best foraging opportunities.

Common Scoter were recorded within 200m of the existing sea wall, foraging when the area was covered by water. Small numbers of red-throated diver were mostly recorded commuting past the site or occasionally foraging approximately 500m out to sea.

A peak count of wader numbers was recorded in December where approximately 150 Oystercatcher, 20 Sanderling, 60 Dunlin, 5 Curlew and 30 Redshank were recorded over the survey area. These birds were subject to frequent disturbance from dogwalkers and were flushed into the air continually before settling on another part of the beach.

Use of the beach by large numbers of people exercising dogs or undertaking other leisure activities was recorded during the wintering bird surveys, this caused large amounts of temporary disturbance on the beach. In these events birds would be flushed from areas used for foraging or loafing but would generally fly less than 50m before re-settling.

Cormorants were recorded during these surveys on sand banks at the mouth of the River Clwyd. These were recorded again during the walkover survey.

Breeding Bird Species

The surrounding areas of introduced scrub and hedgerows provide potential nesting and foraging habitat for a range of passerine species, however, these areas will not be directly impacted upon by the proposed scheme.

4.3.13 Fish

The study area is within 10km of nursery grounds¹⁶ of the following fish species that are known to occasionally be associated with shallow (10m or less) nearshore waters¹⁷: Herring *Clupea harengus*; Cod *Gadus morhua*; Sandeel *Ammodytidae*; Plaice *Pleuronectes platessa*; Sole *Solea solea*; Whiting *Merlangius merlangus*; Spotted ray *Raja montagui*; Thornback ray *Raja clavate*; Angler fish *Lophius piscatorius*. All these species are listed under Section 41 of the NERC Act.

Furthermore, the site boundary is within 10km of spawning grounds¹⁸ of the following fish species that are known to occasionally be associated with shallow (10m or less) nearshore waters: Cod *Gadus morhua*; Mackerel *Scomber scombrus*; Sandeel *Ammodytidae*; Plaice *Pleuronectes platessa*; Sole *Solea solea*; Whiting *Merlangius merlangus*. All these species are listed under Section 41 of the NERC Act.

For the 2016 fishing season, a total of 388 Atlantic Salmon *Salmo salar* and 609 sea trout were caught from the Dee catchment, and 12 Atlantic salmon and 777 sea trout from the Clywd catchment¹⁹; these species are listed under Section 41 of the NERC Act. Being diadromous and spending a proportion of their lives migrating through coastal waters between marine and freshwater environments, it is likely that individuals (adults migrating into freshwater and juvenile smolts migrating to sea) pass close to the site boundary during migration periods.

European eel *Anguilla anguilla* have been recorded in fish surveys undertaken since 2010 in tributaries of the Mersey, Dee, Clywd, Elwy and Conwy²⁰. This species is listed under Section 41 of the NERC Act. Being diadromous and spending a proportion of their lives migrating through coastal waters between marine and freshwater environments, it is likely that individuals (adults migrating to sea and juvenile migrating into freshwater) pass close to the site boundary during migration periods.

¹⁶ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas, Lowestoft, 147: 56 pp.

¹⁷ Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N., and Brown, M., (2010a) Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones).

¹⁸ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas, Lowestoft, 147: 56 pp.

¹⁹ Environment Agency. 2017. Salmonid and Freshwater Fisheries Statistics for England and Wales, 2016 [online] Available at: <https://www.gov.uk/government/publications/salmonid-and-freshwater-fisheries-statistics> (Accessed 29th Sept 2018).

²⁰ From Natural Resources Wales information. <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Brook Lamprey *Lampetra planeri* and Sea Lamprey *Petromyzon marinus* have been recorded in fish surveys undertaken since 2010 in tributaries of the Clywd, Dee and Elwy²¹. Both species are listed under Section 41 of the NERC Act. As Sea Lamprey are anadromous, with adults spending a proportion of their life at sea parasitically feeding on other estuarine and marine fish species, it is possible that individuals may pass close to the site boundary²².

Liverpool Bay supports various fish species of commercial importance including Clupeidae species such as herring *Clupea harengus* and sprat *Spratus spratus* which are known to have nursery grounds in the bay; other species such as plaice *Pleuronectes platessa* and sole *Solea solea* also use the bay for spawning and as a nursery area²³. Herring and sprat are amongst the most frequently recorded prey species of red-throated divers which is one of the primary reasons for the SPA designation, although this species is also considered to be an opportunistic feeder and can also feed on a broad range of fish species²⁴.

4.3.14 Otter

Otter has been recorded within close proximity to the study area (see Table 4-3) and the River Clwyd is considered to provide suitable foraging and resting habitats for Otter. Otter may also venture out into the coastal waters around Kinmel Bay. There is the potential for Otter to use the intertidal area for foraging, however, the existing sea walls and revetments within the study area did not provide suitable sites for holts or laying up.

4.3.15 Reptiles and amphibians

Although the desk study returned numerous reptile and amphibian records within 1km of the site, the habitats surveyed were considered unsuitable for these species. The terrestrial habitats are considered unsuitable for Great Crested Newt.

Kinmel Bay LNR supports a small population of Common Lizard and the dune habitats to the east of the site also provide habitat for reptile species.

4.3.16 Marine mammals

No records for marine mammals were returned in the desk study, however it is likely that common species of marine mammal will use the coastal waters adjacent to the works area as well as the wider area of Liverpool Bay. There is anecdotal evidence of Grey and Common Seal occasionally hauling out at the eastern end of the scheme.

4.4 Future Baseline

A number of coastal habitats in this area are already under pressure and are likely to be lost without further intervention. This includes the pockets of sand dune and vegetated shingle that exist up against the existing flood defences. As sea levels rise it is likely that these habitats will be squeezed up against the existing flood defences and infrastructure and lost.

Littoral sediments will also be impacted as sea levels rise and changes in benthic community structure will occur as the levels of tidal inundation change. Rock, including existing rock armour will become inundated for longer during the tidal cycle and there is the potential for this to become further colonised by intertidal species.

4.4.1 Evaluation

²¹ From Natural Resources Wales information. <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

²² Maitland PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

²³ Natural England, Countryside Council for Wales. 2012. Liverpool Bay SPA Conservation Advice Package. [Online] Available at: <http://publications.naturalengland.org.uk/publication/3236717>. (Accessed 5th January 2016).

²⁴ Guse, N., Garthe, S. & Schirmeister, B. 2009. Diet of red-throated divers *Gavia stellata* reflects the seasonal availability of Atlantic herring *Clupea harengus* in the southwestern 34 Baltic sea. Journal of Sea Research, 62: 268-275.

This section evaluates the nature conservation importance of the area of the works and its locality in terms of its relative importance in a geographical context.

The nature conservation sites, habitats and species that have been identified as important ecological features have been evaluated based on the criteria given in the following tables. The importance of the feature is defined with reference to the geographical context.

Table 4-3: Evaluation of nature conservation importance

Ecological Feature	Evaluation rationale	Importance of feature of importance of site to feature
Liverpool Bay / Bae Lerpwl SPA	Qualifying features: Inter-tidal sands exposed calcareous rocks, limestone reefs, mobile sands, Red Throated Divers, Common Scoters.	International
Kinmel Dunes LNR	Designated due to being one of the last remaining areas of sand dunes in the area.	National
Intertidal Habitats	Intertidal sand habitats and intertidal rock habitats have the potential to support a number of marine invertebrates.	National
Vegetated Shingle	There are isolated pockets of vegetated shingle located throughout the length of the proposed works.	National
Open Dune Habitat	There are pockets of open dune present in front of the existing sea wall and promenade at Kinmel Bay . The Kinmel Bay LNR, designated for sand dune habitats, is located immediately adjacent to the proposed scheme and proposed site compounds may encroach into these habitats.	National
Coastal Grassland	There are areas of semi-improved grassland within the scheme area around the Golden Sands Holiday Park, these areas of grassland are heavily managed and trampled but still support some species typical of coastal grassland.	Regional
Wintering Birds	The foreshore at Kinmel Bay provides potential foraging habitat for a range of wildfowl and wading bird species, some of which are features of the local European protected sites.	International
Fish	The study area is within 10km of nursery grounds of the following fish species that are known to occasionally be associated with shallow (10m or less) nearshore waters ²⁵ :	National
Reptiles	Kinmel Bay LNR supports a small population of Common Lizard and the dune habitats to the east of the site also provide habitat for several reptile species.	National
Otter	Otter have been recorded within close proximity to the study area and the River Clwyd is considered to provide suitable foraging and resting habitats for Otter. Otter may also venture out into the coastal waters around Kinmel Bay.	National
Marine Mammals	All dolphin, porpoise and whale species are protected under Conservation of Habitats and Species Regulations 2010 (as amended) and the Wildlife and Countryside Act 1981 (as amended). All Seals found in the UK also receive protection under the Wildlife and Countryside Act 1981 (as amended).	International
Marine Invertebrates	The foreshore provides habitat for a range of benthic invertebrate species.	Regional

²⁵ Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N., and Brown, M., (2010a) Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones).

4.5 Assessment Methodology & Assessment Criteria

This Ecological Impact Assessment has considered the following ecological features that may be impacted by the proposed scheme:

- Statutory designated sites for nature conservation;
- Non-statutory designated sites for nature conservation;
- Species and habitats of principal importance for nature conservation;
- Habitats & species of principal importance for the conservation of biodiversity designated under the NERC Act (2006)
- Invasive non-native species.

4.5.1 Desk-Based Assessment

A desk-based study was undertaken to collate information on statutory and non-statutory conservation sites and records of species that are afforded legal protection or are otherwise of nature conservation importance. Ecological records were requested from Cofnod, North Wales Environmental Service. This included ecological species records and local nature conservation sites within 1km of the site boundary. In addition, the MAGIC database was searched for European designated sites (SACs and SPAs) and internationally designated Ramsar sites as well as nationally statutory designated sites including SSSIs, National Nature Reserves (NNRs) and Local Nature Reserves (LNRs) within 2km of the site boundary.

4.5.2 Field Surveys

The following field surveys have been undertaken at the site:

- Phase 1 Habitat Survey
- Assessment of the site's potential to support protected and notable species
- Intertidal Biotope Survey
- Over-Wintering Bird Surveys

4.5.3 Method of Assessment

The assessment of ecological impacts has been undertaken following current best practice provided by the Chartered Institute of Ecology and Environmental Management²⁶.

This assessment identifies the potential effects of the proposed works on biodiversity within each of the site boundaries and their wider zone of influence. It determines the significance of the identified effects of the construction and operational phases at each site.

Ecological features include nature conservation sites, habitats, species assemblages/communities or populations or groups of species. The assessment of the significance of predicted impacts on ecological features is based on both the 'importance' of a feature and the nature and magnitude of the impact that the project will have on it. Impacts may be direct (e.g. the loss of species or habitats), or indirect (e.g. effects due to noise, dust or disturbance).

The impact assessment process involves:

- Identifying and characterising impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts;
- Assessing the significance of any residual effects after mitigation;
- Identifying appropriate compensation measures to offset residual effects; and

²⁶ CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. [Online] Available from: <https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf>

- Identifying opportunities for ecological enhancement

The assessment includes potential impacts (direct, indirect, secondary and cumulative) on each ecological feature determined as important from all phases of the project and describes in detail the impacts that are likely to be significant, referring to the following characteristics:

- Positive or negative
- Extent
- Magnitude
- Duration
- Timing
- Frequency
- Reversibility

4.5.4 Important Ecological Features

It is impractical for an assessment of the ecological impacts of a project to consider every ecological feature (species, habitat etc.) that may be affected; instead it should focus on those that are important. These are ecological features that are valued in some way and could be affected by the proposed project; other valued ecological features may occur on or in the vicinity of the proposed works area but do not need to be considered because there is no potential for them to be affected significantly.

Various characteristics contribute towards the importance of ecological features, for example, naturalness, rarity, diversity, and connectivity.

The importance of an ecological feature should be considered within a defined geographical context. For the purposes of this assessment the following frame of reference has been used:

- International
- National
- Regional
- Local (i.e. the sites and their vicinities)

Consideration of impacts at all scales is important, and essential if objectives and maintenance of healthy ecosystems are to be achieved.

Ecological features on sites have been valued within the geographical context.

4.5.5 Legally protected species

Notwithstanding what has been said above, there is also a need to identify all legally protected species that could be affected by the proposed works. Therefore, it is inappropriate to assess the significance of impacts within the context of species' legal protection, as impacts on such species have to avoid contravention of the law, otherwise the scheme cannot go ahead.

4.5.6 Determining ecological significant effects

For the purposes of this assessment, a significant effect is an effect that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general²⁷. Effects can be considered significant at a wide range of scales from international to local.

Significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance

²⁷ CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. [Online] Available from: <https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf>

and distribution). Table 4-4 details the factors that have been considered in the determination of significant effects on ecological features.

Table 4-4: Determining ecologically significant effects

Ecological Feature	Consideration
Designated sites	Will the project undermine the site's conservation objectives? Will the project positively or negatively affect the conservation status of habitats or species for which the site is designated? Will the project have positive or negative effects on the condition of the site or its interest/qualifying features? Will the project remove or change any key characteristics? Will there be an effect on the nature, extent, structure and function of component habitats? Will there be an effect on the average population size and viability of component species? Will there be an impact on wider ecosystem functions and processes?
Habitats	Will the project positively or negatively affect the conservation status of the habitat? Will it affect its extent, structure and function as well as its distribution and its typical species within a given geographical area?
Species	Will the project positively or negatively affect the conservation status of the species? Will it affect its abundance and distribution within a given geographical area?

4.5.7 Residual Impacts

Where impacts are identified, mitigation measures are proposed to avoid, reduce or minimise them. Those impacts remaining after implementation of mitigation are the residual impacts. An assessment of the residual impacts has then been undertaken to determine the significance of their effects on ecological features.

4.5.8 Precautionary principle

The evaluation of significant effects has been based on current scientific evidence and professional judgement. Where sufficient information is not available to allow a robustly justifiable conclusion of no significant effect, a significant effect is assumed, and any uncertainty is acknowledged.

4.5.9 Nature conservation evaluation

The section evaluates the nature conservation importance of each site in terms of its relative importance in a geographical context.

The nature conservation sites, habitats and species that have been identified as important ecological features have been evaluated based on the criteria given in Table 4-4. The importance of the feature is defined with reference to the geographical context of the site i.e. the specific importance of each site to each of the habitats or species populations identified as being present within it or making use of it.

4.5.10 Cumulative effects

A search of the Local Planning Authorities online planning portals was checked for any relevant plans or projects with the potential to act in-combination with the present proposals to increase the impact on the site's biodiversity. Particular attention is given to other coastal defence schemes along this section of coastline as the impacts of these are likely to be similar, and therefore have a high potential to act cumulatively with the proposed project.

4.5.11 Limitations and Assumptions

Desk-based assessment

Data from biological records centres or online databases is historical information, and datasets might be incomplete, inaccurate or missing. It is important to note that even where data is held, a lack of records for a defined geographical area does not necessarily mean that the species is absent; the area may simply be under-recorded. As such, records cannot be relied on and serve only as an indication of what might/ might not be found.

Ecological site surveys

The habitats and species present in a given area are subject to change over time. A single field visit of this nature captures and reports the situation at the time of survey. As such, the advice contained within this report is considered valid for a period of 18 months before a review on the need for an updated survey/assessment must be made by an ecologist.

Site surveys were subject to differing tidal states. However, all sites were visited at low tide for at least one of the site visits to assess the intertidal habitats present within the works footprints.

No further surveys such as any species-specific surveys have been undertaken to inform this assessment. For the purpose of this impact assessment, a precautionary approach has been taken when assessing the importance of an ecological feature on site when there is limited information available. For the majority of ecological features, no further survey work was considered necessary. Where there is no information about the populations of the ecological feature itself at a site, the likely importance of the habitat to protected species has been identified and mitigation has been designed appropriately.

4.6 Potential Impacts & Significant Effects

4.6.1 Statutory designated nature conservation sites

Liverpool Bay SPA

Liverpool Bay SPA is situated 0.5km to the north the proposed works. The works footprint and access do not fall within the boundary of the SPA, however, the potential for impacts on features of the SPA have also been considered. The Habitat Regulations Assessment concluded that the only means of likely significant effect to the SPA is through release of harmful chemicals from machinery or works during construction. During Appropriate Assessment this pathway has been mitigated through the use of pollution prevention measures which will result in no significant effect on the site integrity of Liverpool Bay SPA. The HRA can be found in Appendix B.6.

Kinmel Dunes LNR

The works are located within close proximity to the Kinmel Bay Dunes LNR and site compounds will be located in the car park adjacent to the reserve with a small encroachment into the reserve. This will impact on a small area of sand dune and dune scrub (approximately 250m², equating to <1% of total LNR area). The compound areas have the potential to further impact the LNR if materials or chemicals are allowed to encroach into the LNR.

4.6.2 Intertidal Habitats

The works will result in the direct impact to 4,500m² of intertidal habitats. For the most part this will consist of renewing artificial rock, however, the scheme will result in the direct loss of approximately 3ha of littoral sediment which will be replaced by the rock revetment. The

sediments in this area consist predominantly of coarse sand, these freely-draining sediments usually lack a macrofaunal community due to their continual mobility.

There is also the potential to negatively impact intertidal and subtidal habitats through pollution incidents negatively impacting water quality. Therefore, appropriate environmental management measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and the release of contaminants from the construction site. These measures will be recorded in the outline CEMP and agreed with the local planning authority and NRW prior to works taking place. Plant movement in the intertidal area also has the potential to negatively impact intertidal habitats through compaction of the foreshore.

4.6.3 Terrestrial Habitats

There will be short-term, temporary losses of amenity grassland habitats during construction. The works will directly impact a small area of open dune habitat within the Kinmel Bay LNR. For the most part this will be temporary, however, the scheme will result in the permanent loss of approximately 1000m² of open dune habitat.

4.6.4 Birds

The foreshore at Kinmel provides potential foraging habitat for a range of wildfowl and wading bird species, some of which are features of the local European protected sites. At high tide there is also the potential for diving or other fish-eating species to utilise the intertidal areas. However, given that the works will likely be carried out at low tide, it is considered that there is ample alternative foraging and loafing habitat available nearby.

The works will not directly impact habitats at Pensarn that have been identified as suitable for ground nesting species such as Ringed Plover.

4.6.5 Otter

There is potential for Otter to use the River Clwyd and potentially into the estuary and surrounding coast. However, it is considered unlikely that works will have any impact on Otter holts or resting sites, as no suitable sites were identified in the survey.

4.6.6 Reptiles

Kinmel Bay LNR supports a small population of Common Lizard and the dune habitats to the east of the site also provide habitat for several reptile species

Impacts to this species include direct harm and temporary, short-term loss of terrestrial habitats during construction activities.

4.6.7 Invertebrates

The foreshore provides habitat for a range of benthic invertebrate species. However, sediments located within the scheme footprint do not hold high value for macroinvertebrate species and the loss of this area will not have a significant impact upon macroinvertebrate assemblages.

There is the potential to negatively impact macroinvertebrate assemblages through pollution incidents. Plant movement in the intertidal area also has the potential to negatively impact intertidal habitats through compaction of the foreshore.

A small amount of *Sabellaria alveolata* has been recorded to outside of the scheme area, however, the species was not recorded within Kinmel Bay. There is the potential for it to colonise the scheme area before construction takes place.

4.6.8 Fish

It is likely that the works will result in a small amount of intertidal habitat becoming inaccessible to fish at high tide, the impact of this would be localised to the site extent and therefore negligible.

There is the potential for a scheme to impact upon fish species during the construction phase. Fine sediment mobilisation has the potential to impact upon on fish species as a result of reduced foraging efficiency of visual predators and cause minor gill irritation.

The works will be carried out at low tide in the dry and therefore the proposals should not cause any noise or vibration impacts to the marine environment.

4.6.9 Marine Mammals

It is likely that a limited number of marine mammal species such as Grey and Common Seal and Harbour Porpoise commute or forage infrequently in the sea near the proposed works area. Although the intertidal habitat has the potential to be utilised by seals for hauling out and basking, this is considered unlikely due to the highly disturbed nature of the area arising from its popularity as a tourist beach.

The works will not require the use of barges to deliver materials and all deliveries will be made via road, therefore, impacts from the works are therefore likely to be restricted to temporary noise disturbance to a few foraging and commuting individuals.

4.6.10 Cumulative effects

Table 4-5: Potential cumulative impacts from other development

Planning/ Marine Licence Reference	Description	Location	Potential for cumulative effects	Significance
Planning application not yet submitted.	Awel y Môr Offshore Wind Farm	Off the coast of Rhyl, DENBIGHSHIRE	Due to the timing, there should be no in-combination effects as the works relating to Central Prestatyn are not due to commence until March 2022.	Not significant

4.7 Mitigation Measures

4.7.1 Statutory designated nature conservation sites

Liverpool Bay SPA

Mitigation

The works should not have significant impact upon the Liverpool Bay SPA due to the small scale of works on the beach. However, the following mitigation measures are incorporated into the HRA found in Appendix B.6:

Pollution prevention measures

Abiding by relevant pollution prevention measures e.g. CIRIA Guidance: Control of water pollution from construction sites, Guidance for consultants and contractors (C532D)²⁸. Information useful for Toolbox Talks on working near water and pollution prevention can be

²⁸ CIRIA (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532). [Online] Available from: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C532&Category=BOOK#:~:text=Guidance%20for%20consultants%20and%20contractors%20%28C532%29%20This%20document,and%20the%20effective%20methods%20of%20preventing%20its%20occurrence.

found on the CIRIA website. Preventing accidental oil and fuel leaks can be achieved by the following actions:

- Any chemical, fuel and oil stores should be located on impervious bases within a secured bund with a storage capacity 110% of the stored volume.
- Biodegradable oils and fuels should be used where possible.
- Drip trays should be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery should be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m).
- Emergency spill kits should be available on site and staff trained in their use.
- Operators should check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages should be reported immediately; and
- Daily checks should be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective should be removed from site immediately or positioned in a place of safety until such time that it can be removed.
- Environmentally sensitive products should be used where possible.

4.7.2 Non-statutory designated nature conservation sites

Mitigation

The area impacted will be limited to as small a footprint as possible. Should it be necessary to remove sand this should be stored in situ and replaced as soon following the completion of the works. Site compounds adjacent to the LNR will be set up on hardstanding with appropriate pollution prevention measures in place to avoid indirect impacts upon the LNR. The limits of the site compound will be clearly demarked, and all workers will be briefed.

Enhancements

Habitat management will be carried out across the LNR to improve the condition of the sand dune habitat. In particular, interventions will be carried out in the areas of scrub in order to provide more structural diversity to encourage an increased diversity of plants and invertebrates to colonise.

Scrub management was identified as an opportunity for improving the condition of habitats present at Kinmel Bay LNR as there are currently extensive dense stands of Gorse and Bramble scrub as well as the INNS Red Valerian.

Finally, any areas of Sea Buckthorn will be removed as it is considered non-native in North Wales. It has been locally introduced and can rapidly invade and dominate dune habitats, reducing the value of the habitat to biodiversity through suppressing ground flora, and reducing invertebrates and bird diversity.

All management tasks will be agreed with Denbighshire County Council Ecologists prior to being carried out and will be supervised by the ECoW

4.7.3 Coastal Habitats

Mitigation

Appropriate environmental management measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and the release of contaminants from the construction site. These measures will be recorded in a detailed CEMP and agreed with the local planning authority and NRW prior to works taking place.

To minimise disturbance and habitat degradation, plant will keep to agreed haul routes and not stray outside of these areas. It is considered that in this case, the haul routes will rapidly recover following the completion of the works.

Enhancements

The scheme has the potential to result in the small-scale loss of intertidal habitats close to the existing sea wall, both through direct loss and future coastal squeeze. Whilst this is not considered to be a significant impact, intertidal habitats are a priority habitat and compensatory and enhancement measures are built into the scheme.

Ecological enhancements will be added in the form adding texture to the boulders within the intertidal zone. These indentations will create niches and ecological opportunities for colonisation by intertidal species. These enhancements will be located on 10% of surface rocks within the proposed revetment at Towyn below the MHWS.

Attention needs to be given to the placement of modified boulders, so they are suitably positioned to be inundated during each tidal cycle and should be agreed with the ECoW.

4.7.4 Terrestrial Habitats

Mitigation

The loss of amenity grassland, pockets of vegetated shingle and small pockets of sand dune habitat will be compensated through coastal grassland creation and contribution to the management objectives of the Kinmel Bay LNR detailed above.

Enhancements

Landscaped amenity areas will be planted with a suitable grass and wildflower mix that represents the surrounding coastal grassland. The mix of species recommended for the grassland enhancement can be found in Appendix B.5. Site enhancements for protected and priority species

The proposed enhancements that form part of the scheme, will provide overall gains to the following protected and priority species:

- Birds - through seeding a species diverse grass and wildflower mix along the new coastal embankment in order to encourage invertebrates and reptiles, which will provide new foraging habitat for birds.
- Reptiles - through seeding a species diverse grass and wildflower in the landscaped amenity areas, which will encourage invertebrates, and also through conducting controlled scrub clearance of the dense areas of Gorse and Bramble scrub at Kinmel Bay LNR will improve the habitat mosaic for reptiles.
- Priority invertebrate species - The coastal grassland planting will provide linked corridors throughout the length of the scheme for a range of pollinator species such as bumblebees.

4.8 Construction phase mitigation and additional enhancement measures

The following sections include specific mitigation required for species on site during the construction phase. Where additional enhancement measures will be incorporated into the project, these are also given below.

4.8.1 Invertebrates

Mitigation

A small amount of *Sabellaria alveolata* has been recorded to the east of the scheme, however, the species was not recorded within Kinmel Bay. Given the ephemeral nature of the species there is the potential for it to colonise the scheme area before construction takes place. A

survey will be undertaken prior to works being undertaken in the littoral zone to ensure that the species is not present.

As detailed above appropriate pollution prevention measures will be put in place to avoid impacts upon benthic invertebrate species. Haul roads within the intertidal areas will be agreed in advance and adhered to in order to avoid the compaction of a larger area of the foreshore.

4.8.2 Birds

Mitigation

Vegetation removal for the scheme will be minimal and it is considered unlikely that there will be impacts to nesting birds. Areas that have been identified as important for nesting Ringed Plover will not be directly impacted upon by the proposed works. The works will not require the removal of trees suitable for nesting birds, however, should it become necessary to remove small sections of scrub for access, all vegetation clearance will be undertaken outside of the main breeding season (typically between September and end February). If this is not possible, all vegetation clearance will be supervised by an experienced ecologist. Any identified nests will be safeguarded until the chicks have fledged to ensure there are no direct impacts upon nesting birds.

Enhancement

To further encourage nesting birds, including ground nesters, away from the construction footprint, areas of scrub and rough grassland will be maintained and/or created outside of the construction footprint.

A plan for signage and roped off areas at Pensarn will be developed with the local ranger to protect the area for nesting Ringed Plover.

4.8.3 Reptiles

Mitigation

The works will not result in the permanent removal of habitats suitable for reptiles. For the most part the works are unlikely to impact upon habitats suitable for reptiles. However, where works cannot avoid suitable reptile habitat (i.e. dunes, ecotones, rough grassland), vegetation clearance will be conducted in a sensitive manner to avoid direct harm to reptiles. Two-staged vegetation clearance will be conducted under watching brief by an Ecologist between September – October to fit between the bird breeding season and prior to reptile hibernation.

All contracted site workers will be made aware of how to identify Common Lizard, the legal protection afforded to this species and the following actions including what to do if Common Lizard or other reptiles are found.

Should large numbers of reptiles be found during site clearance works, works are to be stopped immediately and working methods evaluated and adjusted as necessary to prevent further impacts to reptiles.

4.8.4 Fish

Mitigation

There is the potential for a scheme to impact upon fish species during the construction phase. Fine sediment mobilisation has the potential to impact upon fish species as a result of reduced foraging efficiency of visual predators and cause minor gill irritation.

The works will be carried out at low tide in the dry and therefore the proposals should not cause any noise or vibration impacts to the marine environment.

4.8.5 Marine Mammals

Mitigation

All works will be undertaken in the dry and a 'soft start' to works should be carried out each day as this will move seals and cetaceans away from the area.

4.8.6 Invasive Non-Native Species (INNS)

No INNS were identified within the works footprint, however, a biosecurity management plan will be required to ensure that no species introduced the works area. Measures will need to be put in place to ensure that there is no spread of invasive non-native species or diseases. The Check-Clean-Dry approach should be followed, ensuring that all PPE and equipment is cleaned before leaving site²⁹. These measures should be recorded in the Environmental Management Plan.

4.9 Impact summary

²⁹ Non-native Species Secretariat (2022) Check Clean Dry. [Online] Available from: <https://www.nonnativespecies.org/what-can-i-do/check-clean-dry/>

Table 4-6: Summary of residual impacts

Ecological Feature	Identified Impact	Effect without mitigation	Mitigation	Enhancement Measure	Residual Impact
Liverpool Bay SPA	Indirect damage through pollution event.	Significant negative effect	Appropriate pollution prevention measures will be put in place		No significant effect
Kinmel Bay LNR	Removal of sand dune habitat	Permanent degradation of the protected site	Clearance will be undertaken using a 2-staged method between September - October, as described in section 5.	Habitat management will be carried out across the LNR, following construction, in order to improve the condition of habitats present. In particular, interventions will be carried out in the areas of scrub in order to provide more structural diversity to encourage an increased diversity of plants and invertebrates to colonise.	No significant effect. Medium term net gain in habitat quality.
On site habitats (coastal)	Pollution of coastal habitats (construction)	Significant negative effect.	Pollution prevention measures following the latest CIRIA guidance will be implemented through the CEMP.	None.	No significant effect.
	Loss of intertidal habitat (priority habitat) during construction	Significant negative effect.	Compensation through habitat improvement on the sea wall.	Enhancement suggested in Section 4 for improving the diversity of microhabitats on the sea wall should be incorporated.	No significant effect.
	Removal of amenity grassland	Temporary loss of habitat.		New areas of coastal grassland will be created will be created using a suitable coastal grassland mix.	No significant effect.
Birds	Potential destruction of nests (construction)	Significant negative effect.	Avoidance of main nesting bird season for vegetation clearance or pre-works nesting bird checks if required. All identified nests will		No significant effect.

Ecological Feature	Identified Impact	Effect without mitigation	Mitigation	Enhancement Measure	Residual Impact
			be safeguarded until the chicks have fledged.		
Reptiles (Common Lizard)	Killing, injuring and disturbance (construction)	Significant negative effect.	Displacement of Common Lizard away from the construction area through appropriately timed vegetation clearance works conducted outside of the main autumn and winter period using 2-staged clearance method.		No significant effect.
Intertidal Invertebrates	Killing, injuring and disturbance	Small negative effect	A survey will be undertaken prior to works being undertaken in the littoral zone to ensure that <i>Sabellaria</i> is not present. Pollution prevention measures will be put in place to avoid impacts upon benthic invertebrate species. Haul roads within the intertidal areas will be agreed in advance and adhered to in order to avoid the compaction of a larger area of the foreshore.		No significant effect.
Fish	Killing, injuring and disturbance	Small negative effect	The works will be carried out at low tide in the dry and therefore the proposals should not cause any noise or vibration impacts to the marine environment.		No significant effect.
Marine Mammals	Disturbance (construction)	Significant negative effect.	All works will be undertaken in the dry and a 'soft start' to works should be carried out each day as this will move seals and cetaceans away from the area.		None.

4.10 Conclusions

It is considered that the mitigation and avoidance measures, as outlined in Section 5 of this report will ensure that any potential impacts are minimised to an acceptable level. A CEMP will ensure that these measures are implemented on site during construction works. There will be no direct impact upon the Liverpool Bay SPA and following the mitigation measures outlined in the HRA there will be no significant impact upon any statutory designated nature conservation sites.

The works will result in the direct loss of a small amount of intertidal sediments and a temporary impact upon associated species, whilst it is not possible to recreate this habitat like for like it is considered that the proposed habitat creation work on site and at the adjacent SSSI and LNR is expected to benefit biodiversity, as well as additional priority species including invertebrates and plants.

5 Landscape and Visual

5.1 Introduction

This chapter defines the existing landscape/townscape/seascape and visual baseline environments; assesses their sensitivity to change; describes the key landscape and visual related aspects of the proposed scheme; describes the nature of the anticipated change upon both the landscape and visual environments; assesses the effects during construction; the period following completion prior to the maturing of mitigation planting (short- to medium-term) and once the mitigation planting is mature (long-term) (the 'operational phase').

It is accepted practice within landscape and visual assessment work that the extent of the study area for a development proposal is broadly defined by the visual envelope of the proposed scheme and the anticipated extent of visibility arising from the scheme itself, based on the Zone of Theoretical Visibility (ZTV) study. In this case a study area of 2km has been agreed with the planning authority as being appropriate to cover all potentially material landscape and visual impacts.

All figures associated with this chapter are located in Appendix C Landscape and Visual.

5.2 Legislative and Planning Policy Context

5.2.1 National Planning Policy

Relevant national planning policy is set out in 'Planning Policy Wales (February 2021)' (NPP). The NPP makes clear that the purpose of planning is to help achieve sustainable development (Section 1), and that design (Section 2) and effects on the natural environment (Section 6) are important components of this.

Paragraph 1.22 sets out that in determining applications for development this means that developments which accord with an up-to-date development plan should be approved. Section 2 sets out considerations in 'People and Places: Achieving Well-being Through Placemaking' and notes in paragraph 3.10 that:

'In areas recognised for their particular landscape, townscape, cultural or historic character and value it can be appropriate to seek to promote or reinforce local distinctiveness. In those areas, the impact of development on the existing character, the scale and siting of new development, and the use of appropriate building materials (including where possible sustainably produced materials from local sources), will be particularly important.'

With respect to historic environment Section 6 'Distinctive & Natural Places' paragraph 6.1.17 notes that:

'Conservation area designation introduces control over the total or substantial demolition of unlisted buildings within these areas, but partial demolition does not require conservation area consent. Procedures are essentially the same as for listed building consent. When considering an application for conservation area consent, account should be taken of the wider effects of demolition on the building's surroundings and on the architectural, archaeological or historic interest of the conservation area as a whole. Consideration should also be given to replacement structures. Proposals should be tested against conservation area appraisals, where they are available.'

On landscape Section 6 paragraph 6.3.4 states that:

'Where adverse effects on landscape character cannot be avoided, it will be necessary to refuse planning permission'.

In relation to coastal development Section 6 paragraph 6.5.20 states that:

'In considering new coastal defence works, account should be taken of all potential environmental effects, both on and off-shore, including the impacts on habitat fragmentation and consequential 'coastal squeeze', as well as information contained in Shoreline Management Plans and other relevant documents such as Area Statements.'

5.2.2 Local Planning Policy

The site lies within Conwy County Borough Council (CCBC). Current local planning policy is described in the Conwy Local Development Plan 2007-2022 (Adopted October 2013).

Denbighshire County Council is also partially located within the study area. Policy for this district is only relevant to this assessment insofar as it identifies locally valued landscapes and their purposes of designation. The Denbighshire County Council Local Development Plan 2006-2021 (June 2013) has been reviewed.

5.2.3 Conwy Local Development Plan 2013

Policies of relevance to this LVIA are outlined below.

Strategic Policy DP/1 – Sustainable Development Principles states that 'Development proposals should, where appropriate:

- "... d) Be designed to a high standard, being attractive, adaptable, accessible, safe and secure as set out in Policy DP/3; ...*
- f) Conserve or enhance the quality of valued open spaces, the character and quality of local landscapes and the wider countryside in line with Strategic Policies NTE/1 and CFS/1 - 'Community Facilities and Services'; ..."*

The effects of the proposed scheme on local landscapes is considered in Section 5.4 of this Chapter.

Strategic Policy TOU/1 – Sustainable Tourism states that development will be supported where it is *"improving connectivity by supporting delivery of... improvements to the Wales Coastal Path and Public Rights of Way Improvement Plan..."*, enhancing and protecting these existing assets – allowing safe public access and promoting tourism into the area.

The effects of the proposed scheme on users of the Wales Coast Path and Public Rights of Way (PRoW) are considered in Section 5.4 of this Chapter.

Strategic Policy TOU/2 – New Sustainable Tourism and Recreational Development states that provided that criteria are met, including:

- "j) The proposal would not appear obtrusive in the landscape and is accompanied by a detailed landscaping scheme and, where appropriate, a Landscape and Visual Impact Assessment"*

The effects of the proposed scheme on local landscapes are considered in section 5.4 of this Chapter.

Strategic Policy NTE/1 – The Natural Environment states that development will be supported where it protects the existing environment by:

- "a) Safeguarding the Plan Area's biodiversity, geology, habitats, history and landscapes through the protection and enhancement of sites of international, national, regional and local importance, in line with Policy DP/6 – National Planning Policy and Guidance'; ...*
- c) Where appropriate and necessary, improving the quality of statutory and non-statutory landscapes and areas of biodiversity value affected by development, through management agreements, habitat connectivity, improved planting, landscape and maintenance specifications, in line with the Development Principle Policies and Policy NTE/3 – 'Biodiversity'; ...*

f) Respecting, retaining or enhancing the local character and distinctiveness of the individual Special Landscape Areas in line with Policy NTE/4 – 'The Landscape and Protecting Special Landscape Areas' and as shown on the Proposals Map;

g) Protecting the Coastal Zone in line with Policy NTE/5 – 'The Coastal Zone'; ..."

The effects of the proposed scheme on local landscapes are considered in section 5.4 of this Chapter.

Strategic Policy NTE/4 – The Landscape and Protecting Special Landscape Areas (SLAs) states that SLAs need to be conserved. However, there are no SLAs located within the study area for the proposed scheme.

Strategic Policy NTE/5 – The Coastal Zone states that development in the Coastal Zone will only be permitted where it:

- "a) Specifically requires a coastal location;*
- b) Does not adversely affect the open character of the zone;*
- c) Does not adversely affect the nature conservation value of the zone with any effects identified mitigated for;*
- d) Does not detract from the tourism value or facilities;*
- e) Does not interfere with natural coastal processes;*
- f) Does not impede the function of any existing coastal defence structures;*
- g) Accords with the Development Principles of the Plan"*

The policy description continues: *"A high proportion of Conwy's coastline is protected from flood risk although breaching from the sea is a continual risk..."*.

The effects of the proposed scheme on local landscapes are considered in Section 5.4 of this Chapter.

5.3 Baseline Conditions

An overview of the baseline study results is provided in this Section with the full baseline description of the individual landscape and visual receptors being provided alongside the assessment in Section 5.4 for ease of reference.

This Section provides a review of the key local guidance documents and identifies those landscape and visual receptors which merit detailed consideration in the assessment of effects, and those which are not taken forward for further assessment as effects *"have been judged unlikely to occur or so insignificant that it is not essential to consider them further"* ³⁰.

Both this Section and the Section 5.4 describe landscape/seascape/townscape character and visual receptors before considering designated landscape. It is common for designations to encompass both character and visual considerations within their special qualities or purposes of designation. It therefore makes a more natural reading sequence to draw together those aspects of character and views which relate to the designation if they have been described earlier in the Chapter.

5.3.1 Zone of Theoretical Visibility

A Zone of Theoretical Visibility (ZTV) study was generated, based on the proposed design. This is shown on Figure 5.4 in Appendix C and indicates areas of potential visibility of the proposed scheme. The analysis was carried out using a topographic model including settlements and woodlands (with heights derived from NEXTMAP 25 surface mapping data) as visual barriers in order to provide a more realistic indication of potential visibility. It has been

³⁰ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, paragraph 3.19.

modelled to include the increase in height of the sea wall and the provision of shelters and toilet facilities at a height of 3m.

The ZTV study was used to aid the identification of those receptors that are likely to be most affected by the proposed scheme and those which are unlikely to have visibility. However, areas shown as having potential visibility may have visibility of the scheme screened by local features such as trees, hedgerows, embankments or buildings.

The ZTV for the proposed scheme (Figure 5.4, Appendix C) shows that potential visibility would extend out to sea for an extensive area, given the location of the proposed scheme along the coast. To the east and south east, potential visibility is shown extending along the low lying and largely undeveloped valley of the River Clwyd and up to the urban edge of Rhyl. To the south, visibility is largely contained to a strip of land along the coast, up to the edge of the built development of Kinnel Bay and Towyn. Potential visibility is also shown extending through a largely undeveloped gap around the Tir Prince Raceway and Towyn Park, between Kinnel Bay and Towyn. To the south west potential visibility is again restricted to the land along the coast, up to the settlement edge.

In reality, the extent of visibility of the proposed scheme would be much reduced from the theoretical visibility indicated by the ZTV study. Site observations confirm that the ZTV study does not pick up the majority of the caravans and chalets at the numerous holiday parks along the coast or the changing landforms of the dunes, as well as extensive vegetation within the wider landscape, all of which would significantly reduce the extent of visibility of the proposed scheme from that illustrated by the ZTV. The anticipated main area of visibility, based on site observations, is referred to as the 'Zone of Visual Influence' (ZVI).

The ZTV study does not pick up the extensive areas of caravans and chalets within the many holiday parks along the coast, all of which would restrict visibility of the proposed scheme to a narrower strip along the coastline than indicated by the ZTV study. The dunes at Kinnel Dunes Nature Reserve towards the centre of the study area and Horton's Nose at the north eastern end of the proposed scheme also restrict visibility to a greater extent than indicated in the ZTV study. There are also a number of buildings along the River Clwyd that are not picked up by the ZTV study and that would limit visibility of the proposed scheme. Across the study area vegetation cover is more extensive than indicated by the ZTV. There are areas of mature tree cover within the built-up areas that are not picked up by the ZTV study.

In reality, the ZVI for the proposed scheme would extend across the western part of Horton's Nose, where upgrades to the existing coast path and pedestrian crossing would be visible; along the coast to the edge of the closest edge of development, with occasional areas extending slightly further into the development where there are areas of open space adjacent to the coast path; a wider area at Kinnel Dunes Nature Reserve where there is no built development; and visibility to the south west would not extend beyond the northern extension of Happy Days Caravan Park, except during construction when the temporary construction compound at the south western edge of the proposed scheme would be visible.

Based on fieldwork observations, it is judged that effects on landscape or visual receptors outside the ZVI described above would experience Negligible change and effects on these receptors are not assessed in further detail in this report.

5.3.2 Landscape Character and Coastal Context

The proposed scheme is located along the coastline, which is heavily influenced by the presence of numerous holiday parks and the settlements of Kinnel Bay and Towyn. The coastline itself has sandy beaches that are subject to a relatively large tidal range and often feature existing flood defences such as rock armour. The existing coastal path forms a well-used promenade along the coast at present.

Paragraphs 5.13-5.15 of GLVIA3 indicate that landscape character studies at the national or regional level are best used to "set the scene" and understand the landscape context³¹. It indicates that Local Authority Assessments provide more detail and that these should be used to form the basis of the assessment of effects on landscape character – with (appropriately justified) adaptation, refinement and interpretation where required.

Relevant landscape character assessments are:

- Natural Resources Wales National Landscape Character Areas
- Conwy and Denbighshire Landscape Sensitivity and Capacity Assessment (May 2013)
- A Countryside Strategy for Conwy 1998-2003 and Clwyd Landscape Assessment 1995
- LANDMAP

Local Development Plan 2007-2022 (October 2013) states: 'There is no consistent/current landscape character assessment which covers both Conwy and Denbighshire. The most recent assessment is the Denbighshire Landscape Strategy'.

5.3.3 National and Local Landscape Character

Natural Resources Wales National Landscape Character Areas

National Landscape Character Areas (NLCAs) are shown on Figure 5.5. The proposed scheme is situated within NLCA08: Colwyn and Northern Coastline (North Wales Coast).

NLCA08: Colwyn and Northern Coastline is described as:

"...coast in the western half, where the development of seaside resorts and main transport links have squeezed into the limited available flat land, and started to spread up some hillsides. The hills run back from the coast in the central section, allowing the broad Vale of Clwyd to reach the sea, flanked to the east by the distinctive line of the Clwydian Range of hills, and finally issuing its river between Rhyl and Towyn. Much of the coastal strip has been developed for tourism, from planned Victorian seaside resorts, notably Llandudno, Colwyn Bay and Rhyl, through country hotels and sanatoria, to more recent and less formal sea-front developments, holiday camps and caravan parks. Traditionally this was where the folk of the north west of England took their holiday, and although the nature of holidays has changed, the area is still known for its seaside holiday destinations and some, notably Llandudno and Colwyn Bay, appear to be surviving and adapting accordingly. Inland are the estates and wooded parklands..."

Today's coastline is strongly influenced by both geology and human interventions... Human influence on the coast is particularly evident at Llandudno, Colwyn Bay and Rhyl, with their long promenades and hard coastal defences..."

Whilst the NLCAs are identified at a national level, they provided the greatest level of detail available in terms of describing the character of the Site and its context, and the characteristics of that landscape. NLCA08: Colwyn and Northern Coastline will be used as the basis of assessment of effects on landscape character within this LVIA. LANDMAP information will be used to supplement the information on NLCA08 as appropriate.

Conwy and Denbighshire Landscape Sensitivity and Capacity Assessment for Wind Energy Development (2013)

For the purpose of assessing the sensitivity of the landscape for wind energy development, Conwy and Denbighshire were divided into smaller geographical areas which broadly represent different character areas of the landscape. A total of 42 landscape units were identified across Conwy and Denbighshire. Limited detail is provided in relation to each of the landscape units in terms of key characteristics or description, as the primary purpose of the document is to provide an assessment of the sensitivity and capacity of each landscape unit

³¹ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment.

for wind energy development. The Site is located within Strategy Area 15 – Coastal Flats, described as located along the coastline of Denbighshire, extending from Abergele in the west past Prestatyn in the east. Within that, the Site is located within Landscape Unit A4 - Coastal and Estuarine Flats (Prestatyn to Abergele), an established holiday destination and recreational area with a large scale open and relatively straight coastal landscape and extensive, mostly flat area of coastal farmland.

Given the extensive nature of both the Strategy Area and the Landscape Unit, and the lack of detail in terms of description and key characteristics, the landscape units from this Landscape Sensitivity and Capacity Assessment will not be used as the basis of assessment of effects on landscape character within this LVIA.

A Countryside Strategy for Conwy 1998-2003 and Clwyd Landscape Assessment 1995

These documents are not listed as part of the evidence base for the Conwy Local Development Plan and not available on the Council website. Both documents are referenced in the Conwy and Denbighshire Landscape Sensitivity and Capacity Assessment for Wind Energy Development, and described as identifying our broad landscape character types across the former county of Clwyd/Conwy. The Countryside Strategy for Conwy identifies the Council's aims for the management of Conwy's countryside, referring to the Clwyd Landscape Assessment.

Given that these documents are not readily available now and that the Conwy Local Development Plan refers to LANDMAP in relation to consideration of landscape character, the broad landscape character types identified in these two documents will not be used as the basis of assessment of effects on landscape character within this LVIA.

LANDMAP

LANDMAP is a GIS (Geographical Information System) based landscape resource where landscape characteristics, qualities and influences on the landscape are recorded and evaluated into a nationally consistent data set. LANDMAP includes evaluation scores which are defined as 'Outstanding' (important at an international or national level), 'High' (important at a regional or county level), 'Moderate' (important at a low level) or 'Low' (little or no importance). LANDMAP separates information into five 'aspect layers', within the Site these include:

- Geological Landscapes:
 - Towyn, CNWGL051, coastal flats which cover extensive low area of tidal flat deposits at the western mouth of Afon Clwyd, crossed by Afon Gele, with settlements of Pensarn and Towyn. Stretches of blown sand forming undulating ground or low dunes along the coast east of Pensarn. The Site is located within this geological aspect which is identified as having a High overall rating.
- Landscape Habitats:
 - Kinmel Bay Dunes and Foreshore, CNWLH001 which cover intertidal area, including muds/sands, saltmarsh, shingle/gravel and boulders/rocks. The Site is located predominantly within this landscape habitat, which is identified as having a High overall rating due to the range of important national habitats that support a very good range of common species.
 - Towyn Urban Area, CNWLH002, which covers terrestrial habitats, built up areas and residential/green space. The Site extends into this landscape habitat, which is identified as having a Low overall rating given the built-up area and limited habitats.
- Historic Landscapes

- Conwy eastern foreshore, CNWHL032, which covers foreshore area to the west of the Conwy estuary. Comprising sand and shingle beach backed by managed sea fronts and promenades at Rhos-on-Sea, Colwyn Bay and Old Colwyn. The beaches have yielded a number of prehistoric (and some Roman) finds which derive from the significant areas of now inundated prehistoric land surface known to lie offshore. Later medieval and post medieval activity is evidenced by a number of fish traps and fish weirs and the remains of the occasional 'modern' shipwreck. The Site is located predominantly within this historic landscape aspect, which is identified as having a Moderate overall rating given that the foreshore has some potential but otherwise limited historic value.
- Towyn & Kinmel Bay, CNWHL085, which covers settlement. The Site extends into this historic landscape aspect, which is identified as having a Low overall rating given the integrity as a modern resort development.
- Visual and Sensory
 - Llandudno to Kinmel Bay intertidal, CNWVS052, which covers Intertidal Zone - a unique, dynamic and expansive natural intertidal area of the north Wales coast consisting of broad sweeping sandy beaches enclosed by headlands such as around Llandudno, Colwyn Bay and a linear beach Kinmel Bay plus a pebbly beach at Penrhyn Bay. There is coastal protection in the form of groynes and a masonry wall behind the two main settlement beaches, sea defences at Rhos and a rubble protected seawall elsewhere. The beaches have wide sea views to the north. The Site is located predominantly within this visual and sensory aspect, which is identified as having a High overall rating as the area is open with panoramic views to the sea and the backcloth of hills with aesthetically pleasing wild elements and patterns. The area is in moderate condition with consistent character throughout slightly spoilt by intrusive development. The area has a highly distinctive character as an exposed coast
 - Towyn and Kinmel Bay, CNWVS034, which covers the urban area. The Site extends into this visual and sensory aspect, which is identified as having a Low overall rating given the built-up area and limited habitats.
- Cultural Services
 - Llandudno to Kinmel Bay intertidal, CNWCLS076, which covers Coastal Waters. The Site is located predominantly within this cultural services aspect.
 - Towyn and Kinmel Bay, CNWCLS052, which predominantly covers the urban area. The Site extends into this cultural services aspect.
 - Llandulas Coast, CNWCLS091, which predominantly covers the urban area. The Site extends into this cultural services aspect.

Whilst NLCA08: Colwyn and Northern Coastline will be used as the basis of assessment of effects on landscape character within this LVIA, LANDMAP information will be used to supplement the assessment as appropriate.

5.3.4 Seascape Context

Natural Resources Wales National marine Character Areas

National Marine Character Areas (MCAs) are shown on Figure 5.5. The proposed scheme is situated within MCA 02: Colwyn Bay and Rhyl Flats.

MCA 02: Colwyn Bay and Rhyl Flats is described as: '*covering the shallow coastal and inshore waters of Colwyn Bay and the extensive sand banks of Rhyl Flats, Chester Flats and Constable Bank*'.

Whilst the MCAs are identified at a national level, they provided the greatest level of detail available in terms of describing the seascape character in the vicinity of the Site. MCA 02:

Colwyn Bay and Rhyl Flats will be used as the basis of assessment of effects on seascape character within this LVIA.

5.3.5 Visual Receptors

Visual receptors are “the different groups of people who may experience views of the development”³². In order to identify those groups who may be significantly affected the ZTV study, baseline desk study and site visits have been used.

The different types of groups assessed within this report encompass local residents; people using key routes such as roads; cycle ways, people within accessible or recreational landscapes; people using Public Rights of Way; or people visiting key viewpoints. In dealing with areas of settlement, Public Rights of Way and local roads, receptors are grouped into areas where effects might be expected to be broadly similar, or areas which share particular factors in common.

Three representative viewpoints have been selected to assess the effects on visual receptors. These were agreed with Conwy Borough Council during discussions in relation to wider scope of coastal defence improvements and have subsequently been supplemented with additional illustrative viewpoints to further demonstrate the likely effects of the proposed scheme. In addition, two of the representative viewpoints are also ‘specific viewpoints’ as they are promoted viewpoints within the study area.

5.3.6 Visual Environment of Existing Site

The Site runs along the North Wales coastline on the northern edge of the settlements of Kinmel Bay and Towyn, which include extensive areas of caravans and chalets located at holiday parks, Figure 5.1 (Appendix C). There are currently panoramic views out to sea, above the sea wall and over the beach, including views of the offshore wind farms to the north west. Built development to the south of the Site limits views to the south, although higher ground beyond the settlements is visible in the distance. The Wales Coast Path and Sustrans National Cycle Route 5 run through the Site, along the coastal promenade, which is heavily used by holiday makers accessing the coast. There is very little vegetation along the coast to influence visibility, except for coastal grassland within area of dunes at Kinmel Dunes and Horton’s Nose. The topography is relatively flat along the coast, with higher land to the south west outside the study area, Figure 5.3 (Appendix C).

5.3.7 Visual Receptor Groups

Visual effects are assessed for groups of visual receptors within close proximity to each other that are judged to experience similar visual effects arising from the proposed scheme. These are referred to as ‘visual receptor groups’ and include motorists on local roads, users of rights of way and local residents or visitors to settlements.

The following visual receptor groups have been identified within the extent of the ZVI (described earlier in Section 5.2) and are taken forward for detailed assessment in Section 5.4. The extents of the Visual Receptor Groups described below.

It is judged that for those visual receptors located outside of the ZVI there would be little to no visibility of the proposed scheme, and that effects would be Negligible at most. Visual receptors located outside of the ZVI are not taken forward for detailed assessment.

The following visual receptor groups are located within the study area and have theoretical visibility of the development, Figure 5.4:

- The promenade along the seafront, within the Site boundaries. See representative viewpoint 2 (Figure 5.7) and viewpoints II and IV (Figure 5.9). Visual receptors include recreational users of the promenade.

³² Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment.

- Kinmel Bay and Beach, immediately north of the Site, where close proximity to longer distance views would be experienced, depending on the level of the tide. See representative viewpoint 2 (Figure 5.7) and viewpoints II, IV and V (Figure 5.9). Visual receptors include recreational users of the beach and nearshore waters.
- Horton's Nose nature reserve and the area around the Harbour Hub Café, immediately to the east and south east of the Site. See representative viewpoint 1 (Figure 5.6) and illustrative viewpoint I (Figure 5.9). Visual receptors include recreational visitors to the nature reserve, the Rive Clyde and the café, and users of Horton Nose Lane.
- Kinmel Dunes Local Nature Reserve, immediately to the south of the Site. See representative viewpoint A (Figure 5.8) and illustrative viewpoint III (Figure 5.9). Visual receptors include recreational visitors to the nature reserve; users of Promenade Car Park and the café and kiosks there; and visitors to other businesses within the wider area of the nature reserve such as Baysville Coffee and Grill.
- The northern edge of the settlements of Kinmel Bay and Towyn, immediately to the south of the Site. See illustrative viewpoints II, III and IV (Figure 5.9). Visual receptors include local residents, visitors to and residents at the various holiday parks, users of open spaces within the settlements along this northern edge (such as adjacent to illustrative viewpoint II at Sunnyvale Holiday Park or at Arnold Gardens near illustrative viewpoint IV), and users of local roads along the northern edge of the settlements.

5.3.8 Key Routes

The following long-distance road, rail and recreational routes pass through the study area:

- The Wales Coast Path (passes through the Site)
- Sustrans National Cycle Route 5 (passes through the Site)
- The North Wales Coast railway line
- A458

Both the Wales Coast Path and Sustrans National Cycle Route 5 run through the Site and visual effects on users of these routes are assessed further in Section 5.4. The North Wales Coast railway line and the A458 run through the built-up areas of Kinmel Bay and Towyn, and lie beyond the ZVI described above. The visual effects of the proposed scheme on users of these routes would be Negligible and are not assessed in detail in Section 5.4.

5.3.9 Specific Viewpoints

There are no panoramic viewpoints identified on Ordnance Survey mapping for the area of the Site. However, site visits identified that there is a viewing platform identified on signage at Horton's Nose (Viewpoint 1) and further viewpoint on a manmade mound at Kinmel Dunes (Viewpoint 3). Both of these locations will be assessed as specific viewpoints.

5.3.10 Landscape Designations and Value

Designated Landscapes

As shown on Figure 5.2, there are no designated landscapes located within the 2km study area.

Local Landscape Value

Although there are no designated landscapes located within the area, there are a number of features that contribute to the value of the local landscape and townscape, such as the long-distance walking and cycling routes, beaches, open spaces, recreational facilities and other public rights of way. Given the draw of the area as a holiday and recreational attraction, the coastal area within which the Site is located is assessed to be of Local Value.

5.3.11 Future Baseline

Various factors may result in changing land use patterns within the study area. For example, the effects of a changing climate, such as increased mean annual air temperatures, hotter summers, altered seasonal rainfall patterns, drier summers, wetter winters and the increased frequency of extreme rainfall events and the intensity of storms may influence, combined with cost of living rises, may influence visitors to the area and the corresponding recreational provisions. Agricultural practices in the wider study area may change in response to the effects of these same factors, changing market conditions and opportunities for diversification.

In addition to influencing the recreational offer of the area and the type of agriculture undertaken, various climate related factors may also affect the survival and long-term health of trees and other vegetation, perhaps through the introduction of invasive species, pathogens and viruses. The lack of long-term management of woodlands and copses may also influence the survival of these landscape features, including as a result of tree loss to wind throw during storms.

Along the coast, change may result from sea level rise and modification through coastal erosion and deposition. Additional coastal defensive structures, further to those included as part of this proposed scheme, may also be modified or installed.

Whilst the potential exists to alter the character of the local landscape and seascape, such changes are likely to be localised and therefore would not affect the findings of the assessment of effects on landscape and visual receptors in general.

5.4 Assessment Methodology & Assessment Criteria

"Landscape and Visual Impact Assessment is a tool used to identify and assess the significance of and the effects of change resulting from development on both the landscape as an environmental resource in its own right and people's views and visual amenity." ³³

Paras. 2.20-2.22 of the same guidance indicate that the two components (assessment of landscape effects, and assessment of visual effects) are "related but very different considerations".

The assessment method for this LVIA draws upon the established GLVIA3; An Approach to Landscape Character Assessment (Natural England, 2014), Landscape Institute (LI) Technical Information Note 05/2017 regarding townscape character; LI Technical Guidance Note 02/2019: Residential Visual amenity assessment (RVAA); LI Technical Guidance Note 06/19: Visual Representation of development proposals; LI Technical Guidance Notes 02/21: Assessing landscape value outside national designations and other recognised guidelines.

The methodology is described in more detail in Appendices C.12.

5.4.1 Assessment Terminology and Judgement

A full glossary is provided in Appendix C.14. The key terms used within this assessment are:

- Susceptibility and Value – which contribute to Sensitivity of the receptor;
- Scale, Duration and Extent - which contribute to the Magnitude of effect; and
- Significance.

These terms are described in more detail below.

5.4.2 Sensitivity of the Receptor

³³ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment.

Table 5-1: Susceptibility

Susceptibility indicates the ability of a landscape or visual receptor to accommodate the proposed scheme “without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies.” ³⁴	
High	Undue consequences are likely to arise from the proposed scheme.
Medium	Undue consequences may arise from the proposed scheme.
Low	Undue consequences are unlikely to arise from the proposed scheme.

Susceptibility of landscape character areas is influenced by their characteristics and is frequently considered (though often recorded as ‘sensitivity’ rather than susceptibility) within documented landscape character assessments and capacity studies.

Susceptibility of designated landscapes is influenced by the nature of the special qualities and purposes of designation and/or the valued elements, qualities or characteristics, indicating the degree to which these may be unduly affected by the development proposed.

Susceptibility of accessible or recreational landscapes is influenced by the nature of the landscape involved; the likely activities and expectations of people within that landscape and the degree to which those activities and expectations may be unduly affected by the development proposed.

Susceptibility of visual receptors is primarily a function of the expectations and occupation or activity of the receptors³⁵.

Table 5-2: Landscape Value

Landscape Value is “the relative value that is attached to different landscapes by society” (GLVIA3, page 157).	
Nation/ International	Designated landscapes which are nationally or internationally designated for their landscape value.
Local/ District	Locally or regionally designated landscapes; also areas which documentary evidence and/or site observation indicates as being more valued than the surrounding area.
Community	‘Everyday’ landscape which is appreciated by the local community but has little or no wider recognition of its value.
Limited	Despoiled or degraded landscape with little or no evidence of being valued by the community.

Table 5-3: Sensitivity

Sensitivity is assessed by combining the considerations of susceptibility and value described above. The differences in the tables below reflect a slightly greater emphasis on value in considering landscape receptors, and a greater emphasis on susceptibility in considering visual receptors.				
Landscape Sensitivity				
		Susceptibility		
		High	Medium	Low
Value	National/International	High	High-Medium	Medium
	Local/District	High-Medium	Medium	Medium-Low
	Community	Medium	Medium-Low	Low
	Limited	Low	Low-Negligible	Negligible

³⁴ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment.

³⁵ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, para 6.32.

Sensitivity is assessed by combining the considerations of susceptibility and value described above. The differences in the tables below reflect a slightly greater emphasis on value in considering landscape receptors, and a greater emphasis on susceptibility in considering visual receptors.

Visual Receptor Sensitivity				
		Susceptibility		
		High	Medium	Low
Value	National/International	High	High-Medium	Medium
	Local/District	High-Medium	High-Medium	Medium
	Community	High-Medium	Medium	Medium-Low
	Limited	Medium	Medium-Low	Low

For visual receptors; susceptibility and value are closely linked - the most valued views are also likely to be those where viewer's expectations will be highest. The value attributed relates to the value of the view, e.g. a National Trail is nationally valued for access, not necessarily for the available views. Typical examples of visual receptor sensitivity are included in a table in Appendix C.12.

5.4.3 Magnitude of Effect

Table 5-4: Scale of Effect

Scale of effect is assessed for all landscape and visual receptors and identifies the degree of change which would arise from the development.	
Large	Total or major alteration to key elements, features, qualities or characteristics, such that post development the baseline will be fundamentally changed.
Medium	Partial alteration to key elements, features, qualities or characteristics, such that post development the baseline will be noticeably changed.
Small	Minor alteration to key elements, features, qualities or characteristics, such that post development the baseline will be largely unchanged despite discernible differences.
Negligible	Very minor alteration to key elements, features, qualities or characteristics, such that post development the baseline will be fundamentally unchanged with barely perceptible differences.

Table 5-5: Duration of Effect

Duration of effect is assessed for all landscape and visual receptors and identifies the time period over which the change to the receptor as a result of the development would arise.	
Permanent	The change is expected to be permanent and there is no intention for it to be reversed.
Long-term	The change is expected to be in place for 10-25 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.
Medium-term	The change is expected to be in place for 2-10 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.
Short-term	The change is expected to be in place for 0-2 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.

Most effects will be long-term or permanent. However, medium or short-term effects may be identified where mitigation planting is proposed, or local factors will result in a reduced duration of effect (for example where maturing woodland will screen views in future). The effects arising from the construction of the development will usually be short-term.

Table 5-6 Extent of Effect

Extent of effects is assessed for all receptors and indicates the geographic area over which the effects will be felt.	
Wide	Beyond 4km, or more than half of receptor.
Intermediate	Up to approx. 2-4km, or around half of receptor area.
Localised	Site and surroundings up to 2km, or part of receptor area (up to approx. 25%).
Limited	Site, or part of site, or small part of a receptor area (< approx. 10%).

The Magnitude of effect is informed by combining the scale, duration and extent of effect. Figure 5-1 Magnitude of Effect below illustrates the judgement process.

As can be seen from Figure 5-1, scale (shown as the layers of the diagram) is the primary factor in determining magnitude; most of each layer indicates that magnitude will typically be judged to be the same as scale, but may be higher if the effect is particularly widespread and long lasting, or lower if it is constrained in geographic extent or timescale. Where the Scale of effect is judged to be Negligible the Magnitude is also assumed to be Negligible and no further judgement is required.

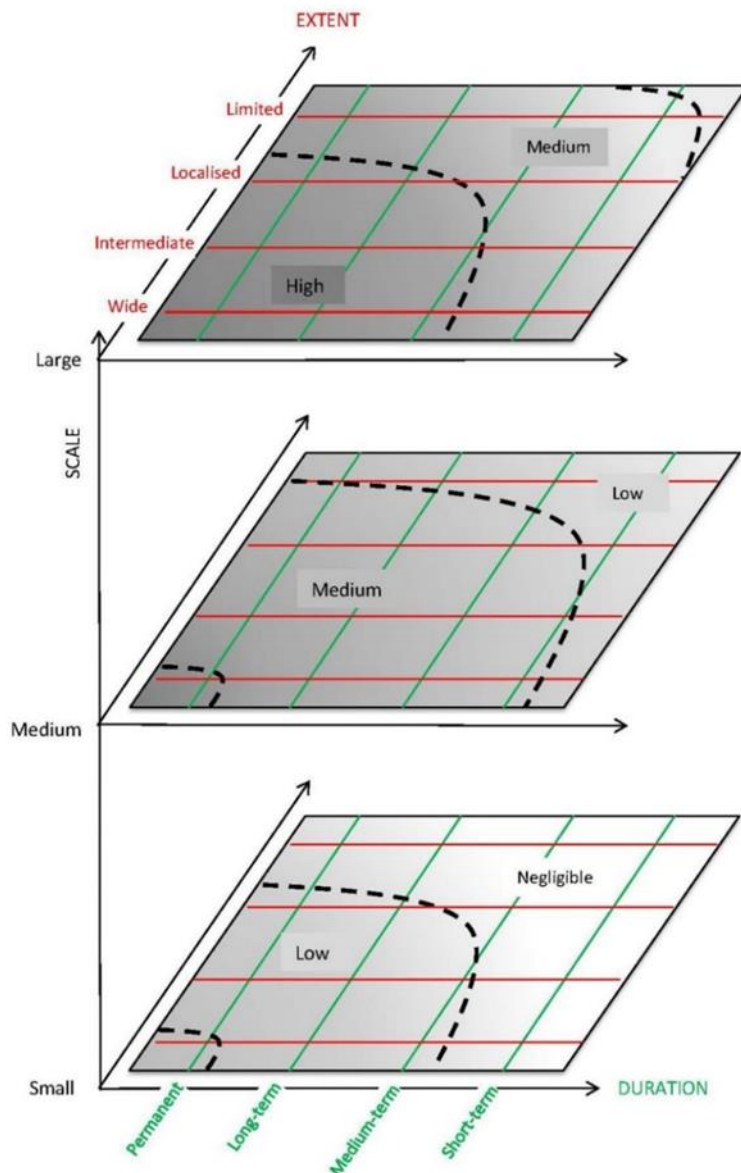


Figure 5-1: Magnitude of Effect

5.4.4 Significance

Significance indicates the importance or gravity of the effect. The process of forming a judgement as to the degree of significance of the effect is based upon the assessments of magnitude of effects and sensitivity of the receptor to come to a professional judgement of how important this effect is. This judgement is illustrated by Figure 5-2 Significance below:

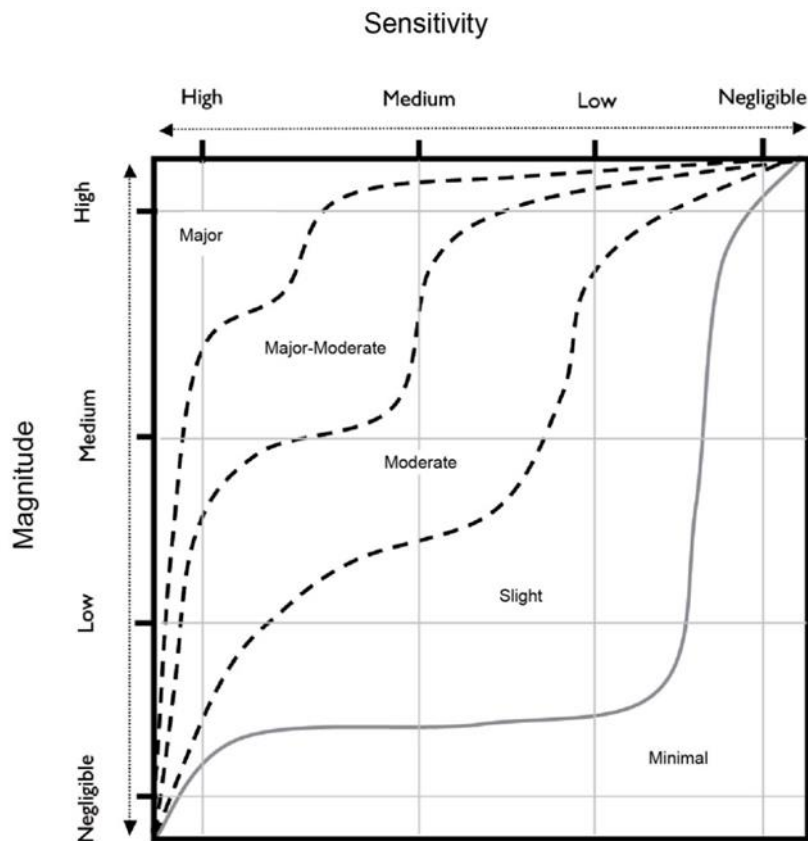


Figure 5-2: Significance

The significance ratings indicate a 'sliding scale' of the relative importance of the effect, with Major being the most important and Minimal being the least. Effects that are Major-Moderate or Major are considered to be significant. Effects of Moderate significance or less are "of lesser concern" ³⁶. It should also be noted that whilst an effect may be significant, that does not necessarily mean that such an impact would be unacceptable, or should necessarily be regarded as an "undue consequence" ³⁷.

Where intermediate ratings are given, e.g. "Moderate-Slight", this indicates an effect that is both less than Moderate and more than Slight, rather than one which varies across the range. In such cases, the higher rating will always be given first; this does not mean that the impact is closer to that higher rating but is done to facilitate the identification of the more significant effects within tables. Intermediate judgements may also be used for judgements of Magnitude.

5.4.5 Positive/ Adverse/ Neutral

Effects are defined as adverse, neutral or positive. Neutral effects are those which overall are neither adverse nor positive but may incorporate a combination of both.

The decision regarding the significance of effect and the decision regarding whether an effect is beneficial or adverse are entirely separate. For example, a rating of Major and Positive would indicate an effect that was of great significance and on balance positive, but not necessarily that the proposals would be extremely beneficial.

³⁶ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, para 3.35.

³⁷ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, para 5.40.

Whether an effect is Positive, Neutral or Adverse is identified based on professional judgement. GLVIA 3rd edition indicates at paragraph 2.15 that this is a “particularly challenging” aspect of assessment, particularly in the context of a changing landscape³⁸.

5.4.6 Cumulative Assessment

Cumulative assessment relates to the assessment of the effects of more than one development. For each of the identified cumulative schemes within the study area agreement is reached with the Planning Authority as to whether and how they should be included in the assessment.

Developments that are subject to a valid planning application are included where specific circumstances indicate there is potential for cumulative effects to occur, with progressively decreasing emphasis placed on those which are less certain to proceed. Typically, operational and consented developments are treated as being part of the landscape and visual baseline i.e. it is assumed that consented schemes will be built except for occasional exceptions where there is good reason to assume that they will not be constructed.

In this case, a cumulative assessment for the landscape and visual effects of the proposed scheme in combination with other proposed schemes has been outlined in Cumulative and In-Combination Effects, Section 14.

5.4.7 Residential Amenity

This LVIA does not include a separate residential amenity assessment. LI TGN 02/2019 on Residential Visual Amenity Assessment indicates that *“It is not uncommon for significant adverse effects on views and visual amenity to be experienced by people at their place of residence as a result of introducing a new development into the landscape. In itself this does not necessarily cause particular planning concern. However, there are situations where the effect on the outlook / visual amenity of a residential property is so great that it is not generally considered to be in the public interest to permit such conditions to occur where they did not exist before.”* However, given the relatively minor nature of the proposed scheme, and the lack of permanent residential properties in close proximity to the Site, it is considered that the effects resulting from the proposed scheme would fall below the Residential Visual Amenity Threshold referred to in LI TGN 02/2019 as visual effects *“of such nature and/ or magnitude that it potentially affects ‘living conditions’ or Residential Amenity”*.

5.4.8 Distances

Where distances are given in the assessment, these are approximate distances between the nearest part of the proposed scheme and the nearest part of the receptor in question, unless explicitly stated otherwise.

5.4.9 Assumptions and Limitations

Desk-study & Fieldwork

The baseline conditions of the Site and the surrounding landscape described in the subsequent Sections has been informed by desk-study and fieldwork (undertaken in August and October 2022).

A ZTV study (Figure 5.4) has been produced and used as a tool to inform the professional judgements made in this LVIA. The ZTV study has been modelled on the height parameters available at the time of assessment.

5.5 Potential Impacts & Significant Effects

³⁸ Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, para 2.15

This Section sets out the effects that the proposed scheme would have on both landscape and visual receptors.

Key potential impacts during the construction phase might include the visual effect of site vehicles and construction traffic, within the Site and in surrounding areas; other components typical of construction activities, including workers' accommodation, stockpiles of materials, lighting of specific areas, such as construction compound at the south western end of the Site; and gradual modification of landscape character as part of a phased programme of works. Effects during construction would be temporary and short term, with the total construction period for the proposed scheme anticipated to be 18 months, and would be of notably lower magnitude than those on completion, although more likely to be perceived as adverse.

Construction activities would be restricted to localised, very short term, temporary views of construction activity, which would not give rise to significant landscape character or visual effects over and above those during operation. The primary effects arising will be from the presence of the proposed scheme within the study area and this assessment therefore focusses on the operational effects.

Effects are assessed during the period following completion. As there is limited scope to incorporate any planting that would reduce landscape or visual effects over time, due to the nature of the proposals, effects are considered to be permanent.

5.5.1 Effects on Landscape and Seascape Character

Natural Resources Wales national Landscape Character Areas

National Landscape Character Areas (NLCAs) are shown on Figure 5.5. As identified in Section 5.2, the proposed scheme is situated within NLCA08: Colwyn and Northern Coastline (North Wales Coast).

The key characteristics of NLCA08 relevant within the study area are described as:

- The mouth of the Vale of Clwyd.
- Seaside resort towns.
- A generally man-made coastal edge.
- Ecological importance.

In relation to the seaside towns, the character area description for NLCA08 states "urban development and arterial road and railway routes along coast, constricted in places by topography and rising hills. Much 19th century development with more recent suburbia. Some caravan parks and holiday camps between Llanddulas to Prestatyn coalesce settlements". In relation to the man-made coastal edge, the description records "promenades, sea walls, groynes, rock armour and other forms of protecting the coastal edge run for most of the length of the coastline".

The Site is typical of the coastal part of NLCA08, whilst not extending into the inland, hilly part of the NLCA. The coastal resorts and associated holiday parks, man-made coastal edge with associated flood protection measures and the occasional areas of ecological importance such as Kinmel Dunes and Horton's Nose are all features within the Site or immediately adjacent to it. Given that coastal defence features are already characteristic of much of the coastal area of NLCA08 but that some areas are of ecological importance, the Susceptibility of the NLCA to the type of development proposed is assessed to be Medium. Combined with the Local Value of the area, as assessed in Section 5.2, the Sensitivity of NLCA08 is judged to be Medium.

Within the Site, elements of the proposed scheme that could affect the landscape character of NLCA08 include the widening of the promenade/coastal path, increasing the height of the sea wall, introducing new or larger areas of rock armour, changes to the beach accesses, changes to The Promenade Car Park and the introduction of new shelters and toilet blocks. However, all of these features already existing within the Site or its immediate vicinity. The widening of

the promenade would be barely perceptible post construction, as would the increase in sea wall height, which would still allow views of the beach and out to sea. Whilst some of the beach accesses would be larger than at present to allow access for all to the beach, these would again be relatively minor alterations to existing elements of the coastal character. The Promenade Car Park and associated kiosks and café already exert an urbanising influence in the Kinmel Dunes area, which would only be slightly expanded by the proposed scheme. The influence of the proposed scheme would not generally extend southwards, given the proximity of the urban edge and holiday parks immediately to the south in most locations. To the north, the influence of the proposed scheme would extend across the beach in the areas where new or larger areas of rock armour are proposed, due to the physical change in the extent of rock armour and the change from dunes or coastal grassland in some locations to the harder coastal defence.

Overall, the effects of the proposed scheme on NLCA08 are assessed to be Small Scale over a Localised Extent of the NLCA. These effects would be Permanent, and are assessed to be of Low Magnitude, Slight Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development, but many aspects of the proposed scheme would provide enhancements to the existing character.

Natural Resources Wales National Marine Character Areas

National Marine Character Areas (MCAs) are shown on Figure 5.5. As identified in Section 5.2, the proposed scheme is situated within MCA 02: Colwyn Bay and Rhyl Flats.

The key characteristics of MCA 02 relevant within the study area are described as:

- Low-lying coastline backed by coastal levels.
- Long sandy beaches and shingle storm beaches.
- Shallow waters.
- Developed coastline with many seaside resort towns.
- Wales Coast Path.
- A55, A548 and main Holyhead to Chester railway line follow close to the coastline.
- Popular shore and boat angling areas. Rhyl includes the main harbour.
- Rhyl Flats Offshore Wind Farm.
- Limestone hills form a backdrop.

In relation to the long sandy beaches and shingle storm beaches, the MCA statement indicates that *"All the soft coastline is protected by various coastal defences including groynes, rock armour, beach recharging, walls and traditional promenades"*. The statement also notes that many of the coastal settlements have caravan and chalet parks on their fringes and that the offshore wind farm forms a dominating offshore feature.

The seascape within the study area is typical of MCA 02, containing shallow waters with sandy beaches adjacent to a developed coastline. The main transport corridors are present onshore, although not a prominent feature within the immediate vicinity of the Site, and both the backdrop of limestone hills and the offshore wind farm are visual characteristics. Given that coastal defences are already characteristic of the coastline along the edge of MCA 02, along with the presence of coastal settlements and holiday parks, the Susceptibility of the MCA to the type of development proposed is assessed to be Medium-Low. Combined with the Local Value of the area, as assessed in Section 5.2, the Sensitivity of MCA 02 is judged to be Medium-Low.

The elements of the proposed scheme that could affect the seascape character of MCA 02 include increasing the height of the sea wall, introducing new or larger areas of rock armour, changes to the beach accesses, the introduction of new shelters and toilet blocks. However, none of these features would be located within the MCA and all of them already exist within

the immediate vicinity of the Site. None of the elements of the proposed scheme would prevent views of the backdrop of limestone hills or the offshore wind farm as key characteristics of the MCA. As for NLCA08, the influence of the proposed scheme would extend northwards across the beach in the areas where new or larger areas of rock armour are proposed, due to the physical change in the extent of rock armour and the change from dunes or coastal grassland in some locations to the harder coastal defence.

Overall, the effects of the proposed scheme on MCA 02 are assessed to be Small-Negligible Scale over a Localised Extent of the MCA. These effects would be Permanent, and are assessed to be of Low-Negligible Magnitude, Slight Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development, but they are in keeping with the existing character of the coastline.

Effects on LANDMAP

The overall value of LANDMAP aspects in which the Site is located (Section 5.2) are unlikely to be affected, with some benefits as outlined in the paragraphs above.

5.5.2 Visual Effects

Visual Aids

Annotated photographs for the three representative viewpoints are shown on Figures 5.6-5.8 supporting this LVIA. The method of presentation for each viewpoint has been informed by Landscape Institute Technical Note 06/19 'Visual Representation of Development Proposals'. The viewpoint description, description of effects and scale of effect for each viewpoint (see Figure 5.4 for locations) is set out on the relevant photograph.

In addition to the representative viewpoints, illustrative viewpoints to demonstrate further aspects of the Site and its local context are provided at Figure 5.9 with their locations shown on Figure 5.4.

The scale of effect at each representative or specific viewpoint is summarised in Table 5-7 below:

Table 5-7 Representative viewpoints

Viewpoint Reference & Location	Distance, direction from proposed scheme	Scale of effect
Specific Viewpoint 1 - Viewpoint at Horton's Nose close to Wales Coast Path	110m, east	Small, Neutral
Representative Viewpoint 2 - Towyn Beach	Within proposed scheme	Medium-small, Positive
Specific Viewpoint A - Viewpoint at Kinmel Dunes close to Wales Coast Path	15m, south	Medium-small, Positive

Each of the viewpoints is a 'sample' of the potential effects, representing a wide range of receptors – including not only those actually at the viewpoint, but also those nearby, at a similar distance and/or direction.

Visual Receptor Groups

This assessment focuses on effects on groups of visual receptors, incorporating effects on views from public spaces and streets within settlements (or around the houses in areas with isolated dwellings), and the routes and accessible landscapes within and around the settlements and along the coast. Residents and visitors within these communities are assessed to be of High-Medium sensitivity. The assessment of effects on settlements focuses on the visual amenity of public spaces, though views from groups of dwellings will also be

noted in the descriptions. Effects on private residential amenity are a separate matter, and only require assessment when a development is likely to have effects over the Residential Visual Amenity Threshold referred to in LI TGN 02/2019 (as set out within Section 5.3), which is not the case in respect of this development.

The promenade along the seafront, within the proposed scheme boundary, Viewpoint 2, Figure 5.7 and illustrative viewpoints II and IV Figure 5.9. These illustrate that the promenade, which is the route of the Wales Coast Path and Sustrans National Cycle Route 5, is currently a relatively wide pathway between the existing sea wall and either the edge of the built-up area with boundary fences usually present immediately adjacent to the pathway at holiday parks and garden boundaries adjacent to the permanent developments. In some locations there are narrow grass verges and occasional areas of planting or coastal grassland. This only widens out at Horton's Nose and Kinmel Dunes where there is a more open area adjacent to the route.

Along this corridor, the main elements of the proposed scheme that would be visible would be the widening of the route for the stretches where this would occur, the increase in height of the sea wall, the new or larger areas of rock armour where these areas are visible from the promenade and the introduction of the individual features such as pocket parks, shelters, beach accesses and toilet blocks where these are adjacent to the promenade. None of these features would be entirely new along the promenade, with many of them, including the width of the promenade and the height of the sea wall, likely to be barely perceivable once construction is complete.

Overall, the effects of the proposed scheme on users of the promenade are assessed to be Medium-Small Scale over a Wide Extent of the visual receptor group. These effects would be Permanent, and are assessed to be of Medium-Low Magnitude, Moderate Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development but they are in keeping with the existing character of the promenade and would enhance it in some locations.

Kinmel Bay and Beach, immediately north of the Site, where close proximity to longer distance views would be experienced, depending on the level of the tide, Viewpoint 2 (Figure 5.7) and illustrative Viewpoints II, IV and V (Figure 5.9). These illustrate that the beach is currently sandy but frequently has some level of rock armour against the existing sea wall. The width of the beach varies with the level of the tide.

Along the beach, the main elements of the proposed scheme that would be visible would be the new or larger areas of rock armour where these areas are present, the increase in height of the sea wall, and the introduction of the individual features such as pocket parks, shelters, beach accesses and toilet blocks where these are adjacent to the beach. None of these would introduce entirely new elements to the beach with the rock armour being a continuation of the existing treatment along the beach and the height of the sea wall likely to be barely perceivable once construction is complete.

Overall, the effects of the proposed scheme on users of the beach are assessed to be Medium-Small Scale over a Wide Extent of the visual receptor group. These effects would be Permanent, and are assessed to be of Medium-Low Magnitude, Moderate Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development but they are in keeping with the existing character of the beach.

Horton's Nose nature reserve and the area around the Harbour Hub Café, immediately to the east and south east of the Site, Viewpoint 1 (Figure 5.6) and illustrative Viewpoint I (Figure 5.9). These viewpoints demonstrate that at Horton's Nose the dune landscape would interrupt views of the proposed scheme in many locations and that the area around the Harbour Hub Café is already an urbanised area with lots of hard surfacing associated with pedestrian, cycle and vehicular routes.

Within this visual receptor group, the main elements of the proposed scheme that would be visible are the widening of the Wales Coast Path, the introduction of the new pedestrian

crossing adjacent to the café and in a localised area of the receptor group the increase in height of the sea wall and the increase in rock armour. For much of the visual receptor group, views would be largely unchanged or there would only be views of the widened footpath and upgraded pedestrian crossing, which would be very minor elements and entirely in keeping with the existing views.

Overall, the effects of the proposed scheme on users of Horton's Nose nature reserve and the area around the Harbour Hub Café are assessed to be Medium-Small Scale over a Limited Extent of the visual receptor group, where there would be views of the changes to the sea wall and rock armour. These effects would be Permanent, and are assessed to be of Low-Negligible Magnitude, Minimal Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development but they would be very minor elements of the views.

Kinmel Dunes Local Nature Reserve, immediately to the south of the proposed scheme, .

Viewpoint A (Figure 5.8) and illustrative Viewpoint III (Figure 5.9). These viewpoints demonstrate that the dune landscape is the main component of views in the Local Nature Reserve, with The Promenade Car Park forming a notable feature and the promenade and sea wall delineating the edge of the dunes. Within the Local Nature Reserve, visitors are either observing the wildlife and natural features highlighted on signage around the dunes, passing through to use the facilities at the car park/other attractions or accessing the promenade and beach.

Within this visual receptor group, the main elements of the proposed scheme that would be visible are the enhancements to the car park, the introduction of the parklet and toilet block, and to a lesser extent the widening of the promenade and increase in height of the sea wall. The higher sea gate and changes to the beach access would also be visible, with some limited visibility of the increased area of rock armour. The upgraded car park and the new parklet and facilities adjacent to the promenade would be positive new features of the view and not dissimilar to the existing view. The increase in height of the sea wall would still allow views over it to the sea and the widened footpath would be a very minor change to the existing views.

Overall, the effects of the proposed scheme on users of Kinmel Dunes Local Nature Reserve are assessed to be Medium-Small Scale over a Localised Extent of the visual receptor group. These effects would be Permanent, and are assessed to be of Medium-Low Magnitude, Moderate Significance (Not Significant) and, on balance, Positive, given the enhancements to the car park and provision of the parklet.

The northern edge of the settlements of Kinmel Bay and Towyn, immediately to the south of the Site. See viewpoints II, III and IV (Figure 5.9). These viewpoints illustrate that from the edge of the settlements, when the holiday park developments are included, there are only views of the proposed scheme from the very northern edge immediately adjacent to the Site as the flat landform and close proximity of dwellings or caravans/chalets obstruct views from further into the settlements.

Within this visual receptor group, the main elements of the proposed scheme that would be visible are the widening of the Wales Coast Path and the increasing of the height of the sea wall. The new or larger areas of rock armour would be a minor element of the view beyond the sea wall, and the individual elements such as the new parklets, upgraded beach accesses and shelters would be visible where these occur in close proximity to the edge of the settlement. For much of the visual receptor group, views would be largely unchanged or there would only be views of the widened footpath and increased height of the sea wall, which would be minor elements and entirely in keeping with the existing views.

Overall, the effects of the proposed scheme on residents of and visitors to Kinmel Bay and Towyn are assessed to be Medium-Small Scale over a Localised Extent of the visual receptor group. These effects would be Permanent, and are assessed to be of Medium-Low Magnitude, Moderate Significance (Not Significant) and, on balance, Neutral, given that there would be

some elements of new built development, but they would be minor elements of the views and would general be an improvement on existing views.

5.5.3 Key Routes

Both the Wales Coast Path and Sustrans National Cycle Route 5 pass through the Site and follow the alignment of the promenade. The assessment of effects for users of these routes is therefore as set out above in relation to the visual receptor group for the promenade.

5.5.4 Specific Viewpoints

These specific viewpoints are considered to be of High-Medium sensitivity, reflecting their local importance.

Viewpoint at Horton's Nose (Viewpoint 1) (110m, east) – This specific viewpoint is located within Horton's Nose nature reserve. A boardwalk has been created through the nature reserve to allow public access and the viewpoint is located on a viewing platform along the boardwalk. The main direction of view from the viewing platform is out to sea, but there are panoramic views in all directions. The existing dune landscape forms the foreground to the views, with the seafront, a holiday caravan park, a boat repair and storage facility, and Rhyl Harbour Car Park are prominent beyond the dunes. To the south, the Harbour Hub Café and car park are visible, with the River Clwyd lined with rock armour and B5118 beyond and a view of largely commercial development in Rhyl.

The proposed scheme in the vicinity of this specific viewpoint would comprise the introduction of rock armour on the sea side of the existing sea wall, raising the height of the existing sea wall, a new access point over the rock armour to the beach, widening of the existing coast path to 4.5m along the eastern edge of Sunnyvale Holiday Park and an upgraded zebra crossing to the north of the Harbour Hub Café.

The existing sea wall is a minor component within the view. Therefore the enhanced height, although perceptible, would be of a small scale. The most perceptible change would be the new rock armour which is considered to be in keeping with the existing character of the Site and Study Area, where rock armour regularly forms a feature of the coastal environment. Other elements of the proposed scheme would be largely screened from this viewpoint.

Overall, the effects of the proposed scheme on visitors to the viewpoint at Horton's Nose nature reserve are assessed to be Small Scale over a Localised Extent of the view, where there would be views of the changes to the sea wall and rock armour. These effects would be Permanent, and are assessed to be of Low Magnitude, Slight Significance (Not Significant) and, on balance, Neutral, given that there would be some elements of new built development, but they would be very minor elements of the views.

Viewpoint at Kinnel Dunes (Viewpoint A) (15m, south) - This specific viewpoint is located within Kinnel Dunes Local Nature Reserve. A viewing platform has been created on top of one of the sand dunes, close to the Promenade Car Park. The viewing platform has panoramic views in all directions, although the focus of views on signage for the nature reserves indicates that the primary direction of the viewpoint is out to sea. The existing dune landscape forms the foreground to the views, with the sea wall and coast path visible to the north west, with the beach beyond, and Promenade Car Park with associated kiosks and café visible to the south west. The coastline to the west curves round to Colwyn Bay and the higher ground beyond, whilst the coast to the east is more linear and largely obscured by the sand dunes. To the south, there are open views of residential development in Kinnel Bay, with higher ground beyond.

The proposed scheme in the vicinity of this representative viewpoint would comprise of the following changes: upgrades to Promenade Car Park, including new parking bays and rain gardens; new Gallery Parklet proposed directly south of the promenade/Coast Path; proposed widening of the promenade/Coast Path to 4.5m; raising the existing sea by 0.5m; upgrade of the current floodgate to suit the new wall height; upgraded access point (stepped and

ramped) north-east of the Promenade Car Park and a proposed new kerb (150mm upstand to act as secondary defence wall).

The most perceptible change from the viewpoint would be the introduction of the new proposed Galley Parklet and associated toilet block as a new feature. The extension of Promenade Car Park into the grassland area to the south of it will also be a noticeable change to the view. The changes to the width of the promenade, and the height of the sea wall and flood gate would also be perceptible, but these are alterations to existing features and would be in keeping with the existing characteristics of the view. The upgraded access point (north-east of the car park) would also be visible from this viewpoint when looking north east, but would again be replacement of an existing similar feature. Views north towards the sea would remain largely unchanged as the sea wall would not be raised to a height that restricts the existing views. Similarly, views looking south across the settlements and rising landscapes beyond would be retained.

Overall, the effects of the proposed scheme on visitors to the viewpoint at Kinmel Dunes Local Nature Reserve are assessed to be Medium-Small Scale over an Intermediate Extent of the view. These effects would be Permanent, and are assessed to be of Medium-Low Magnitude, Moderate Significance (Not Significant) and, on balance, Positive, given the enhancements to the car park and provision of the parklet.

5.5.5 Effects on designated landscapes

As identified in Section 5.2, there are no designated landscapes within the study area.

5.6 Mitigation Measures

Mitigation measures relevant to this chapter are embedded within the design of the proposed scheme. Landscape and visual impact have been considered as part of the design process to create a design to that minimises effects, whilst providing benefits to users of the area.

5.7 Residual Effects

Embedded (primary) mitigation has been considered in the assessment of effects above. As there are no secondary or tertiary mitigation measures relevant to this assessment, residual effects would be the same as those identified in Section 5.4.

5.8 Summary of Landscape and Visual Effects

This assessment describes the existing landscape and views, considers their sensitivity to change and identifies the changes likely to arise from the proposed scheme; providing judgements of the importance of effects arising.

The Site comprises a stretch of the North Wales coastline to the north of Kinmel Bay and Towyn. It is currently a promenade the forms part of the Wales Coast Path and Sustrans National Cycle Route 5, with an adjacent sea wall and much of the stretch of coastline already having sea defences in the form of rock armour. The coastline is heavily developed, with holiday parks forming a large part of the land use immediately to the south of the Site.

The proposed scheme comprises improvements to the existing coastal defences, including increasing the height of the existing sea wall with corresponding increases in the height of flood gates, increasing the extent of rock armour along the beach, and upgrading beach access points to allow improved access for all. In addition, there would be enhancements to the width of the coast path, upgrading of The Promenade Car Park and the introduction of new parklets along the promenade.

In landscape and seascape character terms, the Site is located within National Landscape Character Area 08: Colwyn and Northern Coastline (North Wales Coast) and National Marine Character Area 02: Colwyn Bay and Rhyl Flats is located immediately to the north. Both the landscape and seascape character assessments refer to built development, holiday parks and

a man-made edge to the coast with rock armour as being key characteristics. There would be no significant effects on either landscape or seascape character as a result of the proposed scheme.

In visual terms, visibility of the proposed scheme would be relatively contained. The Zone of Visual Influence for the proposed scheme would extend across the western part of Horton's Nose, where upgrades to the existing coast path and pedestrian crossing would be visible; along the coast to the edge of the closest edge of development, with occasional areas extending slightly further into the development where there are areas of open space adjacent to the coast path; a wider area at Kimmel Dunes Nature Reserve where there is no built development; and visibility to the south west would not extend beyond the northern extension of Happy Days Caravan Park, except during construction when the temporary construction compound at the south western edge of the proposed scheme would be visible.

In most views, the proposed scheme would not appear out of character with the existing coastline. For much of the Zone of Visual Influence views would be largely unchanged or any changes would be very minor elements and entirely in keeping with the existing views. Elements such as the enhancements to The Promenade Car Park, the introduction of the parklets, shelters and toilet block, will be localised changes and will provide enhancements both the provision of facilities and views. The widening of the coast path and increase in height of the sea wall, along with the higher sea gate and changes to the beach accesses would also be visible, but would be barely perceivable as a change once constructed. The increase in height of the sea wall would still allow views over it to the sea and beach. The additional areas of rock armour would change some views, but would be in keeping with existing views along this stretch of coast. There would be no significant effects on either landscape or seascape character as a result of the proposed scheme.

6 Coastal Processes

6.1 Baseline Conditions

The key interest areas for this chapter are:

- Hydrodynamics (wave climate and tidal regime)
- Sediment dynamics and transport
- Coastal geomorphology

The assessment of coastal processes was undertaken through the use of a range of source material, including but not limited to the following:

- North West England and North Wales Shoreline Management Plan 2: Main SMP2 Document;³⁹
- North West England and North Wales Shoreline Management Plan 2: Appendix C – Baseline Process Understanding;⁴⁰
- DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes;⁴¹
- Kinnel Bay to Llanddulas Beach – Detailed Design Stage: Review of beach profiles (1997 – 2020);⁴²
- Channel Coastal Observatory⁴³, referred to herein as CCO, and;
- Remote assessment via site photographs, historic maps, LiDAR imagery⁴⁴, aerial imagery⁴⁵, geological maps⁴⁶ and engineering design plans⁴⁷.

6.2 Limitations

The data collated within this chapter has been obtained by undertaking a desk-based assessment of coastal processes and the potential impacts of the proposed defence scheme on those identified process mechanisms. This assessment has drawn upon existing published documentation including grey and academic literature sources and previously published reports relevant to the study site. Given the uncertainty associated with predicting natural change in the coastal environment predictions of anticipated changes in beach morphology and geomorphic processes cannot be stated definitively but are estimated using the best available data and specialist knowledge and expertise.

6.3 Site context

The second iteration of the Shoreline Management Plan (SMP2) for North-west England and North Wales was published in 2011. It covers the coastal zone which extends between Great Ormes Head in North Wales and the Scottish Borders. This area, known as Cell 11, is subdivided into cells with Sub-cell 11a, stretching from Great Ormes Head to Southport Pier which includes the Clwyd, Dee and Mersey Estuaries.

³⁹ Halcrow Group Limited (2011). North West & North Wales Coastal Group. North West England and North Wales Shoreline Management Plan 2: Main SMP2 Document

⁴⁰ Halcrow Group Limited (2011). North West & North Wales Coastal Group. North West England and North Wales Shoreline Management Plan 2: Appendix C – Baseline Process Understanding

⁴¹ British Geological Survey (2005) DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes. Continental Shelf and Margins Commissioned Report CR/05/057

⁴² HR Wallingford (2021). Kinnel Bay to Llanddulas Beach – Detailed Design Stage: Review of beach profiles

⁴³ Channel Coastal Observatory (2022). Realtime data – Rhyl Flats. Data accessed via:

<https://coastalmonitoring.org/realtimedata/?chart=100&tab=waves>

⁴⁴ National Library of Scotland (2022). Data accessed via: <https://maps.nls.uk/>

⁴⁵ Google Earth Pro (2022). Llanddulas to Kinnel Bay area – date range 1985 to 2022.

⁴⁶ British Geological Survey (2022). British Geological Survey – Geology Viewer. Data accessed via:

https://geologyviewer.bgs.ac.uk/?_ga=2.232864214.919077300.1664180314-1446653846.1664180314

⁴⁷ Amey Consulting (2022). Detailed design general arrangement drawings - Llanddulas to Kinnel Bay Coastal Improvements

The Kinmel Bay Scheme falls within this sub-cell which is further divided into multiple cells based on linked processes. The coastal zone incorporating the Kinmel Bay Scheme is Sediment Sub-cell 11a.2 (Figure 6-1).

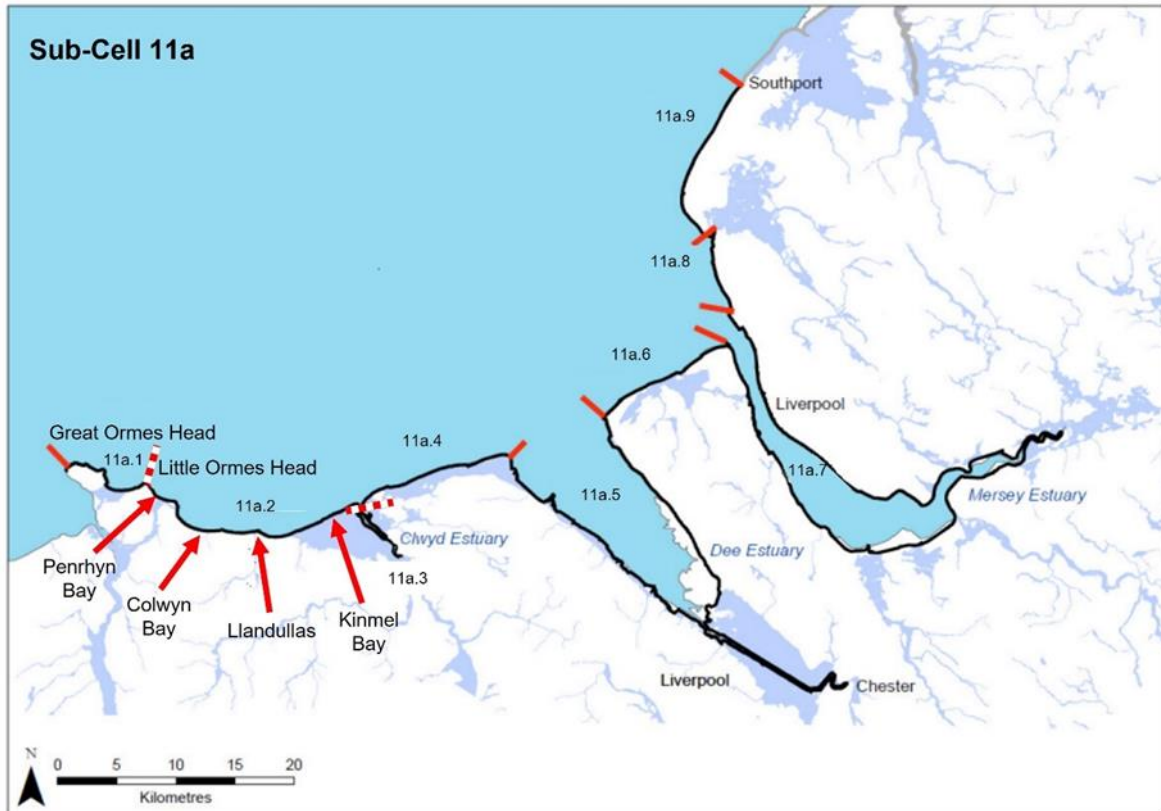


Figure 6-1: Overview map of Sub-Cell 11a with the western and eastern boundaries of Sediment Sub-cell 11a.2 recorded as the red and white hashed lines. Key locations including Kinmel Bay are also identified.

The coastal area that incorporates Towyn and Kinmel Bay is relatively low-lying in comparison to the western section of the sub-cell, thus making it more susceptible to coastal inundation in response to future rises in sea level. However, the coastal frontage is protected against long-period oceanic swell waves, due to its location within the Irish Sea (Figure 6-3). Dominant wave conditions resulting from the prevailing winds and available fetch lengths occur mainly from the north-west, resulting in predominantly high wave angle conditions along the north-facing coast. The combination of tide and wave conditions has resulted in the formation of wide beaches comprised of a shingle backshore and sandy foreshore.

There are a number of existing coastal defence interventions within the wider sub-cell that provide protection against wave overtopping and coastal flooding. These range from an existing rock revetment and timber groynes in the west of the sub-cell, outside of the scheme boundary at Llanddulas Beach, and a series of rock revetments that are located along the coastal frontage between Belgrano Beach and Kinmel Bay in the east. Under a "Do Nothing" scenario these defences are given a residual life of between <20 – 50 years.⁴⁸

The area of the proposed scheme lies adjacent to the Liverpool Bay Special Protection Area (SPA), site code - UK9020294. The SPA area covers 252,757.73 ha and extends approximately 17.5 km from the coastal frontage of Llanddulas and Kinmel Bay and lies in both English and Welsh territorial waters. The site qualifies as an SPA under The Birds

⁴⁸ North West England and North Wales SMP2 Appendix C, Section C4 - B – Baseline Processes – Little Orme to Point of Ayr

Directive (2009/147/EC) for regularly supporting breeding Common and Little Terns and overwintering Red-throated Divers. The site also forms part of the Natura 2000 network.

The Water Watch Wales website identifies the proposed scheme lies within the 'North Wales coastal waterbody' (WFD Ref: GB641011650000) and the 'Clwyd Permo-Triassic Sandstone' groundwater waterbody (WFD Ref: GB41001G202100).

The North Wales coastal waterbody encompasses a 45 km stretch of the North Wales coast from Great Ormes Head to the Wales/England border, equating to an area of 146.25 km². The waterbody is designated as a Heavily Modified Waterbody (HMWB) due to modification associated with coastal protection. The waterbody is currently assessed as having an overall status of "Moderate". The driving elements for not achieving good are:

- Mercury, and its compounds - confirmed as arising from diffuse pollution from contaminated bed sediments and atmospheric deposition.
- Phytoplankton blooms - arising from an unknown pollution source (currently under investigation).

The Clwyd Triassic Sandstone groundwater body spans a broad area along the North Wales Coast, from between Colwyn Bay and Kinmel to Prestatyn, and south to Llysfas. It encompasses an area of 237.32 km² in size. The waterbody has a quantitative status of "Good" and a chemical status of "Good", giving it an overall status of "Good".

There is one designated bathing water located within the immediate area of the scheme at Kinmel Bay (Sandy Cove). The status of this bathing water is assigned under the Bathing Water Directive 2006/7/EC:

- Kinmel Bay (Sandy Cove) - (BWD Ref: GB40400). The bathing water was designated in 1988 and was rated as "Good" for the 2021 bathing season (May – September). Issues have been highlighted at this location relating to short term pollution arising following periods of heavy rainfall when faecal contaminants wash into the sea from livestock, sewage and urban drainage via local rivers and streams. At Kinmel Bay there were a total of 25 warnings of a pollution risk forecast during the 2021 bathing water season. There is one identified origin of point source pollution surrounding the sampling location, a storm water overflow. Finalised data and the associated BWD status relating to the 2022 bathing water season is yet to be published.

6.4 Tidal Regime

The coast of North Wales has a semi-diurnal tidal cycle which is the dominant physical process within the wider Irish Sea. The coastline incorporating Kinmel Bay is subject to a macrotidal regime whereby the mean spring tidal range is approximately 7.5 m, the mean neap tidal range is 3.9 m, as obtained from nearby tidal data recorded at Rhyl 1.5 km northeast of Kinmel Bay (Table 6-1).

Table 6-1: Astronomical tide levels at Rhyl

Parameter	Tide Level (mAOD)
Highest Astronomical Tide (HAT)	5.03
Mean High Water Springs (MHWS)	3.97
Mean High Water Neaps (MHWN)	2.17
Mean Sea Level (MSL)	0.22
Mean Low Water Neaps (MLWN)	-1.7

Mean Low Water Springs (MHWS)	-3.5
Lowest Astronomical Tide (LAT)	-4.56

Admiralty TotalTide (ATT) software has been used to extract the underlying astronomical tidal diamond data in the vicinity of the study area. Values relate to locations approximately 15 km north of the Kinmel Bay coastal frontage (Figure 6-2).

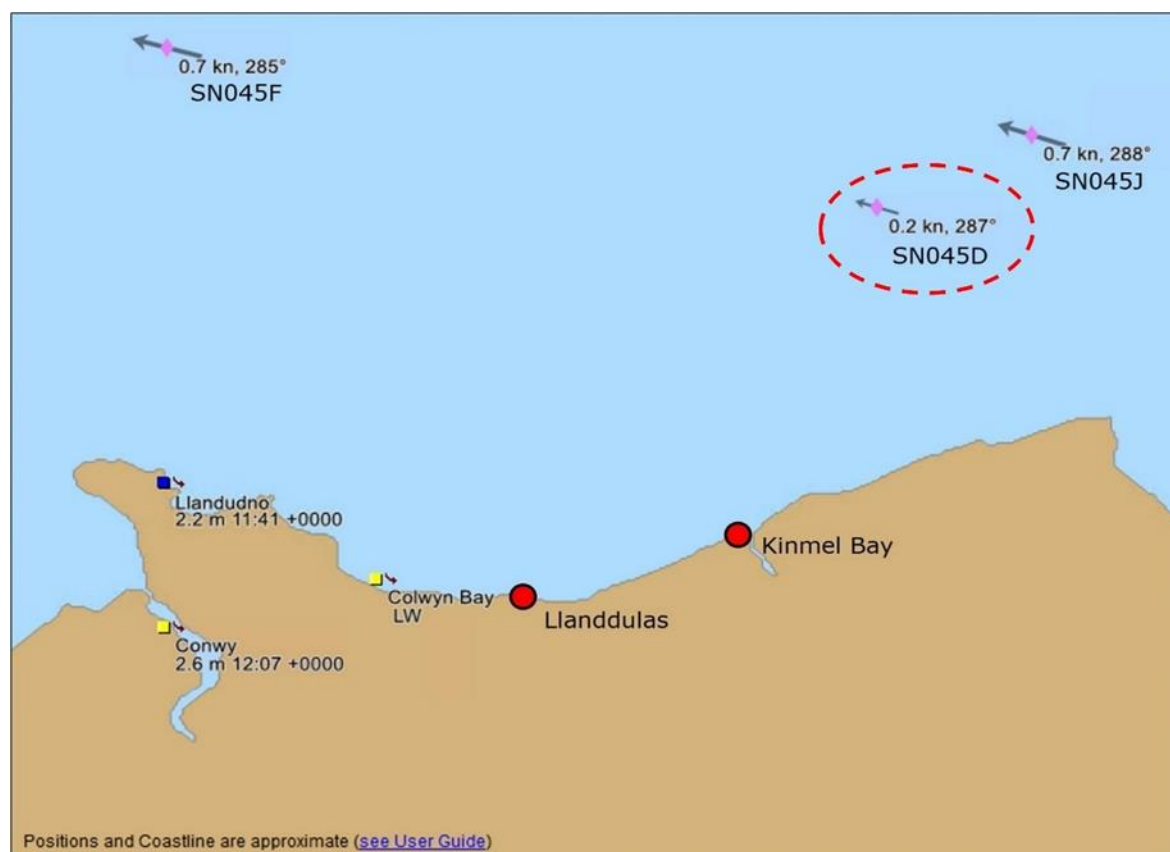


Figure 6-2: Tidal diamond data locations; tidal conditions derived from highlighted datapoint, SN045D (Source: Admiralty TotalTide)

Astronomical tidal diamond data obtained from the nearest datapoint (SN045D) is shown in Table 2. These data indicate a general west to east (flood), and east to west (ebb) tidal stream. Maximum flow rates on the flood tide are recorded 3 hours prior to High Water (HW) with typical values of 1.4 kn (spring tide) and 0.8 kn (neap tide). This is followed by a period of slack water (0.1/0.2 kn) at HW, prior to the ebb tide which occurs in a near westerly direction. Ebb peak tidal flows occur 2 hours after HW with typical values of 1.4 kn (spring tide) and 0.8 kn (neap tide). Additional tidal diamond data retrieved from ATT is available in the Appendix D.1.

Table 6-2: Typical tidal conditions as derived from the tidal diamond data - for SN047D (Source: Admiralty TotalTide)

Time during tidal cycle	Direction (°)	Spring tide flow rate (kn)	Neap tide flow rate (kn)
-06 h	057°	0.3	0.2
-05 h	088°	0.7	0.4
-04 h	100°	1.2	0.7
-03 h	104°	1.4	0.8
-02 h	092°	0.9	0.5
01 h	079°	0.4	0.1
High Water	289°	0.2	0.1
01 h	268°	1.1	0.6
02 h	270°	1.4	0.8
03 h	271°	1.1	0.6
04 h	275°	0.7	0.3
05 h	313°	0.4	0.2
06 h	020°	0.2	0.1

Tidal flows propagate into the Irish Sea from the Atlantic Ocean through the North Channel between the coasts of Northern Ireland and Scotland and from the south via St. George's Channel, between the coasts of The Republic of Ireland and Wales (Figure 6-3). The tidal flow velocities reportedly increase as volumes of water are directed through narrow inlets, between and around headlands.⁴⁹ Most notably, in the vicinity of sub-cell 11a.2 around the Isle of Anglesey. The tidal currents within sub-cell 11a.2 are relatively weak compared with those around the Isle of Anglesey. This corresponds with the low mean bed stress and limited sediment disturbance reported by Polton et al, (2011). The rocky outcrops of Great Ormes Head and Little Ormes Head provide a protective function to the area eastward by reducing the level of exposure to both tidal and wave forces. The tidal flow values suggest that whilst tidal influence dominates the wider Irish Sea within proximity to the coast these processes diminish.

⁴⁹ Polton, J. A., Palmer, M. R., & Howarth, M. J. (2011). Physical and dynamical oceanography of Liverpool Bay. *Ocean Dynamics*, 61(9), 1421-1439.

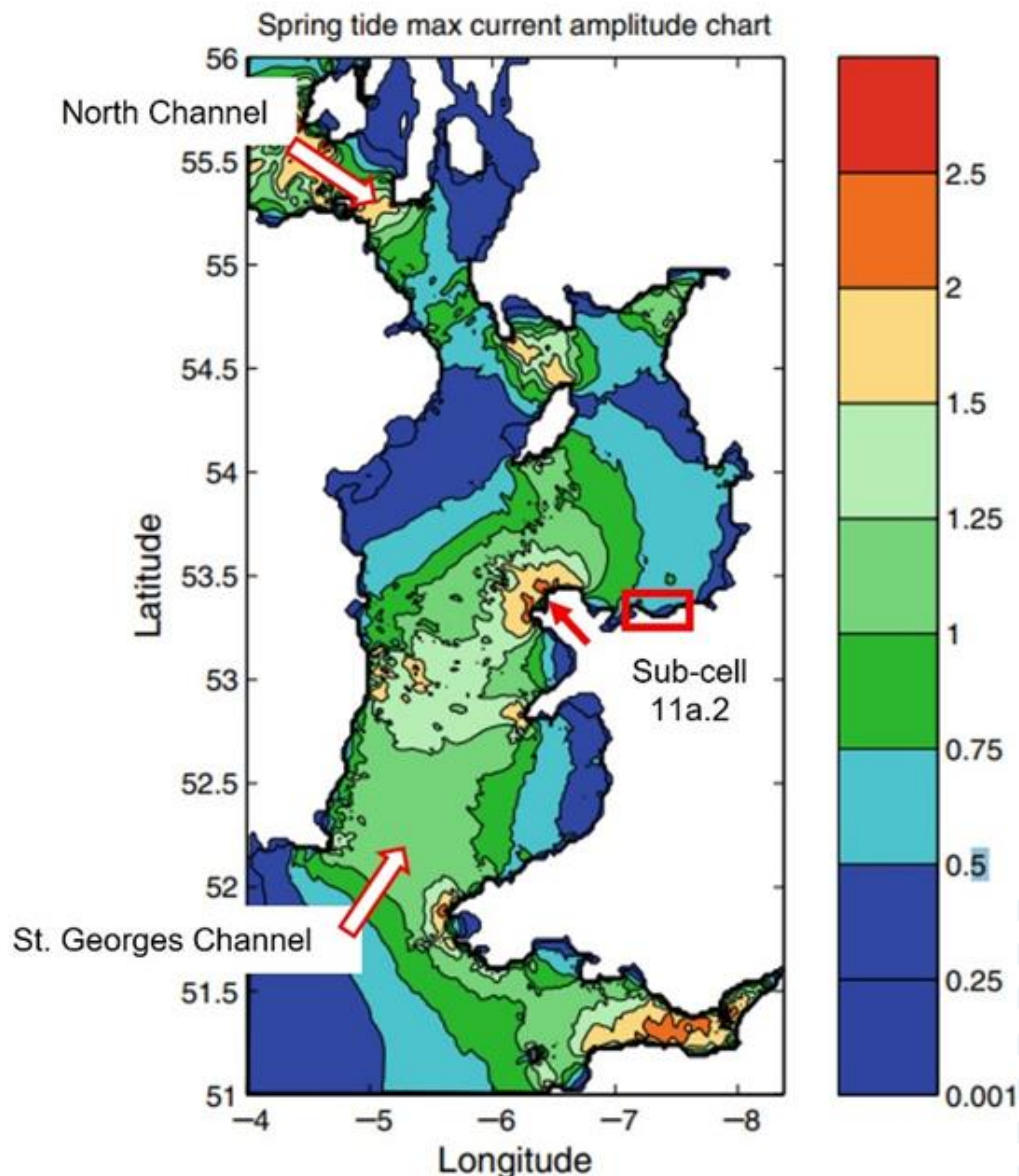


Figure 6-3: Depth averaged maximum currents on an average spring tide (in m/s). Sub-cell 11a.2 is highlighted, and the Isle of Anglesey is identified by the red arrow, figure adapted from Polton et al. (2011).

6.5 Wave Climate

Wave action is a complex process controlled by a range of factors that influence coastal process and shape the landscape. The way these factors combine determines the magnitude of any wave induced flood impacts, including the overtopping of coastal structures. Waves generated in deep water propagate towards land. On entering the nearshore the shallower bathymetry transforms wave processes. This is initiated via the interaction with the seafloor and coastal structures leading to wave shoaling, diffraction, refraction and breaking. The consequence of these processes is that the properties of the inshore waves differ to those generated in deeper water. It is these nearshore waves that directly interact with coastal defences and lead to wave overtopping and incidence of coastal inundation. The magnitude of the waves arriving at the coast depends on the duration and distance across which the wind has blown, the fetch, which results in generation of swell waves.

The Irish Sea is semi-enclosed, meaning wave activity is fetch-limited which impedes the generation of swell waves. However, swell waves do occur, although generally only from the south via St. George's Channel and the northwest from the North Channel (Figure 6-3). The paucity of low frequency, high magnitude swell generated waves means that locally generated, lower magnitude wind waves are more frequent.

The morphology of the coastline within, and to the west of sub-cell 11a.2 also influences wave climate and the level of exposure to wave-generated forces. There are a series of rocky outcrops, Great Ormes Head and Little Ormes Head, that provide partial shelter from long-period swell waves. Penrhyn and Colwyn Bay are located in lee of these rocky protrusions and are afforded a greater level of protection than the Kinnel Bay frontage which is more open and exposed to the incident wave angle.

Wave data have been derived from parameters recorded by the Datawell Directional Waverider Mk III buoy at Rhyl Flats (Table 6-3). The wave buoy forms part of the Channel Coastal Observatory (CCO) National Network of Regional Monitoring Programmes located around the English and Welsh coastline. The wave buoy is located within Liverpool Bay, at Rhyl Flats, approximately 10 km north west of Kinnel Bay in an approximate water depth of 10 m.

Table 6-3: Wave parameters - mean monthly averages recorded from Rhyl Flats (2007 – 2022). (Source: Channel Coastal Observatory).

Month	Hs (m)	Direction (°)	Tp (s)
January	0.86	253	4.8
February	0.80	244	5.0
March	0.68	236	4.5
April	0.56	221	4.1
May	0.53	228	3.9
June	0.50	238	3.8
July	0.50	253	3.7
August	0.57	259	3.9
September	0.66	252	4.2
October	0.75	236	4.4
November	0.88	248	4.7
December	0.89	253	4.9

The significant wave height (Hs) is defined as the average wave height of the highest one-third of recorded waves. The reported wave climate at Rhyl Flats is naturally variable which reflects seasonal influence. Larger waves occur during autumn and winter months, compared with reduced wave heights associated with spring and summer. A maximum wave height of 4.65 m was recorded at Rhyl Flats on 23rd February 2017. Storm activity associated with Storm Eunice resulted in maximum wave heights of 4.5 m recorded on 21st February 2022. Wave periods also reflect the same seasonal variation. The dominant wave direction occurs from the northwest which corresponds with the mean and maximum significant wave heights and is supported by the accompanying wave rose directional data (Figure 6-4). The wave data from Rhyl indicates a north-westerly wave direction which corresponds with the area of greatest fetch and the generation of swell waves from the North Channel. The dominant easterly/westerly tidal flow and the north-westerly wave direction result in net littoral drift of sediment within the sub-cell from west to east.

The orientation of the coastline and the relative shelter afforded by the coastal geological forms and offshore sandbanks reduces wave energy at the coast. These waves propagate across the wider bay area and lose energy as they approach the shore and interact with the seafloor. The gentle gradient of the beach foreshore at Kinmel Bay influences wave transformation producing spilling breaker wave types.

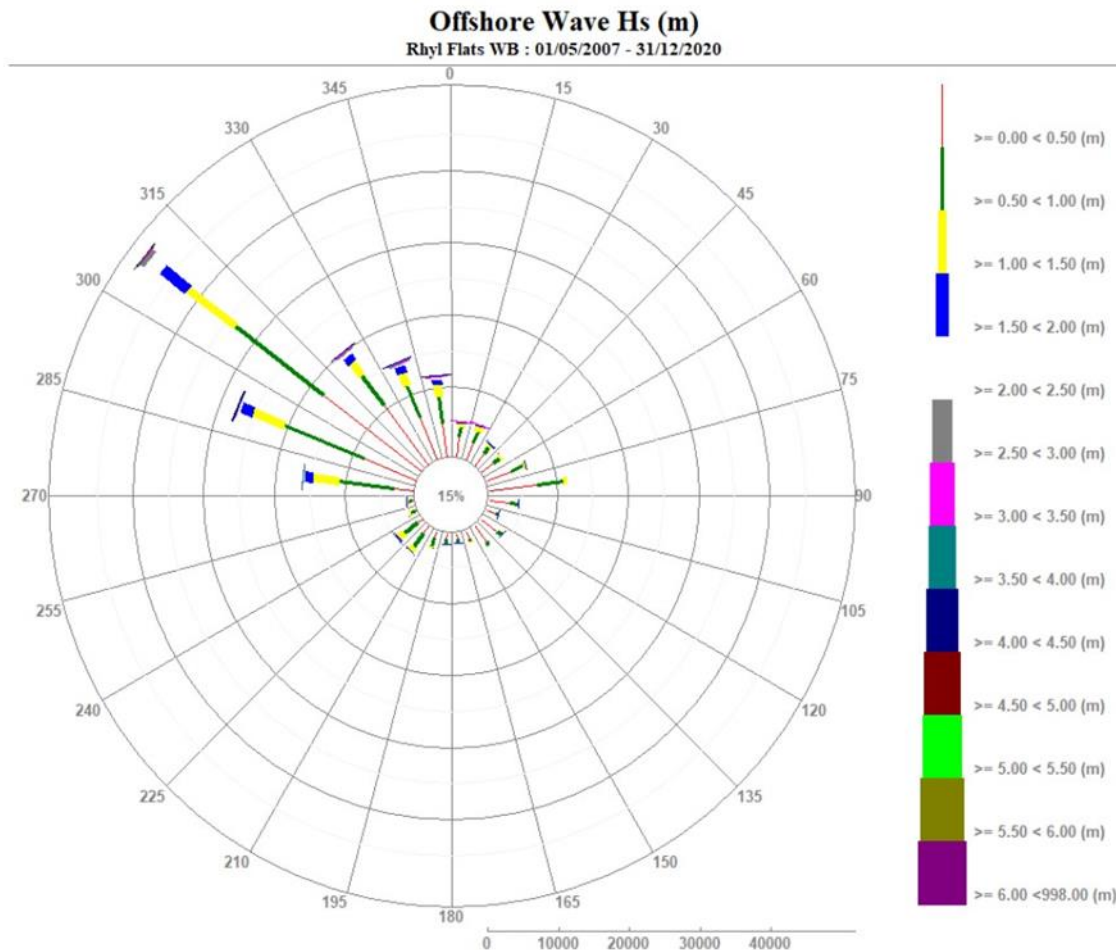


Figure 6-4: Wave rose diagrams of significant wave height (Hs) by wave direction (°) obtained from the Rhyl Flats wave buoy (2007 – 2020). (Source: Channel Coastal Observatory)

6.6 Coastal Geomorphology

The coastal zone within sub-cell 11a.2 displays two distinct morphologies. In the west, Penrhyn and Colwyn Bays are derived from the erosion of the raised till cliffs, alluvial sands and gravels and the underlying sandstone bedrock through which the River Ganol drains into Penrhyn Bay. Moving eastwards to Llanddulas and beyond the topography changes to one dominated by low-lying terrain fronted by sand and shingle barrier beaches. The low elevation of this coastal section makes it vulnerable to wave inundation and flooding, as witnessed in 1990 and during the winter storms of 2013/2014. The likelihood of such occurrences is expected to increase due to rising sea levels and the anticipated increase in storm frequency and intensity arising from climate change.⁵⁰

⁵⁰ Berg, P., Moseley, C., & Haerter, J. O. (2013). Strong increase in convective precipitation in response to higher temperatures. *Nature Geoscience*, 6(3): 181.

The western boundary of sub-cell 11a.2 is defined by Little Ormes Head, a resistant Carboniferous limestone outcrop that influences the level of exposure of tidal and wave activity to the east. This landform acts as a natural obstruction impeding littoral drift. The eastern boundary at Kinmel Bay is defined by the River Clwyd and the estuary as it enters the Liverpool Bay. A key feature of this fluvial input is the training wall that acts as a breakwater to the east. This man-made feature has instigated perturbations to coastal processes in the form of reducing sediment connectivity between adjacent sub-cells and is seen as a point of termination with regards the supply of coarse gravels that are absent on the beaches to the east of this point. Beach sediments supplied from the west alter in size along the Llanddulas to Kinmel Bay frontage with coarse material (shingle) diminishing eastward and fine sediment (sand) beaches dominating to the east at Kinmel Bay. This reflects a limited supply of coarse sediment arising from extensive coastal protection to the west.

A series of rocky limestone outcrops between Little Ormes Head and Llanddulas are interspersed between softer sandstone and mudstone deposits creating a series of cusped-like bays including Penrhyn Bay, Colwyn Bay and the arcuate embayment that extends from Llanddulas to Kinmel Bay. Both Penrhyn Bay and Colwyn Bay are aligned to the northwest which ensures the bays are protected from the dominant influence of wave and tidal activity. Wave energy is refracted around the headlands and sediment is deposited on the western flanks of the defence structures (e.g., breakwaters and rock armour groynes) within the bays. The coastal frontage at Towyn and Kinmel Bay is aligned more shore normal to incoming wave activity. The east-north-east to west-south-west orientation decreases the net sediment transport rate along the frontage as far as the Clwyd Estuary.⁵¹ The combination of geology, shore orientation and hydrodynamic conditions (wave and tidal) has resulted in the formation of a long and wide beaches along the Llanddulas to Kinmel Bay frontage. At Kinmel, the eastward littoral drift has formed an extensive sand dune system (Kinmel Dunes Local Nature Reserve), much of which is now built upon with a mixed provision of residential properties and holiday caravans. The most easterly section of the dune system remains connected to the beach and is stabilised by well-established vegetation. Management of this area has seen the construction of a network of raised wooden walkways aimed at reducing pedestrian trampling.

The coastline between Towyn and Kinmel Bay is characterised by mixed sand-shingle barrier beaches with the lower shore generally comprising of sand. The deposition and reworking of beach face sediments is organised to present a series of shore parallel shingle ridges that form a reflective barrier to incoming wave activity, this is particularly evident at the coastal frontage at Kinmel Bay.⁵² The frontage at Towyn is characterised by the rock revetment that extends approximately 15 m from the sea wall, giving way to a narrower (10 m wide) accumulation of cobbles and shingle prior to an extensive sandy foreshore.

The wave and tidal conditions dictate that sediment transport occurs from west to east. This is confirmed by the direction of sand wave crests found on the mobile offshore seabed bedforms of Rhyl Flats and Constable Bank.⁵³ However, the presence of natural and artificial barriers impedes the transport process. These take the form of resistant rocky outcrops, the numerous coastal defence structures and outflow from the River Dulas to the west and River Clywd to the east.

In response to the dominant wave and tidal influence fluvial inputs from the River Dulas and Clywd also contribute terrestrial sediments to the sub-cell as well as partially interrupting littoral drift. The rivers flow through semi-rural hinterland prior to reaching the coastal towns of Llanddulas and Kinmel respectively. Flow from the Clywd Estuary cuts through a sandflat at Kinmel and Rhyl creating a physical barrier that influences sediment connectivity. The notable

⁵¹ North West England and North Wales Shoreline Management Plan 2: Appendix C – Baseline Processes

⁵² Lee, M (2005). Investigation of beach levels at Pensarn Shingle Ridge. Conwy County Borough Council. CCW Contract Science Report no. 695

⁵³ DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes Continental Shelf and Margins Commissioned Report CR/05/057.

lack of shingle eastward of the Clywd suggests it is a barrier to the mobilisation of gravels that are found extensively along the Llanddulas, Towyn and Kinmel Bay frontages.

Outflow from the River Dulas and Clywd Estuary are managed by rock armour training walls which channel flow, and entrained sediment into Liverpool Bay. These structures facilitate the accumulation of sediment creating extensive sandflats that extend seaward from the coastline. The sandflat at Kinmel Bay is a rich source of sand-sized sediment to the extensive coastal sandflats at the mouth of the Dee Estuary 15 km east of Kinmel Bay. Aerial imagery indicates this landform extends to the mean low water mark, approximately 700 m from the seawall at Kinmel Bay. The sand accumulation at Kinmel Bay forms part of the more expansive Rhyl Flats, an extensive network of offshore sandbanks and flats upon which an offshore wind farm is located approximately 9 km north of Kinmel Bay. Rhyl Flats is formed in shallow offshore waters (10 – 20 m) and extends west to incorporate Constable Bank, a linear submarine sand spit positioned roughly parallel to the shore. The dominant north-westerly wind-driven currents, waves and tidal processes interact with these submerged features which provide a source of onshore transport of sand-sized sediment at Towyn and Kinmel Bay. They also act to maintain the recirculation of sand sediments within the wider sediment cell.⁵⁴ The offshore sandbanks and flats also have an impact on wave hydrodynamics by exerting influence on the nearshore wave climate. Wave interaction with the subtidal bedform features reduces wave energy at the coast and alters wave patterns within the area.

In response to the development of the coastal towns of sub-cell 11a.2 a series of defence structures have been constructed to protect coastal assets including housing, road and rail infrastructure from coastal flooding. The defences include concrete seawalls (Colwyn and Kinmel Bay), rock armour revetments (Towyn), fishtail groynes (Penrhyn Bay), timber groynes and rock armour groynes (Llanddulas Beach). However, these structures have contributed to sediment deficits in the littoral drift budget leading to a lowering of beach levels via the reduction in sediment supply from the west.⁵⁵ This has subsequently led to a narrowing of the intertidal zone. Interpretation of historic mapping indicates a landward transgression of the low water mark of 65 m between the early 1900's and 1960's. The implication of extensive coastal defence is the increased likelihood of future coastal squeeze, whereby existing levels of protection prevent the natural rollback of coastal landforms in response to rising sea levels and the expected increase in storm frequency and intensity.

The range of artificial defence structures not only interrupts the natural sediment flux but in the case of sea wall defences they eliminate the input of sediment derived from the cliffs, dunes and low-lying areas landward of the walls. This process limitation affects the land-coastal interaction resulting in a lack of additional sediment input altering flux rates. The reduction in sediment at a local-scale leads to starvation of beach-building material which can leave coastal areas exposed to increase risk of inundation during periods of heightened wave activity. Sediment scarcity subsequently becomes a dominant control in beach evolution.

6.7 Beach Profiles

The proposed defence scheme is to be undertaken within two Coastal Management Units (CMU) located along the coastal frontage of Towyn and Kinmel Bay, as identified in Figure 6-5. These locations are described in Section 2.5. Figure 6-5 provides detail regarding the scheme site locations, proposed area of work and beach profile locations.

At an earlier stage in project development, cross-sectional beach profile data was provided to HR Wallingford by Conwy County Borough Council (CCBC) to determine historic changes to beach profile and provide a qualitative assessment of sediment volumes over time. The

⁵⁴ North West England and North Wales Shoreline Management Plan 2: Appendix C – Baseline Processes

⁵⁵ North West England and North Wales Shoreline Management Plan 2.

graphed beach profiles in this work reported have been obtained and further analysed below source data.⁵⁶

Topographic beach profile data was collected in 1998, 2014, 2018 and 2020 and three cross-sectional profiles have been selected to represent the nearest locations relative to the proposed coastal defence scheme along the Towyn and Kinmel Bay frontage, these are indicated by the triangular markers (Figure 6-5). Profiles are interpreted to assess changes in beach morphology over time.

The profile data demonstrates the extent to which coastal processes and anthropogenic influence have altered beach morphology over the period of data collection and can highlight erosion and accretion of sediment at specific site locations. Limitations exist in that the data is derived from a limited number of periodic assessments over a period of 22 years, and therefore the data provides a brief insight of beach conditions at a specific time and location. Furthermore, the dates of the surveys are unknown which limits any assessment of geomorphic modification arising from changes associated with seasonal weather patterns. These data do not necessarily represent historic trends and only allow for a descriptive assessment of beach modification opposed to a quantitative estimation of sediment gains and/or losses along each transect.



Figure 6-5: Site location: the coastal frontage is sub-divided into Coastal Management Units (CMU). Beach profile locations are indicated by triangular markers. Inset: scheme red line boundary and the three proposed coastal defence sites.

6.7.1 CMU3-5B: Towyn Revetment – Rock armour

Data from the Towyn profile is restricted to three date periods (2015, 2018, 2020) which limits historic interpretation (Figure 6-6). However, the data indicates limited change in the supratidal zone above MHWS reflecting the limited exposure to wave action and/or limited movement of the existing rock armour revetment. Beach profiles from within the intertidal zone reflect a change between the different cross-section profiles most notably between 2018 and 2020. Considerable volumes of sediment have been lost from the upper to mid-intertidal zone resulting in beach lowering of over 1 m which may have resulted from wave scour at the

⁵⁶ HR Wallingford (2021). Kinmel Bay to Llanddulas Beach – Detailed design stage. Review of beach profiles. Report to Conwy County Borough Council (CCBC) – Report no. RT003.

base of the rock revetment, progressive drawn down of sediment during wave backwash and/or the formation of an intertidal ridge and runnel system.

The upper intertidal profile remains relatively unchanged between 2015 and 2018 although within the mid-tidal frame considerable accretion has occurred by 2018. The vertical exaggeration of the profile suggests the formation of a sizeable scarp-like feature measuring approximately 1 m in height. However, the topographic change occurs over 5 m indicating a gradual gradient more likely associated with a response to wave activity. The increase in beach volume may have occurred due to the littoral drift of beach recharge material deposited to the west at Llanddulas Tip in August 2015, or from active onshore deposition from offshore sediment sources (e.g., Rhyl Flats and Constable Bank).

There is a notable accumulation of sediment on the lower foreshore between 2018 and 2020. This may indicate that a proportion of sediment losses from the upper beach (2020) are deposited lower on the foreshore due to wave backwash. Alternatively, the increase in beach volume at the lower foreshore may represent a broad ridge adjacent to a longshore runnel which appears to be present between 55 and 90 m (chainage). These ridge and runnel features exert influence on the changing cross-sectional profile of wide, sandy foreshores and may explain periodic accretion and erosion of sediment within the intertidal range. Aerial imagery from 2022 indicates a well-established ridge and runnel morphology at Towyn, whereby deep, longshore troughs, or runnels, are formed within the intertidal zone. The development of the runnel is attributed to the drainage of tidal water. The subsequent incision and removal of sediment leads to the formation of adjacent sand ridges. These features are found in depositional, swash-aligned, fetch-limited locations with a surplus supply of sand and tidal ranges exceeding 3 m.⁵⁷

Coincidentally, aerial imagery from 2022 identifies a runnel measuring approximately 40 m in width that runs parallel to the shore. The red arrows indicate the approximate location of the runnel edges which correspond with the area of erosion during the 2018 – 2020 timeframe. Despite the accumulated sediment in the lower foreshore the overall trend at this location seems to be one of net sediment loss.

⁵⁷ Anthony, E. J., Levoy, F., Monfort, D., & Degryse-Kulkarni, C. (2005). Short-term intertidal bar mobility on a ridge-and-runnel beach, Merlimont, northern France. *Earth Surface Processes and Landforms: The Journal of the British Geomorphological Research Group*, 30(1), 81-93.

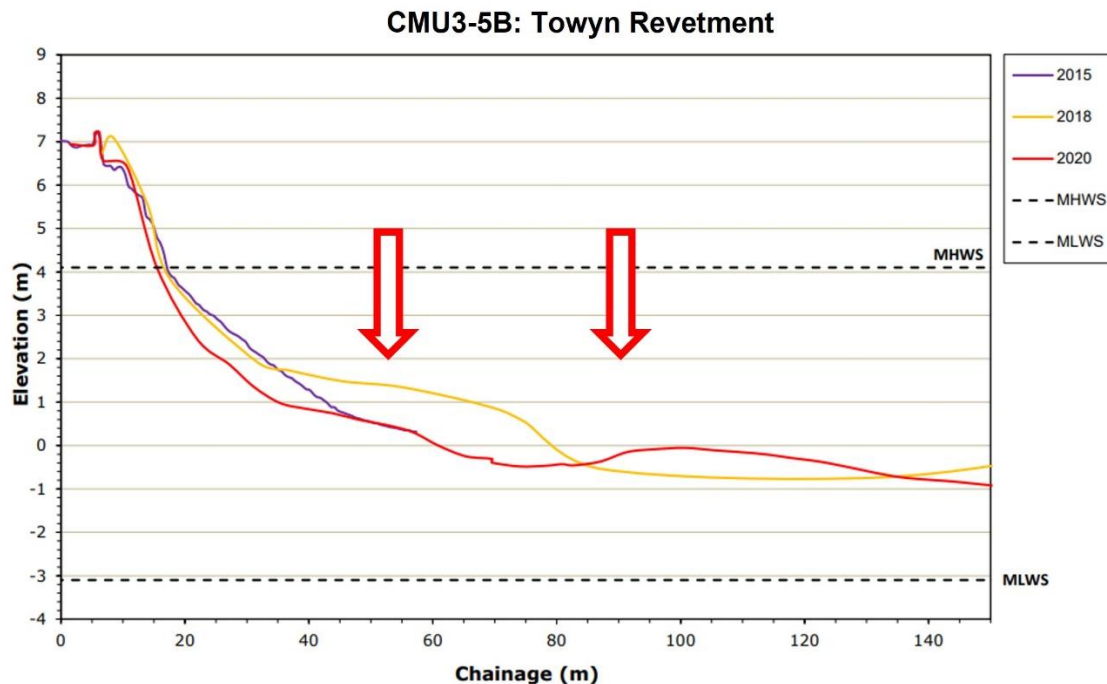


Figure 6-6: Cross-sectional beach profile – Towyn Revetment. Arrows indicate the location of the ridge and runnel landform as identified using 2022 aerial imagery.

6.7.2 CMU3-5C Kinnel Bay

Profile data (Figure 6-7) indicates a periodic change in beach morphology and volume over time. The beach profile of the supratidal area reflects limited change over the monitoring period with volumes remaining relatively unchanged between 2014 and 2020. Conversely, the intertidal zone is characterised by dynamic response to wave and tidal processes as illustrated by the shifting ridge and runnel landforms that pervade the sandy foreshore. The undulating topographic profile is best demonstrated by the 2020 data which shows two distinct runnels that have formed perpendicular to onshore wave/tidal exposure.

The greatest degree of change in profile is evident within the mid-intertidal zone where wave energy is most concentrated over the course of the tidal cycle. There is little evidence to suggest qualitative changes, either erosional or depositional, to beach volumes since 2014. However, sediment volumes appear to have increased relative to the original profile obtained in 1998 suggesting the eastern end of the sub-cell (11a.2) is accreting sediment opposed to suffering from extensive erosion.

The dominant feature of the foreshore profiles are the migratory ridges and runnels. The changing morphology and deformation of these features is often a response to changes in hydrodynamic conditions, e.g., storm wave activity, which flattens intertidal ridges leading to the infilling of adjacent runnels.⁵⁸ This implies a dynamic coastline and suggests the ridge and runnel morphology is ephemeral and cyclical, with migration occurring in response to wave activity within the intertidal range. The large ridge and runnel landforms drain tidal water retained with the mixed gravel sedimentary matrix of the upper beach and act as conduits contributing to the active longshore transport of sand generating localised changes in sediment accumulation altering cross-sectional beach profiles.

⁵⁸ Masselink G. 2004. Formation and evolution of multiple intertidal bars on macrotidal beaches: application of a morphodynamic model. *Coastal Engineering* 51: 713–730.

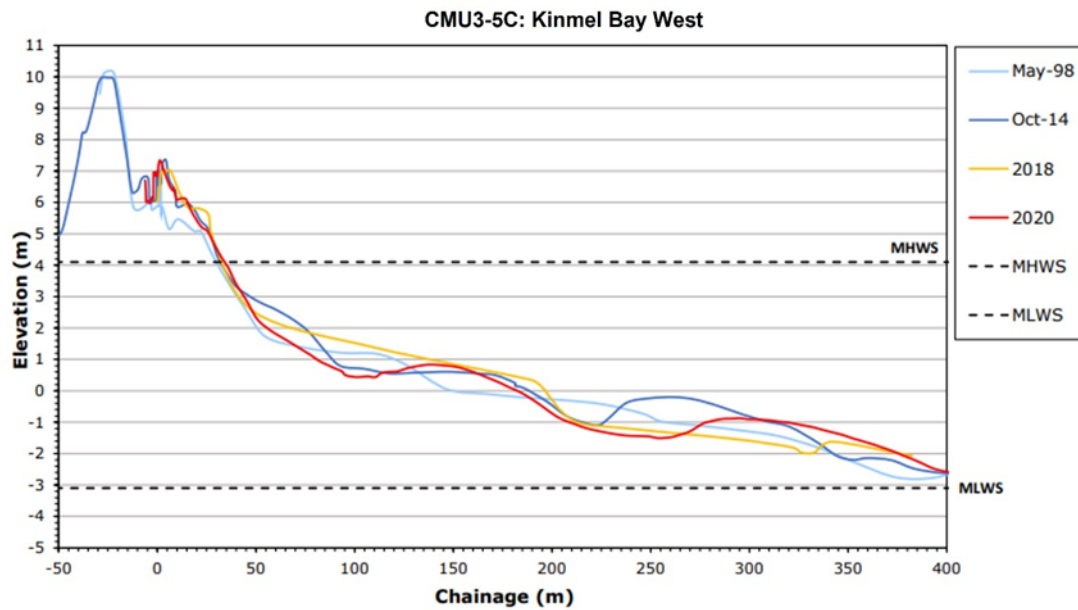


Figure 6-7: Cross-sectional beach profile – Kinnel Bay (West)

Figure 6-8 identifies the ridge and runnel morphology and illustrates the cross-shore extent of these features which stretch hundreds of metres along the sandy foreshore. The image was taken at the approximate location of the above profile, looking towards the eastern end of Kinnel Bay, 20 minutes prior to low water on 9th August 2022. The image reveals two ridge and runnel forms, similar to those recorded in the profile data above. The image also identifies the clear distinction between sediment types found along the frontage, a coarse shingle back shore and sandy foreshore. The exposed foreshore of the intertidal zone highlights the extent to which the tide recedes allowing for a suitable working window within which defence construction can be undertaken.

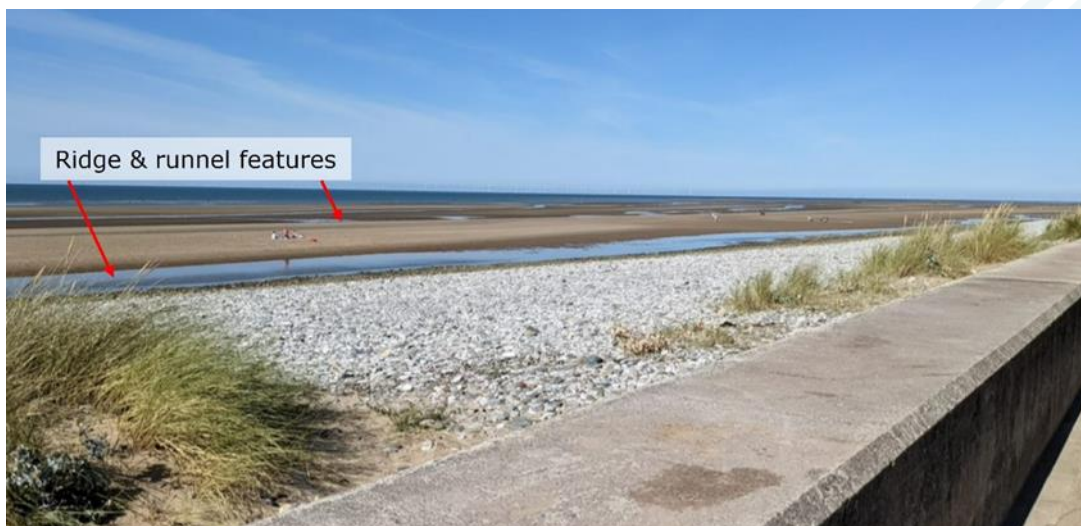


Figure 6-8: Ridge and runnel formation – Kinnel Bay

6.7.3 CMU3-5C: Kinnel Bay (East) – Rock armour

The beach profile (Figure 6-9) indicates considerable change in beach morphology over time suggesting the area is more dynamic and responsive to hydrodynamic conditions than other areas along the coastal frontage. The historic profile data identifies the presence of a

migratory ridge and runnel network as found at other locations to the west. Sediment losses and major changes in beach morphology are evident prior to, and between 2018 and 2020 with the greatest degree of change occurring within the mid-intertidal zone where wave energy is more concentrated throughout the duration of the tidal cycle. The formation of a notable storm ridge crest in the supratidal zone and accreted sediment in the upper intertidal in 2018 suggests a response mechanism associated with storm wave activity. Sediment supply may be attributed to the erosion of material from the beach replenishment that occurred to the west at Llanddulas Tip in August 2015 or from onshore deposition of sediment from offshore sources (e.g., Rhyl Flats and Constable Bank). The removal of this ridge by 2020 may be in response to wave activity and the reworking of sediment.

The area at the eastern end of Kinmel Bay frontage represents a sediment sink. The accumulation of sand, transported by littoral drift, has resulted in the formation of an extensive sandbank that protrudes approximately 700 m seaward from the proposed siting of the rock revetment. The greater degree of modification to the beach profiles at this section is also likely to be attributed to the accumulated sand which is more mobile than the coarse gravels found more extensively to the west.

The temporal change in beach profiles reflects sediment losses and gains within the mid-tidal range. However, whilst this may be attributed to storm wave activity, changes in beach profile are also affected by the runnel network found on the sandy foreshore. Aerial imagery from 2022 identifies this area as being characterised by a series of drainage runnels formed parallel to the shore. A runnel measuring 10 - 15 m wide is located approximately 30 m from the narrow sand dune at the rear of the beach. This corresponds with the trough-like, runnel feature as indicated by the red arrow. A further two, larger runnels measuring 40 - 50 m wide are separated by a sandy raised ridge measuring approximately 100 m, as indicated by the red-line markers. The migration of this sandbank and other similar foreshore landforms relative to the 2020 survey profile represents a key process in the evolution of beach morphology.

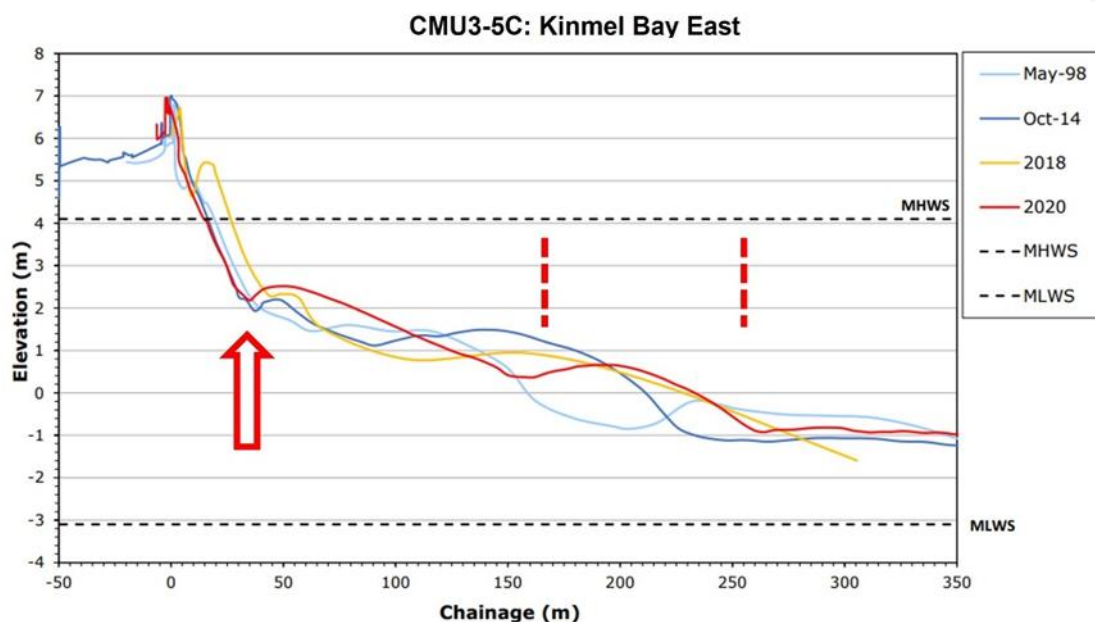


Figure 6-9: Cross-sectional beach profile – Kinmel Bay (East). Arrow indicates the location of a runnel feature, the dashed lines indicate presence of an extensive ridge, as identified using 2022 aerial imagery.

6.7.4 Summary

Collectively the beach profiles reflect cyclical modification of beach morphology over time. However, without quantifiable volumetric data it is not possible to establish the overall sediment losses and/or gains at each location and within the wider sub-cell. The profiles indicate the area is responsive to hydrodynamic conditions, particularly increased wave activity associated with storm events. The combination and interaction between littoral drift, tidal activity and wave action contributes to the accretion and erosion of both coarse (gravel) and fine (sand) grained beach material.

A key mechanism in the modification of beach morphology and subsequent evolution of the beach profiles are the ridge and runnel features found within the intertidal zone along the Kinmel Bay coastline. The migratory foreshore movement of these landforms also acts as a primary driver in sediment supply within the respective CMU's and the wider sub-cell. The migration of these features across the sandy foreshore suggests a dynamic, ephemeral landform created in response to hydrodynamic conditions. The ridges form under low to moderate wave conditions, water draining from the gravel beach at the rear of the profile flows adjacent to the ridges creating runnels that enable drainage and the transfer of sand. Storm waves flatten the ridges which leads to the periodic loss and reformation at different elevations in the intertidal zone relative to wave response (Masselink and Hughes, 2014).⁵⁹

Existing assessments of sediment supply, beach profile data, and aerial imagery suggest a limited input of coarse gravel-sized material within the sub-cell. Moving from west to east along the coastal frontage the shingle ridges become narrower, favouring the wider foreshores and shallow gradients associated with the availability and deposition of finer sand-sized particulates; this is evident at Kinmel Bay by the accumulated sands forming the extensive sandflat. This supports the conclusion of Lee (2005)⁶⁰ that generally, the sedimentary cycle is one of erosion in the west and accretion in the east.

The supply of coarse sediment has reduced since the installation of coastal defences within the west of the sub-cell. The construction of seawalls has eliminated wave-induced erosion of the cliffs to the west, between the Little Orme headland and Llanddulas. Subsequently, the once ready supply of shingle sediment has since been lost. Additional beach defences (groynes/revetments) have further limited sediment supply from the west disrupting the sediment system. The net budget is one where output exceeds input therefore presenting an erosional coastline.

Beach profiles appear to indicate that sediment volumes have decreased during the monitoring period. The loss of sediment and associated beach lowering may be a response to the existing coastal defences that inhibit natural coastal processes. The defence structures fix the shoreline position and prevent the landward migration (roll-back) of the beach in response to wave and tidal conditions. The beach is unable to adjust to a natural state of equilibrium, leading to coastal squeeze, whereby beach widths narrow as sediments are eroded. The sediment transport pathways within this area lead to a sink/deposition eastward towards the dune system at Kinmel Bay. The accumulation of sand deposition at the frontage to Kinmel results in an extensive sandflat.

Long term trends reflect episodic erosion and accretion relating to sediment flux and wider sediment supply beyond the CMU's. The beach profiles demonstrate that the process of erosion and accretion is cyclical, and that beach morphology is subject to periodic modification. The fine-grained sedimentary matrix found along the Towyn to Kinmel Bay foreshore is key to the changing cross-sectional profiles in that it is more responsive to intertidal hydrodynamic processes than the coarser sediments found to the west.

⁵⁹ Masselink, G., Hughes, M., & Knight, J. (2014). Introduction to coastal processes and geomorphology. Routledge.

⁶⁰ Lee, M (2005). Investigation of beach levels at Pensarn Shingle Ridge. Conwy County Borough Council. CCW Contract Science Report no. 695

6.8 Climate change

The impacts of climate change are expected to pose a threat to coastal communities and infrastructure in the future, primarily as a result of the predicted increase in sea level rise. Rising sea levels are the most significant mechanism by which future coastal inundation and flooding is expected to occur.⁶¹ A direct impact of sea level rise is a change in tidal range whereby both low and high-water levels are set to increase beyond contemporary elevations. This is also expected to impact on the extent to which storm surges affect coastal communities and infrastructure particularly when storm events coincide with spring tidal cycles.

Met Office modelled predictions indicate that global sea levels have risen throughout the 20th century and will continue to rise over the coming centuries irrespective of future reductions in greenhouse gas emissions. Modelling of future sea levels based on low and high emission scenarios suggest a mean average sea level change of between approximately 0.4 and 0.7 m by 2100 within the area of the proposed coastal defence scheme at Kinmel Bay. These figures are subject to change depending on a range of variables including thermal expansion, increases in global temperatures and the uncertainty regarding the retreat of ice sheet masses.

To mitigate against the impacts of these predicted rises it is necessary to implement coastal defence schemes that account for and adapt to future changes in sea level and tidal characteristics. Without modifying and constructing defences to protect the coastal frontage at Towyn and Kinmel Bay the likelihood is that coastal flooding will occur more regularly resulting in damage to property and infrastructure as well as posing a threat to life.

Further to the flood defence benefits provided by the scheme ecological enhancements are being incorporated into the revetment structure at Towyn. These include textured rock surface features, e.g., striations, that provide surface topographic complexity that promote favourable habitat substrates for colonization by intertidal species. These modified rock armour boulders are to be placed below MHWS. However, in light of the expected rise in sea level future enhancements can be applied to rock armour higher in the tidal frame as required providing an adaptive strategic approach to future rises in sea level.

6.9 Assessment Methodology & Assessment Criteria

An assessment of the impacts arising from the potential short-term (construction) and long-term (operational) effects of the proposed detailed design on local and regional coastal processes are addressed. These are considered with respect to the Zone of Influence (ZoI) defined by NRW as "the area of the seabed or foreshore that could be affected by the proposed scheme or activity, during both construction and/or operation."⁶²

The assessment of the coastal processes and geomorphology has been undertaken as a desk-based assessment drawing upon a range of sources as described previously, (page 1). A number of potential impacts on coastal processes have been identified from activities associated with defence construction, presented in Table 6-4.

⁶¹ Lowe, J.A., Bernie, D., Bett, P., Bricheno, L., Brown, S., Calvert, D., Clark, R., Eagle, K., Edwards, T., Fosser, G. and Fung, F. (2018). UKCP18 Science Overview Report. Met Office. Reading, UK.

⁶² Natural Resources Wales. 2020. GN041. Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA).

Table 6-4: Sources of potential impacts on coastal processes.

	Material storage on the foreshore	Excavation for defence construction	Sediment mobilisation	Vehicle movements on the foreshore	Modification of natural beach morphology	Modification of beach face gradients
CMU3-5B: Towyn	✓	✓	✓	✓	✓	✓
CMU3-5C (Kinmel Bay West)	✓	✓	✓	✓	✓	✓
CMU3-5C (Kinmel Bay East)	✓	✓	✓	✓	✓	✓

The assessment criteria used to determine the magnitude of impact arising from the scheme and the scale at which those impacts occur is highlighted in Table 6-5 and

Table 6-6. The activities associated with scheme construction and operation have been assessed with regards to their potential to impact on coastal processes; namely, changes to

Sensitivity score	Criteria
High	Coastal processes operating at the scale of Sub Cell 11a (Great Ormes Head to Southport)
Medium	Coastal processes operating at the scale of Sub Cell 11a.2 (Little Ormes Head to the Clwyd Estuary)
Low	Coastal processes operating at the scale of the site or limited to the immediate nearshore zone

nearshore wave climate, beach-sediment exchange (erosion and/or accretion) in the upper shore and sediment transport within the intertidal and nearshore zones. Where the consequences of the changes in coastal processes would impact on specific environmental receptors of value (i.e., ecological receptors), these are addressed as indirect effects in the relevant section of the Environmental Statement.

Table 6-5: Criteria for defining the magnitude of impacts on coastal processes

Magnitude score	Criteria
Major	Major change in the magnitude of the process operating.
Moderate	Moderate change in the magnitude of the process operating.
Minor	Minor change in the magnitude of the process operating.
Negligible / No Change	No perceptible change in the magnitude of the process operating.

Table 6-6: Criteria for defining the sensitivity of coastal processes

Sensitivity score	Criteria
High	Coastal processes operating at the scale of Sub Cell 11a (Great Ormes Head to Southport)
Medium	Coastal processes operating at the scale of Sub Cell 11a.2 (Little Ormes Head to the Clwyd Estuary)
Low	Coastal processes operating at the scale of the site or limited to the immediate nearshore zone

6.10 Potential Impacts & Significant Effects

6.10.1 Construction Impacts

Based on current design drawings the toe of each rock revetment is positioned approximately at, or above mean sea level (MSL) based on recorded beach levels from 2021. The exception is the proposed rock revetment at Towyn whereby the toe of the rock armour extends to MLWN level limiting the available working window at this site. To reduce sediment mobilisation, which may increase turbidity and impact on WFD drivers, excavation and construction at this location will be subject to and planned in accordance with favourable tidal conditions. With construction at Kinnel Bay being limited to the upper tidal frame, impacts associated with the mobilisation of sediment are expected to be reduced. The shallow topography of the foreshore seaward of the proposed scheme will provide a suitable tidal window within which excavation and construction can be undertaken. However, consideration of tidal conditions will be required to maximise the working window which will vary depending on daily tide levels. Continuous reference should be made to tide tables, weather conditions and coastal flood forecasts and construction works planned accordingly. **Negligible impact.**

In advance of, and during construction, rock armour will be temporarily stored and sorted on the beach near to the rock revetment section being constructed. If stored within the tidal frame this material is likely to cause small scale changes to the current flows over and around the rock piles. This increase in turbulence around the rock piles may result in increased localised sediment mobilisation, affecting turbidity, and/or localised scour around the rock piles. The potential rate of erosion will depend on the current velocity and will therefore be dependent on the tidal state, water depth over the rock pile, the presence of waves and the duration that the piles remain on the beach. The turbulence created, and therefore the erosion potential, will also be influenced by the dimensions and shape of the rock pile. It is recommended that the storage of rock armour on the beach/foreshore should, be as high as possible within the tidal boundaries of the site at the time of delivery and storage. Following construction of the rock revetment the beach profile should be reinstated using excavated beach material, no permanent impacts are anticipated. **Negligible impact.**

Storm activity during construction may result in wave interaction encroaching higher in the tidal frame potentially mobilising any temporary stored sediments. The increased volume of material being made available is expected to be negligible during a short-term storm event in comparison to the volume of material mobilised across the tidal sub-cell and is therefore assessed to have a Negligible impact on turbidity of the affected waterbody.

The proposed design allows for repurposing the existing rock armour present on the beach as a secondary filter layer or a lower primary armour layer providing it meets the dimensional requirements outlined in the specification. Revetment infill should be emplaced and profiled to the required levels during low water to restrict transfer of construction material and sediments to the coastal waterbody. Any storage of material for repurposing should be, where possible, restricted to as high as possible within the tidal boundaries of the site relative to the tidal conditions at the time. Surplus beach arisings following excavation are to be used to reinstate the beach profile to the required design specification. **Negligible impact.**

The preferred construction method for excavation, emplacement and arrangement of rock armour is for works to be completed from a 5 m wide temporary running strip placed at the rear of the beach. This will allow excavation to take place reducing the need for plant machinery to access the beach, minimising sediment disturbance. However, the need for plant machinery to access the beach will remain. Access to the beach will be made via existing access points, (i) a 3 m wide concrete slope in lee of the Towyn revetment (SH 97662 80184), (ii) a 4.5 m wide flood gate entrance at Kinnel Bay (SH 98640 80655). Movement of plant machinery along the foreshore is expected to produce tracks in beach sands. The rate of beach material disturbance by vehicles will be dependent on factors including vehicle type, drive type (tracked or wheeled), track/wheel type and dimensions, weight of vehicle (including loads), friction angle between wheels/tracks and the beach and the nature of the

sediment (cohesion and adhesion, etc.). Vehicular movement on the beach should be along designated routes, thereby limiting the potential impacted area and allowing for continued visual monitoring. Any modification of beach levels will be periodically restored using a mixture of the displaced sands and the excavated material from rock revetment construction. It is therefore considered that the short-term implications of plant machinery on beach morphology, local hydrodynamics and sediment regimes will be of a **Negligible impact**.

Impacts relating to sediment dynamics during the construction phase are expected to be limited and small-scale with no long-term detrimental effects. There is no expectation of significant change in beach morphology arising from construction practices, as long as construction works are undertaken in accordance with good practice and the mitigation measures stated herein. Given the position of the proposed revetment design in the upper tidal frame and the mitigation measures stated it is anticipated that the construction phase of the scheme will have **No Significant Effect** on the local hydrodynamic and sediment regimes.

6.10.2 Operation Impacts

Much of the coastal frontage from Towyn to Kinmel Bay is already highly modified with existing coastal defences, e.g., rock revetments and seawalls, currently in place. Subsequently, the natural morphology of the site has already been modified within the footprint of the proposed scheme and beach processes have already adapted to the presence of these structures. The extension and modification to the existing defences is expected to result in an initial period of readjustment in beach morphology. Sediment supply via littoral drift may be altered due to defence encroachment into the intertidal range although this is considered to be of minimal impact as only the Towyn rock revetment is planned to encroach into the intertidal zone. Design specifications indicate the Towyn defence will impinge approximately 25 m into the intertidal zone, relative to the MHWS water level. The revetment at Kinmel Bay is positioned above MHWS, therefore, will only interact with marine-driven processes during periods of particularly high water. The extent to which the revetments extend into the intertidal zone are limited predominantly to the highest tidal ranges and represent a small proportion of the overall beach backshore and foreshore. This is expected to present a **Minor impact** on sediment processes and beach morphology.

Where the defence structure encroaches on the sandy foreshore beach width will be reduced. Where tidal water interacts with the rock armour small-scale changes to current flows over and around the structure which may result in localised scour of beach material at the toe of the defence and from the sandy foreshore. However, the shallow beach foreshore and profile data suggests that some areas within the intertidal zone are depositional as opposed to erosional, and the dissipative function of the rock armour may provide potential for accretion of sediment over time enhancing shoreline progradation. This may offer increased protection at the toe of the structure and further act to dissipate wave energy. The retention of sediment, intercepted by the rock revetment, limits sediment availability, although this is expected to have a minimal impact on sediment flux at a scale beyond the immediate area of work. **Negligible impact**.

The current designed slope gradient of the proposed rock armour revetments ranges from 1:3 to 1:4. The shallow gradient is designed to dissipate wave energy and minimise wave reflection. It is anticipated that this should reduce the potential for the scour of beach material at the toe of the defence and reduce the potential for sediment mobilisation, and associated impacts on beach morphology, water quality (WFD and BWD) and ecology. The proposed location of the rock armour revetments and subsequent construction diagrams indicate that the revetment at Kinmel Bay will be constructed at levels approximate to MSL. The elevation of the defence structure within the tidal frame means the extent to which it encroaches seaward is reduced. Therefore, there will be limited interaction with water flow meaning the impact on the longshore processes of littoral drift, (e.g., sediment retention) is reduced. The revetment at Towyn encroaches seaward of the MLWN level and therefore may

retain sediment by partially interrupting supply from the west. However, this defence structure is in a setback position in lee of the existing protruding, larger Towyn rock revetment, therefore it is expected that the setback location will reduce interaction with longshore sediment processes resulting in a **Negligible impact**.

The encroachment of the rock revetments upon the sandy foreshore and into the intertidal range presents an opportunity for implementing ecological enhancements to the scheme in the form of strategically placed rock armour with textured surface features, including striations within the revetment design structure. Where incorporated into the rock revetment these will provide a suitable substrate for colonization by a range of intertidal species. This is considered to result in a positive impact on marine organisms and therefore present a **Negligible impact**.

The development proposals are expected to have a beneficial impact with regard to current and future coastal flood risk, opposed to any significant negative impact. Furthermore, it is considered that the impacts on coastal processes, hydrodynamic regime and sediment dynamics resulting from the proposed coastal defence scheme and subsequent operation will be negligible. In conjunction with the sensitivity being confined to the immediate site opposed to the Sub-Cell level, the development presents **No Significant Effect** on either the tidal or sediment regimes. Any subsequent alterations are considered to be of low sensitivity with the magnitude of any such impacts anticipated to have a **Negligible impact**.

6.11 Mitigation Measures

In addition to the suggested embedded mitigation measures additional control measures should be applied at Towyn and Kinmel Bay to reduce construction and operational impacts.

- Potential coastal process impacts would be mitigated through the adoption of good construction practices. Construction activities will be conducted under dry conditions during periods of low water to minimise the mobilisation of sediments and construction materials.
- To further reduce the potential for sediment mobilisation within the adjacent waterbody small sections of the toe trench should be excavated within a tidal window with all arisings being placed, where possible, above the MHWS mark.
- Excavation of beach material to formation level to accommodate the rock revetment should be undertaken during dry conditions, i.e., periods of low water when tide levels expose the working areas.
- Ecological enhancements will be incorporated into the scheme in the form of modified rock armour boulders that incorporate textured surface features (e.g., striations). These will provide surface topographic complexity on otherwise unfavourable habitat substrates and promote colonization by intertidal marine species enhancing the ecological benefits of the scheme.
- Beach monitoring (e.g., topographic surveys) of the area is already undertaken on an annual basis along the coastal frontage to record periodic changes in beach morphology. It is recommended that the current programme of monitoring continues, post-construction, at the same/similar time each year to identify changes in beach slope gradient and elevation. Monitoring of beach gradients in front of the defence structures at Towyn and Kinmel Bay will provide valuable data on the morphological response to the implemented flood defence measures and insight to any potential impacts.
- All work schedules should be assessed two weeks in advance to confirm compliance with the stated mitigation measures. Works should cease during storm events, where increased wave activity could mobilise sediments and present hazardous working conditions.

6.12 Residual Effects

Accounting for projections in sea level rise due to climate change it is expected that both Towyn and Kinmel Bay will be subject to coastal squeeze in the future. The existing defences and subsequent proposed designs to protect against wave overtopping and flooding will prevent the beach from naturally adapting to rising sea levels by migrating landward. This is expected to result in a reduction in beach width over time. The timescales for such impacts are not yet known and will reflect external factors beyond the scope of this scheme. However, future monitoring of beach levels, as proposed herein, is expected to provide insight to any such modifications.

Cumulative effects arising from the proposed scheme are expected from the loss of habitat by placement of rock armour over intertidal habitats. However, the rock armour structures will provide refuge and habitat for a range of intertidal species which is considered beneficial. The use of strategically placed modified rock armour boulders within the intertidal zone will also provide additional suitable habitat for intertidal species.

Impacts relating to sediment dynamics at Towyn and Kinmel Bay during the construction phase are expected to be limited and small-scale with no long-term detrimental effects. There is not expected to be any significant change in beach morphology arising from construction practices, as long as they are undertaken in accordance with good construction practices and the stated mitigation measures.

Post construction, long-term impacts, on sedimentary processes are not fully known. However, the shallow gradient of the beach foreshore suggests sediment fluxes favour deposition and accumulation of sediments opposed to erosion and extensive loss of beach-forming material. This is particularly evident at Kinmel Bay East and West. Placement of the rock armour is not expected to alter that ongoing process significantly, and no impacts are anticipated outside the nearshore zone and proposed site boundaries.

The proposals are considered to have no significant residual effect on wider coastal processes and geomorphology. Any alterations to the hydrodynamic and sediment regime during construction and operation are considered to be negligible and confined within the extent of the immediate zone of influence as opposed to operating at the scale of Sub Cell 11a.2 (Little Ormes Head to the Clwyd Estuary) and/or Sub Cell 11a (Great Ormes Head to Southport).

There is predicted to be no significant effect on the sediment budget and on beach morphology arising from the Kinmel Bay Scheme. Any impacts on beach habitat, including damage and disturbance during construction, are expected to be temporary in nature and therefore not significant. The proposed scheme will have a positive effect on flood risk considerably reducing the likelihood of coastal flooding in the future.

The localised nature of the anticipated disturbance to sediments is not expected to have any immediate, or long-term impacts on WFD status and/or effect the current Bathing Water status which is more readily impacted by urban and wastewater discharges. Similarly, ecological receptors, e.g., Liverpool Bay are not considered to be impacted by the limited scale of disturbance, either during construction, or subsequent operation. This is outlined in the Water Framework Directive Assessment, found in Appendix E.1.

6.13 Cumulative Effects

Associated impacts from nearby coastal defence works have also been considered as a means of addressing the cumulative effects. Phase 2 of the Colwyn Bay Waterfront Project is an ongoing project being undertaken approximately 15 km west of the Towyn and Kinmel Bay scheme. The Colwyn Bay scheme includes the construction of coastal defence structures, remedial works and beach recharge as detailed below:

- Seawall repairs – to include re-pointing, filling of voids and grouting;

- Terminal groyne works – to include the removal of the three existing rock groynes that front the promenade. This material is to be re-used to modify the existing Rhos-on-Sea Harbour terminal rock groyne.
- Beach Recharge – importation and placement of approximately 1,000,000 t of dredged sand material. This is to be placed along the beach front south of the Rhos-on-Sea terminal groyne to West Promenade.

The publicly available Environmental Statement for the Colwyn Bay scheme states that the six-month construction period is expected to be completed in June 2023.⁶³ Given the construction phase for the Kinnel Bay scheme is expected to commence in June 2023 there will not be any impacts relating to the construction phases of the respective schemes running concurrently.

The completed works at Colwyn Bay are not expected to have a detrimental impact on the coastal scheme at Kinnel Bay. Although the construction of a terminal groyne at Rhos-on-Sea Harbour may be seen as an impediment to sediment transport this is to be constructed as a modification to the existing groyne which has already modified coastal processes within the local area. Material deposited as part of the beach recharge is expected to be mobilised over time. Owing to the eastward littoral drift this sediment is predicted to feed beaches to the east, including at Towyn and Kinnel Bay, thus providing a beneficial impact on the Kinnel Bay scheme and wider sediment supply within the sub-cell.

Further works are being undertaken at Colwyn Bay as part of the Old Colwyn Coastal Defence scheme. This covers a 1.2 km stretch of coastline from Porth Eirias in the west to Splash Point (Old Colwyn Arches) in the east, approximately 12 km from the Kinnel Bay scheme. The Old Colwyn scheme consists of bolstering the existing rock revetment that protects the seawall. The works are being completed in phases; to date the first 370 m of the rock revetment has been completed, with a further 350 m to follow from Summer 2022. The anticipated completion date for this phase of the works is August 2023. The remaining stretch is awaiting the necessary funding. Once completed there is potential for mobile sediment to be retained by the rock revetment as it encroaches into the intertidal zone. However, the impacts arising from the scheme are expected to be minimal based on the size of the works relative to the wider coastal sub-cell. There will also be limited impacts from the works running concurrently. Given the scheduled commencement/completion dates there is only likely to be an overlap of a few months between completion of the current Old Colwyn phase (August 2023) and commencement of the Kinnel Bay scheme (June 2023).

Additional coastal defence works are being undertaken west of Colwyn Bay. These are (i) the Llandudno Coastal Defence Improvements and; (ii) the Penrhyn Bay Coastal Defence Improvements. The proposed work being undertaken as part of these schemes are yet to be fully finalised however, the Llandudno scheme proposes a number of defence options across two locations. Firstly, the West Shore, located west of Great Ormes Head outside Sub Cell 11, approximately 32 km from Kinnel Bay. Secondly, the North Shore which is located in Sub Cell 11a.1, approximately 22 km west of Kinnel Bay. The proposed works at the West Shore include a range of options including periodic beach nourishment, seawall construction, dune regeneration, breakwater removal, rock placement and the inclusion of sand traps. The frontage wide options on the North Shore include the use of breakwaters, groynes and beach nourishment. The full details of the scheme are yet to be finalised however, as of August 2022 the Welsh Government advised that the proposed beach nourishment option on the North Shore cannot be funded via the Coastal Risk Management Programme (CRMP). These works are expected to be completed by May 2024.

The Penrhyn Bay Coastal Defence Improvements are proposed to include an offshore T-shaped breakwater, extending 100 m into the embayment and extending 90 m in width between two existing groynes, an increase to the crest level of the existing eastern

⁶³ Mott MacDonald (2022). Colwyn Bay Waterfront Project Phase 2b: Environmental Statement, Volume 1 Main Text.

breakwater groyne and beach recharge comprising approximately 55,000 m³ of shingle to be deposited in front of the existing seawall. These works are expected to be completed by October 2023.

The construction of extended breakwaters, rock revetments and groynes may act to retain sediment from the wider sub-cell that may be detrimental to the frontages at Towyn and Kinnel Bay. However, a proportion of the proposed beach recharge material may migrate beyond the footprint of the respective schemes providing beach building material to those beaches located to the east, including Towyn and Kinnel Bay.

7 Hydrology and Hydrogeology

7.1 Introduction

This chapter describes the existing coastal environment in relation to hydrology and hydrogeology and assesses the potential impacts of the construction, operation and maintenance / decommissioning (where practical) of the proposed Kinmel Bay Coastal Defence Improvements on the water environment including on hydrology (surface water quality, levels and flows) and hydrogeology (groundwater quality and levels). A description of the proposed scheme is included in Section 2.5.

This chapter first summarises relevant policy and legislation, and describes the adopted assessment methodology. The overall baseline conditions are described in Section 7.3. How the scheme design has evolved (embedded mitigation) with respect to the protection of the water environment is described in Section 7.4.2. The results of the assessment of the potential (pre-mitigation) effects are then presented, along with details of environmental measures to avoid, minimise, mitigate or compensate for any remaining adverse effects. The chapter concludes with a summary of residual effects (standalone and cumulative) and an evaluation of their significance following the incorporation of the proposed environmental measures into the scheme.

7.2 Legislative requirements & Planning Policy Context

lists the issues from the relevant planning policies guidance and policy guidance which have been considered in assessing potentially significant effects related to the water environment and contaminated land.

7.2.1 National legislation

Flood and Water Management Act 2010

The Flood and Water Management Act (FWMA) 2010 places a duty on Local Authorities to prepare a Local Flood Risk Management Strategy (LFRMS) that sets out how the Lead Local Flood Authority (LLFA) will proactively seek to minimise flood risk and prepare our communities. It places duties on National Park as LLFA to provide better, more comprehensive management of flood risk for people, homes, and businesses by promoting an integrated approach to planning and managing all forms of flood risk.

Schedule 3 of the FWMA requires surface water drainage for new developments to comply with statutory national standards for sustainable drainage systems (SuDS). The statutory standards were published by Welsh Government on 15 October 2018 along with the Statutory Instruments. Schedule 3 to the FWMA 2010 places a duty on local authorities as SuDS Approving Body (SAB) to approve, adopt and maintain systems compliant with section 17 of the Schedule. Under Schedule 3, as of 7th January 2019, all new developments of more than 1 dwelling house or where the construction area is 100m² or more, require SuDS for surface water.

Flood and Coastal Erosion Risk Management in Wales 2020

The National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in Wales 2020 outlines the new direction on sustainable drainage and a revised planning policy to complement the strategy and ensure a consistent national approach to the management of land and water.

The 2020 National Strategy for FCERM in Wales has been prepared alongside new flood risk data to ensure flood, coastal, and planning policies align, taking into account better information to avoid inappropriate development and provide clear advice in the new Wales Flood Map. The new Wales Flood Map is composed of the new Flood Risk Assessment for Wales (FRAW) and the Flood Map for Planning and has been published to comply with the

requirements of the Flood Risk Regulations (2009) and the EU Directive (2007/60/EC). These are available on the NRW geoportal via the NRW website as of March 2022.

Water Environment (WFD) (England and Wales) Regulations 2017

The Water Framework Directive (WFD) 2000/60/EC provides a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters, and groundwater. The Directive requires the Member States to establish river basin districts and for each of these prepare a river basin management plan (RBMP), which is prepared, implemented, and reviewed every six years. The current period from 2015-2021 is Cycle 2 of these RBMPs.

A daughter directive of the WFD, the Groundwater Directive 2006/118/EC establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater.

NRW Advice for planning applications affecting phosphorus-sensitive river Special Areas of Conservation.

In January 2021 National Resources Wales (NRW) released new phosphorous targets for all freshwater Special Areas of Conservation (SAC) catchments in Wales. Legislation accompanies these new targets which sets out that as part of any development proposal the application must provide:

- A clear scale plan showing the location of the nearest mains sewer and proposed connection point;
- Evidence that an application has been made to the sewerage undertaker for connection to a mains sewer, and a copy of their formal response confirming either:
 - that there is treatment capacity to treat the additional wastewater and any additional phosphate from the proposed scheme (in combination with other planned development) within the existing discharge permit limits, or
 - that the necessary treatment capacity to remain within existing discharge permit limits will be implemented within the current Asset Management Plan (AMP) period.
- Confirmation that any development complies with the Flood and Water Management Act 2010 (Schedule 3), effective in Wales from 7 January 2019, requiring new developments to include Sustainable Drainage Systems (SuDS) features that comply with national standards.

These regulations determine that new developments should not increase phosphate load to the surrounding watercourse.

Planning Policy Wales (PPW) 2021

Chapter 6 of PPW (Edition 11, February 2021) provides guidance to the issues relating to water and flood risk. With regards to water services, the Welsh Government aims to secure the provision of water services whilst minimising adverse impacts on the environment, amenities, health, and communities, in light of the consequences of climate change. This should be achieved by ensuring that the infrastructure upon which communities and businesses depend is adequate to accommodate proposed scheme, ensuring sustainable drainage systems are an integral part of the design approach for new development, and ensuring the protection of the quantity and quality of surface and ground water supplies is taken into account as part of development proposals.

Sections of PPW is of particular relevance to sustainable water management and water quality are quoted below:

Section 6.6.6 'The ability of the planning system to protect water features and foster sustainable water management as key attributes of attractive and resilient places to live is closely aligned with securing the multiple benefits of green infrastructure. Embracing integrated approaches should make a contribution toward achieving the requirements

imposed by the EU Water Framework Directive along with Welsh Government policy for the integrated planning and management of water both in urban and rural areas.'

Section 6.6.9 'The adequacy of water supply and sewerage infrastructure should be fully considered when proposing development, both as water service and because of the consequential environmental and amenity impacts associated with a lack of capacity.'

Section 6.6.18 'The provision of SuDS must be considered as an integral part of the design of new development and considered at the earliest possible stage when formulating proposals for new development.'

Section 6.6.19 'Development proposals should incorporate design for surface water management, based on principles which work with nature to facilitate the natural functioning of the water cycle, providing issues such as land contamination would not result in the mobilisation of contaminants which may have an impact over a wider area.'

With regards to development and flood risk, planning authorities should take a precautionary approach of positive avoidance in areas of flooding from the sea or from rivers. Surface water flooding should affect the choice of location and layout of scheme designs. Sections of PPW with particular relevance to flood risk are quoted below:

Section 6.6.25 'Development should reduce, and must not increase, flood risk arising from the river and/or coastal flooding on and off the development site itself. The priority should be to protect the undeveloped or unobstructed floodplain from development and to prevent the cumulative effects of incremental development.'

Section 6.6.27 'Planning authorities should be aware of the risk of surface water flooding and ensure developments are designed and planned to minimise potential impacts. Development should not cause additional run-off, which can be achieved by controlling surface water as near to the source as possible by the use of SuDS.'

PPW uses a series of Technical Advice Notes to provide more guidance on areas of planning and development in Wales. Technical Advice Note 15 (TAN-15), introduced by the Welsh Government in 2004 provides technical guidance relating to development planning and flood risk in Wales. The initial requirements of TAN-15 are to identify the vulnerability classification(s) and flood zones relevant to the proposed scheme and to apply this information to the application of the Justification Tests.

Technical Advice Note 15 (TAN 15) provides the technical guidance to supplement Planning Policy Wales (PPW) in relation to development and flooding. It provides guidelines on development and flood risk in relation to sustainability principles and a framework for the assessment of risks arising from river and coastal flooding and from additional surface water run-off from the development. TAN 15 is supplemented by the Development Advice Maps (DAMs) which provide an indication of areas at risk from extreme flooding events.

TAN 15 promotes the use of Sustainable Drainage Systems (SuDS) to manage and minimise flood risk and environmental harm which may be caused by the development. This is achieved through minimising changes in the volume and rate of run-off caused by the site development and incorporating water quality treatment. In January 2019, the Welsh Government enacted Schedule 3 of the Flood and Water Management Act 2010, requiring the mandatory use of SuDS on new developments with approval and adoption by the SuDS approving body (the SAB).

Conservation of Habitats and Regulations 2017

The Conservation of Habitats and Species Regulations 2017 (as amended) (the 'Habitats Regulations') transpose the requirements of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) into law within England and Wales. These regulations provide for the designation and protection of sites of European importance known as European or Natura 2000 Sites. European Sites comprise:

- a) Special Areas of Conservation (SACs);

- b) Special Protection Areas (SPAs);
- c) Ramsar Sites; and
- d) Candidate and proposed SACs and SPAs.

Soil Policy Evidence Programme Report

Land use change may substantially alter the ecosystem services provided by organo-mineral soils. Land use changes that increase the capacity for food production may reduce soil carbon storage and soil organic matter content. Soil organic matter is integral to most ecosystem services provided by soils including food production, biodiversity support, water regulation and climate resilience. Therefore, management to maintain soil organic matter is important for sustaining soil functions under all land uses.

Groundwater Regulations 1998

These require the prevention of List I substances (such as mercury, cadmium, and polyaromatic hydrocarbons) entering groundwater and the control of List II substances (such as heavy metals, nutrients, and phenols) to avoid pollution of groundwater. Within the context of the WFD, the groundwater daughter directive was brought into force in January 2009, which will seek to prevent deterioration in groundwater quality.

Environmental Permitting (England and Wales) Regulations 2016

The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and the fifteen associated amendments. The permitting regime covers a range of activities that release emissions to land, air, or water or that involve waste. The regime covers facilities previously regulated under the Pollution Prevention and Control Regulations 2000 and Waste Management Licensing and exemptions schemes, some parts of the WRA 1991, and the Groundwater Regulations 2009.

Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 to the Regulations relates to Groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive and the Groundwater Daughter Drainage Directive and exercise their relevant function to ensure all necessary measures are taken to:

- (a) prevent the input of any hazardous substance to groundwater; and
- (b) limit the input of non-hazardous pollutants to groundwater to ensure that such inputs do not cause pollution of groundwater" (Paragraph 6, Schedule 22).

7.3 Baseline Conditions

Desk study information on the site history, hydrology, geology and hydrogeology including potential contamination sources has been obtained by review of a Landmark Envirocheck Report (2022) for the site which includes historical maps of the area.

The data used in the desk study were obtained from the following sources:

Topography and general mapping:

- OS Open Data, Terrain 50 DTM, LiDAR 1/2m DTM (EA Open Data), and
- Aerial photography (Google Earth and Bing Maps).

Geology and Soils:

- British Geological Survey (BGS) 1:50,000 Geology Mapping
- BGS digital geology mapping,
- BGS online borehole database (BGS website),
- BGS online Lexicon (BGS website),
- 1:250,000 soils mapping (Soil Survey of England and Wales, 1983),
- Soil Landscapes Online Viewer (DEFRA, 2022),

- DEFRA's Magic Map, The National Soil Resources Institute (NSRI), and
- Coal Authority online viewer.

Hydrology:

- Flood Risk Online Viewer (<http://lle.gov.wales/catalogue/item/NationalFloodRiskMaps/?lang=en>),
- Cycle 3 (2021) Rivers and Waterbodies Map <https://waterwatchwales.naturalresourceswales.gov.uk/en/>

Hydrogeology:

- Aquifer classification (Envirocheck Report),
- Groundwater vulnerability (Envirocheck Report),
- Source Protection Zones (Envirocheck Report),
- Cycle 3 (2021) Rivers and Waterbodies Map <https://waterwatchwales.naturalresourceswales.gov.uk/en/>, and
- BGS 1:625000 Hydrogeology Mapping of Wales.

7.3.1 Site topography

The ZoI used for the assessment of construction and operational effects (for hydrology and hydrogeology) show a phase buffer of 1km around the Site Boundary.

The site topography is relatively flat, with an elevation of 1 to 10 mAOD across the site (Figure 7-1). In the wider area ground levels gradually dip northwards towards the Irish Sea.



Figure 7-1: Topography

7.3.2 Surface Water

Surface water bodies and abstractions have been identified from a desk-based study of OS mapping and online record data of Natural Resources Wales. An assessment of surface water bodies for ecological and chemical quality is maintained by the NRW under the Water Framework Directive and is viewable through their online Catchment Data Explorer.

The main watercourses in the area are River Gele, River Clwyd, Ffynnon-y-ddol Channel and Coastal North Wales waterbody (Figure 7-2).

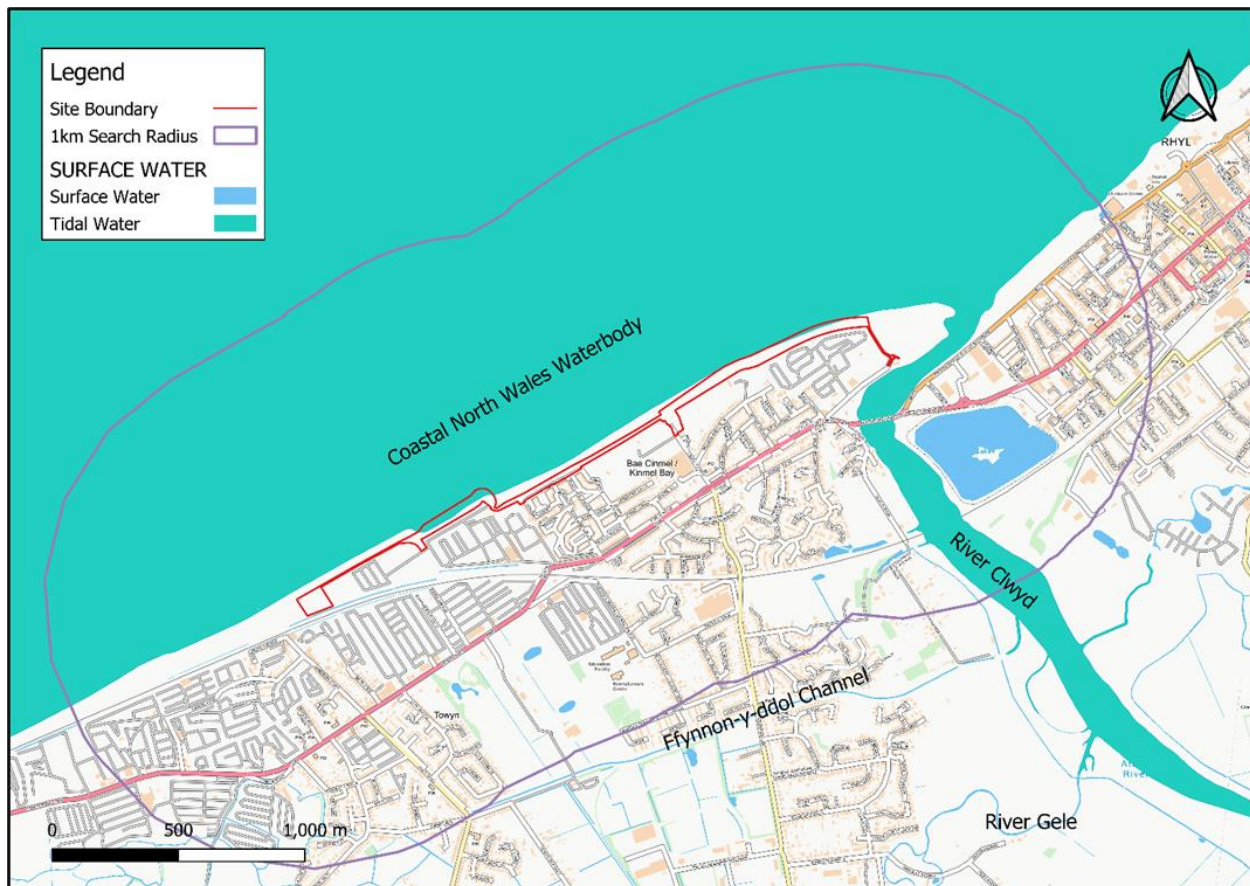


Figure 7-2: Surface water within 1km of the proposed scheme

The River Gele, a tributary of the River Clwyd, flows north-eastwards approximately 1.2km to the southern site boundary before joining the River Clwyd. The watercourse is approximately 12km in length and joins River Clwyd at approximately 1.5km south of the south-east edge of the site. The river used to discharge into the sea directly through the town of Abergele, but the Rhuddlan Marsh embankment act of 1794 diverted the river from the south of the town in an easterly direction across the south of Rhuddlan Marsh and into the River Clwyd at Towyn. A short distance of the river mouth is tidal. The River Gele waterbody belongs to the Conwy Catchment and has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications.

The River Clwyd, the easternmost watercourse, rises in the Clocaenog Forest, 8km northwest of Corwen. Its total length is 56km. Around 2km north of St Asaph, the river is joined by a tributary as large as the main river, the River Elwy. At the confluence of the Elwy and the Clwyd, the river becomes tidal and enters a narrow estuary with much wildlife before meeting the Irish Sea at Rhyl. The River Clwyd marks the boundary between Rhyl and Kinnel Bay. The transitional (between riverine and coastal) water body near the river mouth has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's

classifications. The river waterbody of the River Clwyd has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status and the tributary, River Elwy, has 'good' ecological status, 'good' chemical status and 'good' overall status.

The Ffynnon-y-ddol Channel (and its tributaries) flows eastward approximately 1km to the south of the southern boundary. The Ffynnon-y-ddol is 5.69km in length, a tributary of the Afon Clwyd and runs broadly parallel to the coast of North Wales. It discharges into the Afon Clwyd via the Clwyd pumping station. The tributaries all discharge under gravity into the Ffynnon-y-ddol with the exception of the Pensarn Drain which is pumped into the Ffynnon-y-ddol via the Belgrano pumping station. There is no WFD classification for this waterbody.

The coastal North Wales waterbody within and adjacent to the study area has 'moderate' ecological, 'failing' chemical and 'moderate' overall status under the WFD's classifications.

There are also a number of ponds surrounding the area. These ponds are very small, shallow, freshwater ponds.

There are 3 surface water abstraction licences from River Gele recorded by the EA within 2km of the site boundary. All three abstractions are used for general agricultural purposes (spray irrigation). The nearest surface water abstraction is situated at 1850m from the site boundary.

7.3.3 Groundwater

The 'Clwyd Permo-Triassic Sandstone' groundwater overall status for the study area is 'good', quantitative status is 'Good' and the chemical status is also 'Good' (as of 2021).

Table 7-1 shows the initial screening of water bodies within the Application Site and surrounding area and their overall status under the WFD's classifications.

Table 7-1: Initial Screening of WFD Water Bodies

Water body type	Name	Overall status
Transitional	The River Clwyd	Moderate
River	The River Clwyd	Moderate
	The River Elwy	Good
	The River Gele	Moderate
Coastal	Coastal North Wales Waterbody	Moderate
Groundwater (Quantitative)	Clwyd Permo-Triassic Sandstone	Good
Groundwater (Chemical)	Clwyd Permo-Triassic Sandstone	Good

7.3.4 Flood Risk

Table 7-2 summarises the Flood risk on the site. This information has been compiled from sources taken from JBA's Flood Consequence Assessment (FCA) which is presented in Appendix E.2 and "Natural Resources Wales' Flood Risk Map Viewer". The table shows that there is a medium to high flood risk from the sea. There is no risk of flooding from rivers within the site. In some sections within the site, there is a low risk of flooding from small watercourses.

Table 7-2: Assessment of Flood Risk

Source of flooding	On-site presence	Description
Fluvial	No	The site is not at high risk from fluvial flooding.
Tidal	Yes	The site is at high risk from tidal flooding.
Surface Water and small watercourses	Yes	The site (small areas within the site) is at low risk from surface water and small

Source of flooding	On-site presence	Description
		watercourses flooding.
Reservoir	Yes	The site is at risk of flooding as a result of reservoir failure.
Groundwater	Yes	Properties situated below ground level within the site is at low risk of groundwater flooding.
Canals	No	The site is not at risk of flooding from a canal breach.

Surface Water and Tidal Flood Risk

NRW Flood Risk Assessment Wales (FRAW) maps indicate the risk of flooding from different sources including tidal sources and small watercourses. The site has a high risk of tidal flooding (a chance of flooding greater than 1 in 30 (3.3%) in any given year). The site also has a Low risk of flooding from surface water and small watercourses (a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year).

Reservoir Flood Risk

NRW Flood Risk Assessment Wales (FRAW) also shows that the area may be affected by flooding as a result of a breach of a large, raised reservoir i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land. This map confirms that there is a flood risk from Llyn Aled Reservoir (35km from the site), Llyn Aled Isaf Reservoir (25km from the site) and Dolwen Reservoir (12km from the site) in the east end of the site. The probable flood migrates to the site via tributaries of River Clwyd. The flooding maps show the worst-case scenario for the area that could be flooded if a large reservoir were to fail and release the water it holds.

Groundwater Flood Risk

1.4.25 BGS Groundwater Flooding Susceptibility data of Landmark Envirocheck Report indicates limited potential for groundwater flooding within the site and also potential for groundwater flooding of properties situated below ground level within the surrounding area up to 500m from the site boundary.

7.3.5 Geology and Soil

Information on the soils and geology of the application site and surrounding area has been derived from the Soil Survey of England and Wales (1970), 1:50,000 BGS geology mapping (BGS online map viewer), 1:50,000 BGS geology mapping (Sheet 95 Rhyl) and the BGS online borehole archive (GeoIndex).

Bedrock

The BGS GeoIndex indicates the site is exclusively underlain by Early Triassic Kinnerton Sandstone Formation. The Kinnerton Sandstone Formation comprises up to 150m thick red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified sandstone which is dominantly aeolian formed approximately 247 to 252 million years ago in the Triassic Period (Figure 7-3).



Figure 7-3: Bedrock geology in the proposed scheme

Superficial Deposits

The BGS GeoIndex indicates that the superficial deposits across and the site and surrounding area comprise Beach (Marine and Storm Beach), Tidal Flat and Blown Sand Deposits (Figure 7-4).

The majority of the site is underlain by Beach Deposits with some Blown Sand Deposits in the south and Tidal Flat deposits in the south-west of the site. The uppermost area of the northern boundary is dominated by Marine Beach Deposits.

The BGS records very limited Made Ground deposits across the site, including firm to stiff, red-brown becoming slightly red-brown, silty, fine sandy clay with sub-angular to sub-rounded fine, medium and occasional coarse gravel and also brown sand, limestone chips and dust.

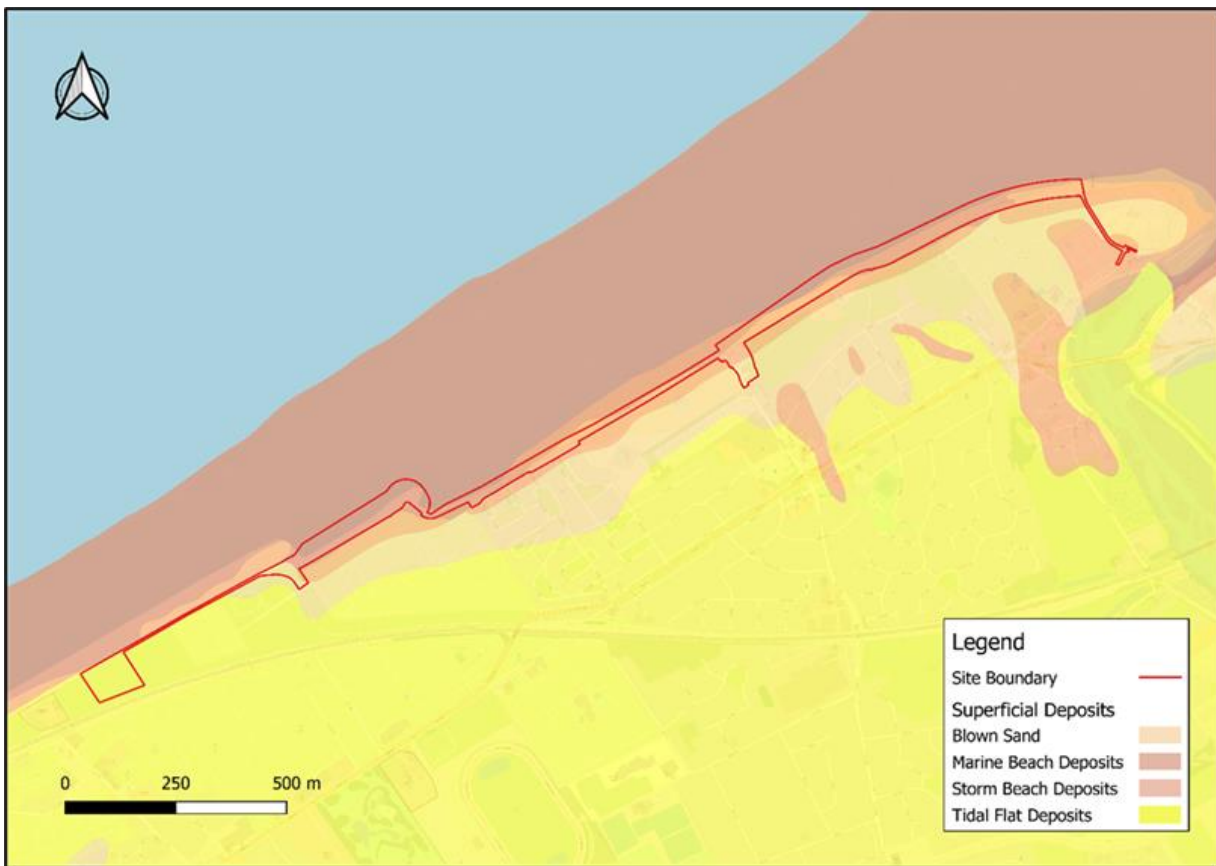


Figure 7-4: Superficial deposits in the proposed scheme

The BGS borehole (BGS Ref. SH97NE2) located approximately 850m to the south from the site, shows around 30m thick superficial deposits including 17.8m post-glacial clays, sands and peats and 12.1m glacial clays and sands (Figure 7-5).

BGS GeoIndex records covering the superficial deposits found within the site boundary described the following characteristics:

- Modern Beach Deposits (Marine and Storm Beach Deposits) – Loose to moderately loose, light-brown, fine, medium and coarse sand, sub-angular to rounded, fine, medium and coarse gravel, cobbles and boulders. The Modern Beach Deposits are formed up to 3mya in Quaternary Period.
- Blown Sand – Coarse, medium and fine sand with medium and fine gravel and traces of shells formed up to 3mya in Quaternary Period.
- Tidal Flat Deposits – Soft to firm light-brown/grey/red-brown silty sandy clay and peat formed up to 2mya in Quaternary Period.

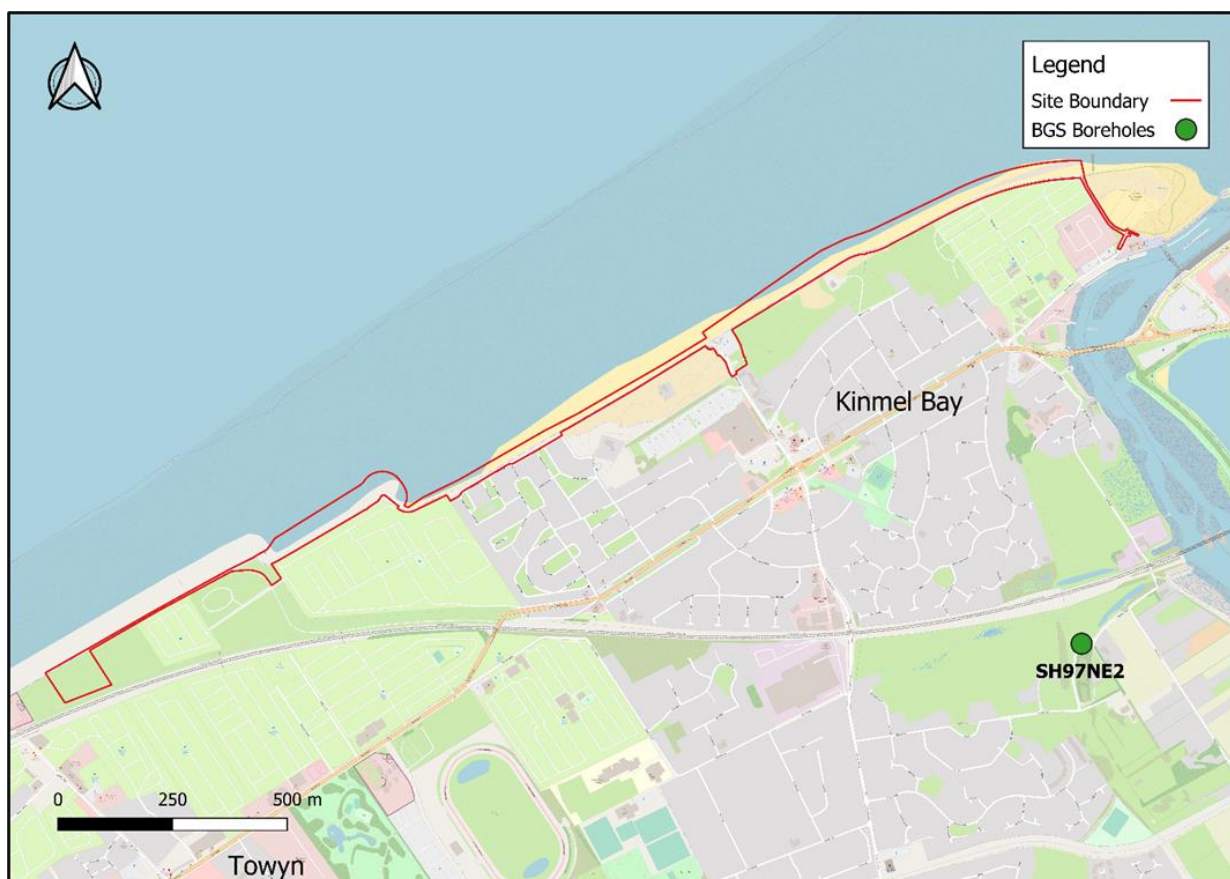


Figure 7-5: Historical borehole location

Soils

The Soil Landscapes Online Viewer (DEFRA, 2022) indicates that the site is exclusively covered by Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater. The landcover is arable with some grassland. The soils are mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to land. These soil types are defined as deep soils which can be easily dug to a depth of more than 1 metre.

Geological Summary

A summary of geological stratigraphy beneath the Application Site is given in Table 7-3.

Table 7-3: Geological Stratigraphy on site

Age	Formation/Group		Description	Thickness
Quaternary Period	Topsoil		Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater.	No data available
	Made Ground		Inferred due to the urban land use present within the site boundary (reworked natural deposits, imported materials, etc).	No data available
	Superficial Deposit	Marine Beach Deposits - Sand	Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the	No data available

Age	Formation/Group		Description	Thickness
			form of dunes, sheets or banks; in association with the marine environment.	
		Storm Beach Deposits - Gravel	Low rounded ridge of coarse materials (gravels, cobbles and boulders) piled up by very powerful storm waves at the inland margin of a beach, above the level reached by normal spring tides.	No data available
		Tidal Flat Deposits – Clay, Silt and Sand	Tidal flat deposits, including mud flat and sand flat deposits, are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief.	No data available
		Blown Sand Deposits	Blown sand is sand that has been transported by wind, or sand consisting predominantly of wind-borne particles.	No data available
Triassic Period	Bedrock Geology	Kinnerton Sandstone Formation – Sandstone	Sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified. Dominantly aeolian.	Up to 150m*
Sources: *BGS Online Lexicon of Named Rock Units				

Coal and Non-coal Mining

The Coal Authority's online interactive viewer has been reviewed for the area. The site is located within North Wales Coal Mining Reporting Area. The Coal Mining Reporting Area, also known as CON29M Coal and Brine Consultation Areas, is the known extent of coal mining activity and is used to determine whether a coal mining report is required for property transactions and the conveyance process. There is no identified coal mining activity within the site area.

7.3.6 Hydrogeology

Aquifer Properties

The geological strata summarised in the Geology and Soils section have been assessed for their hydrogeological properties using the BGS aquifer designation mapping. Table 7-4 summarises the Environment Agency's (EA) hydrogeological classification of the bedrock and superficial deposits.

The Superficial Deposits covering the site including Beach Deposits and Blown Sand Deposits are classified as a 'Secondary A Aquifer', which is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The Tidal Flat Deposits, located in western edge of the site, are designated Secondary Undifferentiated aquifers – meaning it has not been possible to attribute either category A or B. In most cases, this means that the layer in question has previously been designated as

both minor and non-aquifer in different locations due to the variable characteristics of the geology type.

The underlying bedrock unit of the Kinnerton Sandstone Formation is classified as Principal aquifer, which is described as layers of rock that have high intergranular and/or fracture permeability, meaning it usually provides a high level of water storage and transmission. It may support water supply and/or river base flow on a strategic scale. In most cases, Principal aquifers are aquifers previously designated as major aquifers.

Table 7-4: Hydrogeology of the bedrock and superficial geology at the site

Group	Formation	Classification
Superficial (drift) Deposits	Modern Beach Deposits (Marine and Storm Beach Deposits)	Secondary A Aquifer
	Blown Sand Deposits	Secondary A Aquifer
	Tidal Flat Deposits	Secondary Undifferentiated Aquifer
Bedrock	Kinnerton Sandstone Formation	Principal Aquifer; Highly productive aquifer
Explanation of aquifer classes (from Environment Agency website)		
Principal aquifers - "may support water supply and/or baseflow to rivers on a strategic scale."		
Secondary A aquifers - "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers."		
Secondary B aquifers - "predominantly lower permeability layers which may store and yield limited amounts of groundwater."		
Secondary Undifferentiated aquifers – "the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."		

Aquifer vulnerability and groundwater quality

The BGS's aquifer vulnerability mapping indicates underlying superficial deposits and bedrock lithologies are marked as having high vulnerability, meaning they are high priority groundwater resources that have limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Operations or activities in these areas are likely to require additional measures over and above good practice pollution prevention requirements to ensure that groundwater isn't impacted.

The underlying bedrock units in this area falls under the WFD groundwater body 'Clwyd Permo-Triassic Sandstone Water Body'. The water body is classified as having 'good' chemical status, 'good' quantitative status and 'good' overall status as of 2021.

Groundwater Abstraction

There are no groundwater abstraction licences within 2km of the site boundary.

Discharge Consents

The EnviroCheck Report lists 37 no. discharge consents within 1km of the site, 9 of which lie within the site. All of the 9 consents (2 effective) are for the same location at Coventry Camp Sewage Pumping Station and discharge to controlled sea (coastal waters of Irish Sea). From 37 discharge consents 18 consents are effective. All the discharge purposes are for sewage discharge or public sewage, issued to controlled sea (coastal waters of Irish Sea) or freshwater stream (Kinmel Bay drain or Clwyd) receiving water bodies.

Although these discharges are deemed to be active consented, it is possible that many are now out of use, given that only three (3no.) of the discharges were issued in the last ten

years. All three active discharge consents are for the same location at Westbourne Avenue Pumping Station located approximately 90m from the site boundary and discharge to controlled sea (coastal waters of Irish Sea).

There are no discharge consents discharging to groundwater within 1km of the site boundary.

None of the discharges receiving waterbody locations are likely to have their flows or water quality altered by the proposed scheme.

Aquifer Properties and Groundwater Flow

The Kinnerton Sandstone Formation belongs to undifferentiated Permo-Triassic rocks comprising sandstone with some conglomerated and is a highly productive aquifer. The aquifer yields up to 25 Litres per second in Eden and Clwyd valleys.

The general regional groundwater gradient can be expected to reflect the topographic gradient, with groundwater flowing north towards the coast.

Groundwater Source Protection Zone

Source Protection Zones (SPZs) are used to protect areas of vulnerable groundwater that is used for abstraction and where water quality is of high importance (such as drinking water abstractions). SPZs are categorised into three zones, 1-3, with 1 being of highest risk of contamination, and 3 representing the lowest risk but still within the groundwater catchment. There are no SPZs recorded within 1km of the site. The nearest SPZ is located approximately 8km to the south-east of the eastern edge of the site boundary.

Ecological and other designations

Ecological designations are sites that contain water-dependant features that could be affected by the development. Site of Special Scientific Interest are the finest sites for wildlife and natural features, supporting many characteristics, rare and endangered species, habitats and natural features. There are no SSSI within 1km of the site boundary.

The Special Protection Area of 'Liverpool Bay SPA' is located approximately 200m to the north of the whole northern boundary through the coastline.

The Local Nature Reserve of 'Kinnel Dunes LNR' is located within the site boundary. There are no Ancient Woodlands within 1km from the site boundary.

There are no Special Areas of Conservation (SAC) within 1km of the site boundary. The nearest SACs are 'Dee Estuary (Wales) SAC', 8km to the east of the eastern site boundary.

The 'Dee Estuary (Wales) SPA/RAMSAR' is located approximately 8km to the east of the eastern site boundary.

7.4 Assessment Methodology & Assessment Criteria

The methodology for the assessment of potential impacts follows the generic EIA methodology guided by IEMA⁶⁴ and current government guidance⁶⁵ and is based on the following principles:

- Receptor sensitivity (**Error! Reference source not found.**); and
- The magnitude (severity) of the effect (Table 7-6)

⁶⁴ IEMA (2017) Delivering Proportionate EIA. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

⁶⁵ GOV.UK(2014) Guide to Environmental Impact Assessment. [Online] Available from: <https://www.gov.uk/guidance/environmental-impact-assessment>

Table 7-5: Receptor sensitivity

Sensitivity	Criteria	Example
High	Feature with a high yield and/or quality and rarity at a national or international scale, with a limited potential for substitution. Attribute highly sensitive to change	Conditions supporting sites with international conservation designations (SAC, SPA, Ramsar sites), where the designation is based specifically on aquatic features. Highly productive aquifers and surface water resources are typically used for public water supplies. Public water supplies. Conditions supporting a SSSI. Sites with freshwater fish protected areas. Water quality of receptor water body: Supporting WFD element type (e.g. Priority Substances) classified as 'High', 'Good' or Pass'. NPPF PPG Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable".
Medium	Feature with a medium yield and/or quality at a regional scale, or good quality at a local scale, with some limited potential for substitution. Attribute tolerant of some degree of change	Medium productivity aquifer and surface water resources are typically used for smaller public water supplies or industrial water supplies. Industrial water supplies. Conditions supporting local nature conservation interest (e.g. National Nature Reserve [NNR]), where the interest features are water dependent. Water quality of receptor water body: Supporting WFD element classified as at least 'Good' in all cases. NPPF PPG Flood Risk Vulnerability Classification "More Vulnerable".
Low	Feature with variable yield and/or quality at a local scale, with potential for substitution. Attribute tolerant of modest change.	Low productivity aquifer and surface water resources are typically used for private water supplies or not utilised. Private water supplies; livestock supplies; springs; ponds/lagoons; non-statutory groundwater-dependent conservation sites. Water quality of receptor water body: Supporting WFD element type classified as less than 'Good' in any situation (any supporting element). NPPF PPG Flood Risk Vulnerability Classification "Less Vulnerable".
Negligible	Feature with poor yield and/or quality at a local scale, with good potential for substitution. Attribute tolerant of substantial change.	Unproductive strata. Water quality of receptor water body: Supporting WFD element type classified as 'Poor' or 'Bad', with severely restricted ecosystems and pollution. Small surface water bodies such as drainage ditches and ephemeral ponds are too small to be classified under WFD and have limited ecological potential due to being artificial or heavily modified.

Sensitivity	Criteria	Example
		NPPF PPG Flood Risk Vulnerability Classification “Water Compatible”.

Table 7-6: Overview of magnitude of impact

Magnitude	Criteria	Examples
High	Results in a loss of feature/attribute and/or quality and integrity of the attribute. Following the development, the baseline situation is fundamentally changed.	Major reduction in groundwater levels, flow or quality, reducing use and water body status. Major reduction in groundwater levels or water quality leading to a marked deterioration in conditions that support groundwater dependent terrestrial ecosystem (GWDTE) features. Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant SSSI conservation objectives (COs), or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Complete loss of resource or severely reduced resource availability to other water users. Change in flood risk resulting in potential loss of life or damage to nationally critical infrastructure.
Medium	Results in impact on the integrity of feature/attribute, or loss of part of feature/attribute. Following the development, the baseline situation is noticeably changed.	Moderate reduction in groundwater levels, flow or quality, reducing use and water body status in some circumstances. Moderate reduction in groundwater levels or water quality leading to some deterioration in conditions that support GWDTE features. Deterioration in conditions that support GWDTE features. Short-term and reversible breaches of relevant SSSI conservation objectives or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Water quality status may impact upon potential future thresholds in relation to objective WFD status – potential for prevention of waterbody reaching its future WFD objectives. Minor reduction in resource availability for other water users. Change in flood risk resulting in potential for major damage to property and infrastructure.
Low	Results in minor impact on the feature, of insufficient magnitude to affect its use/integrity in most circumstances. Following the development, the baseline situation is largely	Measurable reduction in groundwater levels, flow or quality, but with limited consequences in terms of use and water body status. Measurable reduction in groundwater levels or water quality, leading to a minimal change in conditions that support GWDTE features. Measurable deterioration in river flow regime, morphology or water quality, but remaining generally within SSSI COs, and with no change of WFD status (of

Magnitude	Criteria	Examples
	unchanged with barely discernible differences.	overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs). No change in resource availability for other water users. Increase in flood hazard in areas with no flood risk receptors e.g. increased flooding of agricultural land. Change in flood risk resulting in potential for minor damage to property and infrastructure.
Negligible	Results in little or no impact on the feature, with insufficient magnitude to affect its use/integrity. The impacts are unlikely to be detectable or outside the norms of natural variation.	No measurable reduction in groundwater levels or flow. Any change to water quality will be quickly reversed once activity ceases with no consequence in terms of use, water body status (of overall status or supporting element status) or compromise of EQSs. No measurable reduction in groundwater levels or water quality, leading to no change in conditions that support GWDTE features. No measurable deterioration in river flow regime, morphology or water quality, and no consequences in terms of SSSI conservation objectives, WFD designations, water resources or flood risk. Change in flood risk causes more frequent inconvenience and triggering of emergency response measures but does not result in increased risk of damage to property and infrastructure.

Detailed method of assessment for Environmental Impact Assessment is outlined in Section 3.2.

7.4.1 Scope of Assessment – SPR Model for Water Resources

A Source-Pathway-Receptor (SPR) model has been used to assess the linkages between the proposed activities on site and the identified receptors. A hydrogeological conceptual model has been used as the basis for understanding the groundwater behaviour at site and potential magnitude of impacts.

The sources of impact to the water environment include changes to the groundwater and surface water levels, flows and quality resulting from the development and changes to the morphology of surface waters and aquifer properties.

The pathway is the connection between the activities on site and the potential receptor. A Source-Pathway-Receptor linkage is required for an impact. Without such a linkage there is no impact.

The pathways considered are through the ground and along surface water flow paths. There are a number of hydraulic boundaries present in and around the Application Site which will limit the extent of the impact of on-site activities. These include:

- River Gele and Clwyd - these are regional rivers which are likely to form an effective hydraulic boundary to the south and east of the Application Site. Receptors located to the south of River Gele and east of River Clwyd are therefore not likely to be impacted by site activities and have been scoped out of this assessment.
- Aquifer extents – the limit of the occurrence of superficial sands and gravels (secondary A) aquifer to the south will limit the extent of any impacts through this aquifer.

Environmental receptors that may be present in or near to the Application Site and affected by activities on site during improving coastal defences have been assessed based on desk

study sources. A summary of potential receptors is given below and shown in the **Error! Reference source not found..**

This initial assessment of potential SPR linkage is refined within the assessment using the hydrogeological conceptual model. Based upon the conceptual model, an approximate maximum radius of impact due to coastal defence improvements relative to potential receptors is 1km.

Table 7-7: Sensitivity of water environment receptors

Ref	Description	X	Y	SPR Linkage	Sensitivity
1	Soils	298441	380511	Yes	Medium
2	Secondary A superficial sands and gravels aquifer (Modern Beach, Blown Sand Deposits)	299342	378310	Yes	Medium
3	Principle Aquifer (Kinnerton Sandstone Formation)	297048	379891	Yes	High
4	Ffynnon-y-ddoll Channel	299747	379630	Yes	Very Low
5	River Gele	296831	378350	No – upstream and out of Zol	N/A
6	River Clwyd (Transitional)	299619	380825	Yes	Low
7	River Clwyd (Riverine)	303443	376602	No – upstream and out of Zol	N/A
8	River Elwy	303272	376365	No – upstream and out of Zol	N/A
9	Coastal North Wales Waterbody (Liverpool Bay SPA)	298193	381123	Yes	High
10	Towyn Park pond	297830	379570	Yes	Low
11	Tir Prince Raceway small ponds	298193	379616	Yes	Low
12	Discharge consents	298000	380300	Yes	Low
13	Surface water abstraction (NRW)	299680	379030	No – upstream and out of Zol	N/A
14	Surface water abstraction (NRW)	299810	379095	No – upstream and out of Zol	N/A
15	Surface water abstraction (NRW)	299900	379100	No – upstream and other side of River Gele	N/A

Groundwater aquifers and abstractions as potential receptors

In summary, the following groundwater related receptors have been identified:

- Soils – loamy to clayey soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution applied to land. It is therefore regarded as of Medium sensitivity.
- Secondary A superficial sand and gravel aquifer – permeable strata supporting local water courses and potentially local groundwater abstractions which is located under the whole site. This permeable aquifer will allow the impacts of proposed scheme to propagate to the surrounding area and so can form a pathway to other receptors. Therefore, it is regarded as of Medium sensitivity.
- The underlying bedrock units in this area falls under the WFD groundwater body 'Clwyd Permo-Triassic Sandstone Water Body'. The water body is classified as having 'good' chemical status, 'good' quantitative status and 'good' overall status and therefore is regarded as of High sensitivity.
 - Principal Kinnerton Sandstone aquifer – high permeability sandstone with some conglomerate, highly productive aquifer yielding up to 25 L/s.
- Discharge consents – there are no discharge consents discharging to groundwater within 1km from the site boundary.

- Groundwater abstractions – there are no groundwater abstractions within 1km from the site boundary.

Surface waterbodies and abstractions as potential receptors

The following surface water related receptors have been identified:

- Ffynnon-y-ddol Channel – a tributary of the River Clwyd and runs broadly parallel to the southern site boundary. It discharges into the River Clwyd via the Clwyd pumping station. The tributaries all discharge under gravity into the Ffynnon-y-ddol. The watercourse is too small to be classified under WFD as it has limited ecological potential. As such, the sensitivity of this watercourse is considered to be Very Low.
- River Clwyd – the easternmost watercourse marks the boundary between Rhyl and Kinnel Bay. At the confluence of the Elwy and the Clwyd, the river becomes tidal and enters a narrow estuary with much wildlife before meeting the Irish Sea at Rhyl. The transitional (between riverine and coastal) waterbody near the river mouth has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications. The river waterbody of the River Clwyd has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status. As such, the sensitivity of this waterbody is considered to be Low.
- Coastal North Wales Waterbody – the waterbody within and adjacent to the northern boundary of the site along the coast, has 'moderate' ecological, 'failing' chemical and 'moderate' overall status under the WFD's classifications. The whole area holds an international designation of Liverpool Bay SPA. Therefore, the sensitivity of this watercourse is considered to be High.
- Small ponds including Towyn Park pond and Tir Prince Raceway small ponds – very shallow fresh water lakes with high alkalinity. These small unclassified ponds are also likely to have poor water quality and is therefore regarded as being of Low sensitivity.

Implications of climate change

The UK Climate Change Projections 2018 (UKCP18) project the following:

- Temperatures are projected to increase, particularly in summer;
- Winter rainfall is projected to increase and summer rainfall is most likely to decrease;
- Heavy rain days (rainfall greater than 25mm) are projected to increase, particularly in winter;
- Near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant effects of winds; however, the increase in wind speeds is projected to be modest;
- The frequency of winter storms over the UK is projected to increase; and
- Changes in seasonal recharge rates as a response to variations in rainfall patterns.

The existing/baseline hydrological regime may change as a result of the predicted impacts of climate change, irrespective of any development. River flows, tide levels, and rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off, flood flows within watercourses, and flood levels associated with a breach of flood defences would increase. In addition, the seasonality of rainfall and river flows is likely to become more pronounced. The ES (supported by the Flood Consequence Assessment FCA) takes account of the potential future changes in the hydrological regime by incorporating appropriate allowances for climate change, as published by the EA⁶⁶.

⁶⁶ Environment Agency (2016) Flood risk assessments: climate change allowances. [Online] Available from: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

The existing/baseline hydrogeological regime has the potential to change as a result of the predicted impacts of climate change, given the nature of the geology and aquifers in relation to recharge rates.

The two main influences on the future hydrological and hydrogeological regime of the site, and surrounding area are climate change and local land use change, which have the potential to change the river flow regime (through changes in rainfall patterns and storm surges as a result of climate change and sea level rises) and ground permeability and runoff/infiltration (through changes in land use).

7.4.2 Embedded mitigation

All construction work has the potential to impact on the water environment, through spillages, mobilisation of contaminants and sediment by disturbance of contaminated ground or surface run-off.

Environmental measures that have been incorporated into the proposed scheme are set out in Table 7-8. The measures are designed to protect the water environment at the site from any significant impact. This includes measures designed to safeguard against any deterioration in the overall ecological status of the receiving water bodies, or in any of the contributing status elements.

Construction phase:

- Practice working methods to prevent both water pollution to surrounding surface waters and groundwater and adverse impacts upon surface water drainage regime;
- Appropriate storage of hydrocarbons and petrochemicals in accordance with Control of Substances Hazardous to Health (COSHH) regulations 2002;
- Any surface water potentially contaminated by hydrocarbons would be passed through oil interceptors before discharge;
- These would be in place to prevent silt-laden run-off, arisings, or chemicals entering watercourses; and
- Soil compaction best practice would be implemented during construction to ensure soil is restored to its natural permeability. However, due to the use of excavators and other heavy equipment, it will be expected for short-term soil compaction to occur during the construction phase.

Operational Phase:

Surface Water Management infrastructure would be designed in accordance with CIRIA C753, and guidance set out by both the BSIDB and LLFA, such that the surface water run-off regime replicates that existing before development.

Table 7-8: Rationale for incorporation of environmental measures

Receptor	Potential Impact	Design Mitigation
Surface water		
On-site drainage systems	Potential blocking due to displaced sediment from the construction phase and in turn results in onsite flooding and reduced drainage.	Surface water management structures to ensure onsite drainage is consistent.
Surface watercourses: Ffynnon-y-ddol Channel, River Clwyd, Coastal North Wales Waterbody, Discharges, Ponds	Increase in run-off and stream sediment and change in water quality due to potential discharge of pollutants from the site during construction.	Limiting discharge from site into watercourses by controlling run off. Use of oil interceptors and/or sediment traps before discharge to watercourses under appropriate licence if required.
Soils	Infiltration of pollutants on-site during all phases.	Appropriate on-site measures to control and manage spills during the construction phase.

Receptor	Potential Impact	Design Mitigation
Groundwater		
Superficial Secondary A aquifer Bedrock Principal and Secondary A aquifer: Kinnerton Sandstone Formation	Contamination and pollutants are generated through the construction phase. Changes in recharge to the aquifer.	Oil interceptor implementation on site if required. Collect of surface water through drainage systems during construction phase, reducing the potential for contaminants to infiltrate the aquifer.
Abstractions		
Groundwater abstractions	Contamination and pollutants are generated through the construction phase. Changes in recharge to the aquifer.	N/A

7.5 Potential Impacts & Significant Effects

This section outlines the potential effects that would be anticipated to occur (from the proposed activities) on the water environment, prior to the implementation of any mitigation measures additional to those incorporated into the design. The assessment methodology is outlined in section 7.4. Effects for both the construction and operational phases of development are considered separately.

7.5.1 Construction phase

Potential effects that may arise during the construction phase of the proposed scheme include:

- Surface water drainage – Flows;
- Surface water drainage – Quality;
- Construction site runoff – suspended fine sediments;
- Construction site runoff – chemical spillages;
- Modifications to drainage channels on-site and surrounding watercourses;
- Temporary increase in impermeable area and ground compaction;
- Impacts on groundwater recharge; and
- Impact on flood risk.

Surface water drainage – Flows

Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive locations/receptors in the vicinity of the site.

Construction activities will include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site re-profiling to create construction platforms, preparation of site roads and construction of foundations.

Compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas has the potential to impact upon the surface water drainage regime and increase surface water run-off from the site.

However, such effects would be localised and temporary and controlled using measures set out within the Construction Environmental Management Plan (CEMP). The surface water drains at the East, and south of the site are considered to be of Low sensitivity except the

High sensitivity Coastal North Wales Waterbody (Liverpool Bay SPA). Following implementation of the CoCP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Minor to Negligible** and therefore **Not Significant**.

Surface water drainage – Quality

Construction activities also have the potential to give rise to the contamination of surface water resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in watercourses.

However, such effects would be localised and temporary and controlled using measures set out within the CoCP. The surface water drains and surrounding water courses except the North Wales Coastal Waterbody (Liverpool Bay SPA) are considered to be of Low sensitivity. The North Wales Coastal Waterbody (Liverpool Bay SPA) is considered to be of High sensitivity. However, following implementation of the CoCP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect on surface watercourses would be **Minor to Negligible** and therefore **Not Significant**.

Construction site runoff – Suspended fine sediments

The water environment and the flora and fauna that it supports may be adversely affected by excessive levels of fine sediment contained within surface water runoff originating from construction activities associated with the proposed scheme. Construction activities will involve the excavation and movement of materials at the application site. Therefore, inappropriate management of surface water could result in sediment loading of watercourses. There is also an associated risk of an increase in the potential for leaching of pollutants into surface water receptors.

A Construction Environmental Management Plan (CEMP) will be prepared as part of the surface water drainage strategy. This will detail how silt-laden surface water will be managed during the construction process to ensure impacts of the development on surrounding watercourses are avoided. The CEMP will be prepared in line with CIRIA C502 Environmental Good Practice on Site and CIRIA C532 Control of Water Pollution from Construction Sites. Following implementation of the CEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Minor to Negligible** and therefore **Not Significant**.

Construction site runoff – Chemical spillages

A number of potentially polluting materials may be used during the construction phase. These include oils, types of diesel, fuels, hydraulic fluids, cement/concrete, bentonite, solvent/paints, flocculants, etc. The accidental spillage of these may result in the contamination of surface water or groundwater.

A CEMP will be prepared as part of a surface water drainage strategy. This will detail how spills will be managed during the construction process to minimize the impact of the development on surrounding watercourses. As noted above, the CEMP will be prepared in line with CIRIA C502 Environmental Good Practice on Site and CIRIA C532 Control of Water Pollution from Construction Sites. Following implementation of the CEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Minor to Negligible** and therefore **Not Significant**.

7.5.2 Operation Phase

Potential effects that may arise during the operation phase of the proposed scheme include:

- Surface water drainage – Flows
- Surface water drainage – Pollution and Water Quality
- Groundwater aquifer – Flows
- Groundwater aquifer – Water Quality

Surface water drainage – Flows

The proposed scheme will give rise to an increase in the impermeable area within the catchment through the widening of the coastal path and extension of car park, thereby increasing surface water run-off to the adjacent drains. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land downstream. However, such effects would be controlled by the embedded mitigation measures outlined above, specifically, the drainage strategy that controls surface water flows such that the surface water run-off regime replicates that existing prior to development. Therefore, the magnitude of impact will be Minor to Negligible following the implementation of embedded mitigation measures. On this basis, the significance of the effect would be **Minor to Negligible** and therefore **Not Significant**.

Surface water drainage – Pollution and Water Quality

There is the potential for the contamination of surface water entering the local surface water drains, resulting from the flushing of silts and hydrocarbons from areas of hardstanding. However, the implementation of pollution control measures as part of the drainage strategy will facilitate the control of diffuse pollution. The surface water drains and WFD water bodies except the Coastal North Wales Waterbody are considered to be of Low sensitivity. The Coastal North Wales Waterbody (Liverpool Bay SPA) is considered to be of High sensitivity. The magnitude of impact will be Minor to Negligible following the implementation of embedded mitigation measures. On this basis, the significance of the effect would be **Minor to Negligible** and therefore **Not Significant**.

Groundwater aquifer – Flows

The collection of surface water from the site, potentially limits the volume of direct recharge to the aquifers. Both the superficial deposits and the bedrock are productive aquifers and therefore constitute a viable resource for abstraction.

The superficial and bedrock aquifers are deemed to have 'High sensitivity'. However, following implementation of the CoCP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Minor** and therefore **Not Significant**.

Groundwater aquifer – Water Quality

The collection of surface water from the site minimises the potential for any contaminated surface runoff to reach the superficial or bedrock aquifers during the operational stage. In addition, control of replacement of material in the construction phase means that rainfall infiltration through the new fill material is unlikely to introduce potential contaminants. On this basis, the significance of the effect on water quality would be **Minor to Negligible** and therefore **Not Significant**.

7.5.3 Maintenance/ Decommissioning

At the end of its operational life, the decommissioning of the Coastal Defences is considered to have similar effects upon the water environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. On this basis, there is unlikely to be a requirement for additional mitigation measures.

7.6 Mitigation Measures

7.6.1 Additional Mitigation

Where the presence of contaminated materials is known or suspected, testing of soil samples in advance of construction can be used to clarify the baseline conditions and potential contaminants in the soil. Further details regarding contaminated land are discussed in Section 9 Contaminated Land.

Construction and Decommissioning

Potential effects arising from the construction of the Flood Defences are likely to be localised and temporary and controlled by embedded mitigation measures delivered through the CoCP. The effects are therefore Minor to Negligible and Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those already identified.

At the end of its operational life, the decommissioning of the Flood Defences is considered to have similar effects on the water environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. On this basis, there is unlikely to be a requirement for additional mitigation measures.

Operation

With the implementation of embedded mitigation measures as set out above, the effects associated with the operation of the Flood Defences are Negligible and therefore Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those identified.

7.7 Residual Effects

There are no residual significant effects on hydrology and hydrogeology as a result of the proposed scheme.

7.7.1 Cumulative and in-combination effects

Construction and operation of the proposed scheme could occur simultaneously with 'Other Developments' located in the vicinity of the application site. Other proposed scheme will be subject to compliance with local and national planning policy and the Water Environment (WFD) regulations. Other proposals will therefore be required to demonstrate (amongst other matters) that flood risk is not increased, that the surface water drainage regime and water quality are not adversely affected. Without demonstrating compliance, planning permission would not be granted and construction could not commence.

The 'Other Developments' are therefore likely to be subject to embedded mitigation and additional mitigation, where applicable, as required by the specifics of the proposed schemes. This would result in the residual effects of the construction and operational phases being classified as Not Significant or Beneficial. When combined with the Not Significant residual effects of the Kinmel Bay Coastal Defences construction and operational phases, the cumulative effects are likely to be Not Significant or Beneficial, depending on the extent of mitigation measures implemented as part of 'Other Development'.

The cumulative impacts of other developments has been assessed in Section 14: Cumulative and In-Combination Effects .

8 Cultural Heritage

8.1 Introduction

This Chapter of the Environmental Statement presents the assessment of the proposed scheme on the historic environment baseline during both the construction and operational phases. The assessment includes consideration of the predicted impacts along with mitigation proposals to minimise such impacts.

A Heritage Desk-based Assessment for the proposed scheme has been prepared and is included as a technical appendix (Appendix F.1).

8.2 Legislative and Planning Policy Context

The assessment addresses the requirements of relevant legal frameworks and planning policy pertinent to the Site and the proposed scheme. A summary of relevant policy and legislation is included below, and more detail is included in the Heritage Desk-based Assessment (Appendix F.1).

8.2.1 Planning Policy Wales 2021

Planning Policy Wales (PPW)⁶⁷ sets out the land use planning policies of the Welsh Government (Edition 11, February 2021) as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation. The planning policy of the Welsh Government with regards to the historic environment is set out in Chapter 6.1 of PPW. It is supplemented by Technical Advice Note (TAN) 24: The Historic Environment and Cadw associated best practice guidance on the historic environment.

8.2.2 Technical Advice Note 24: The Historic Environment

The purpose of Technical Advice Note (TAN) 24⁶⁸ is to provide guidance on how the planning system considers the historic environment during development plan preparation. TAN 24 provides specific guidance on how the following aspects of the historic environment should be considered:

- World Heritage Sites,
- Scheduled Monuments,
- Archaeological remains,
- Listed Buildings,
- Conservation areas,
- Historic parks and gardens,
- Historic landscapes, and
- Historic assets of special local interest.

TAN 24 defines the historic environment as follows: *"all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed."*

TAN 24 defines an historic asset as follows: *"an identifiable component of the historic environment. It may consist or be a combination of an archaeological site, a historic building*

⁶⁷ Welsh Government (2021) Planning Policy Wales Edition 11

⁶⁸ Welsh Government (2017) Technical Advice Note 24: The Historic Environment

or area, historic park and garden or a parcel of historic landscape. Nationally important historic assets will normally be designated.”

8.2.3 The Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015⁶⁹ places duties on public bodies requiring them to act in accordance with the ‘sustainable development principle’ and establishes well-being goals, which include achieving ‘a Wales of vibrant culture and thriving Welsh language’, described as ‘a society that promotes and protects culture, heritage and the Welsh language. A properly protected, conserved and enhanced historic environment can improve the quality of life and well-being for everyone.

8.2.4 The Historic Environment (Wales) Act 2016

The legislative framework for the historic environment in Wales was revised by The Historic Environment (Wales) Act 2016⁷⁰. The 2016 Act amended the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990. It extended the definition of Scheduled Monuments and enhanced their protection, as well as making changes to the process of Scheduled Monument consent. Changes were also made to the protection of Listed Buildings. The 2016 Act also provided for a statutory register of historic landscapes, a statutory list of place names, and imposed a statutory duty on Welsh Ministers to compile and maintain HERs.

8.2.5 Conwy County Borough Council Local Development Plan 2013

CCBC adopted the current Local Development Plan in October 2013 and is currently carrying out a full review. The Plan covers the period 2007 to 2022. The following priority issues relevant to this assessment are summarised here and detailed in full in the Heritage Desk-based Assessment (Appendix F.1).

The proposed scheme must consider the issues highlighted in the LDP’s priority issue ‘Protecting Conway’s Cultural Heritage’, which highlights the need to ensure design and built quality to protect, maintain, and where appropriate, improve on the historic built environment.

The proposed scheme must also consider Spatial Objective SO12, Strategic Policy CTH/1 – Cultural Heritage, Policy CTH/2 – Development Affecting Heritage Assets, Policy CTH/3 – Buildings and Structures of Local Importance, Policy CTH/4 – Enabling Development and Policy CTH/5 – The Welsh Language. These spatial and supporting development management policies detail how the council will protect and, where appropriate, enhance its cultural and heritage assets.

8.3 Baseline Conditions

8.3.1 Baseline Data Assessment and Sources Consulted

This section presents a summary of the archaeological and historical background for the proposed scheme as a whole, followed by a discussion of each CMU based on the results from the Historic Desk-based Assessment, the full results of which can be found in Appendix F.1.

The following sources were consulted:

- Cadw for designated assets;
- CCBC Historic Environment Record (HER) as held by Clwyd-Powys Archaeological Trust (CPAT);
- cartographic sources; and

⁶⁹ Welsh Government (2015) Well-being of Future Generations (Wales) Act

⁷⁰ Welsh Government (2016) The Historic Environment (Wales) Act

- documentary sources.

The baseline assessment and data collection were undertaken in 2021. At this time, it was due to the COVID-19 pandemic restrictions, it was not possible to conduct an archive visit as these were closed to the public.

A site visit was undertaken by Patrick Mayer over the 21-22nd February 2022 in order to assess the current site conditions, to identify heritage assets within the vicinity of the scheme and to assess the effects on the setting of nearby and non-designated assets. There were intermittent rain showers and high winds that did not impact the assessment.

The assessment considered both the direct effects of the proposal on cultural heritage assets within the proposed scheme of each CMU, and of indirect effects on assets located outside of the proposed scheme of each CMU. The baseline conditions were determined by means of desk-based studies and a site visit. The desk-based study collected information from the Regional HER, the National Monuments Record (NMR), and Scheduled Ancient Monument and Listed Building information. Aerial Photographs, Cartographic and documentary sources were also reviewed. Following consultation with Welsh Government, it was decided that the 2.5km of the proposed scheme would be taken forward through for a planning application and the assessment proceeded accordingly.

8.3.2 Baseline Context

The buffer is 300m inland and 500m to the sea except at the eastern end where it has been extended to 750m to consider potential setting impacts on the Conservation Area (refer to Figure 1 in the Heritage Desk-based Assessment in Appendix F.1).

The data search (xxxx, 2021) the study area contained six designated assets, including five Listed Buildings and one Conservation Area, 43 non-designated assets, and five archaeological events (see Tables B.1, B.2 and B.3 in Appendix B Gazetteer in the Heritage Desk-based Assessment in Appendix F.1 for full details).

The locations of designated and non-designated assets are shown in Figures 2 and 3 in Appendix A of the Heritage Desk-based Assessment in Appendix F.1. These are discussed within the context of the archaeological and historic baseline in the following sections. Bracketed numbers within the text refer to the record identification number.

The baseline heritage research for the study area dating from the Palaeolithic period to modern day. The recorded heritage assets and document records show the development of the area from the transient use of the land in the prehistoric period through to its modern focus as a holiday destination. The full baseline can be found in the Heritage Desk-based Assessment in Appendix F.1.

8.3.3 CMU Specific Baseline

The following is an overview of the recorded heritage assets within each CMU. The full details can be found in the Heritage Desk-based Assessment in Appendix F.1.

CMU 3-5B: Towyn Revetment

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Historic Parks and Gardens, Protected Wreck Sites or Registered Battlefields within the study area around this CMU.

Non-designated Assets

There are four non-designated assets within the study area around the CMU and all date to the post-medieval and modern period (see Figure 3 in Appendix A of the Heritage Desk-based Assessment in Appendix F.1). There are records that the remains of two shipwrecks (240961;

271737) may be located close to the LWMOT. These are recorded approximately 200-275m from the Site. The location of the Winkups Holiday Camp (418593) is recorded approximately 325m to the south of the Site, however the triangular camp extends to the railway on its north side, to the A548/Towyn Road on its southern side, and to Peris Avenue on its western side. It was founded in 1925 and is one of ten modern holiday parks in north Wales owned by the leisure company Lyons. It has been extended and extensively modified throughout the 20th century. The record for the location of the early 20th century rifle range (300223) is approximately 160m to the south of the beach frontage. The range is no longer extant as the location has been redeveloped as part of the Golden Sands Holiday Park.

CMU3-5C: Kinmel Bay Beach

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Registered Historic Parks and Gardens, Protected Wreck Sites or Registered Battlefields within the study area of this CMU. The designated assets within the study area of this CMU are shown in Figure 2 in Appendix A of the Heritage Desk-based Assessment in Appendix X.

The River Street Conservation Area (311) in Rhyl is approximately 725m to the east of the Site. This Conservation Area is within Denbighshire County Council (DCC) and is designated for being a good example of 19th century town planning characteristically based on a rectilinear grid⁷¹. It is also for being representative of a seaside resort that developed over a relatively short space of time and is characterised as having a 'modest elegance' with buildings that display late Victorian, Arts and Crafts, Edwardian and Art Deco styles of architecture⁷². It is further noted that the River Street conservation area, which features sea front views, is a key strength in attracting a wider range of residents to West Rhyl⁷³.

There are four Grade II Listed Buildings within the study area around this CMU: Nos 72, 73, 74 and 75 West Parade (14334-14337), which combine to create a terrace consisting of 5 double-fronted villas, 3 storeyed with basement and attics, and 3-storeyed wings to rear. (The fifth Listed Building in this terrace, No 71 (14333), is just outside of the study area.) The terrace faces towards the sea and is within the River Street Conservation Area (311). It is approximately 715m to the east of Site, between Butterson Road to its west and River Street to its east. The Listed Buildings in this terrace should be treated as a group. The terrace was built in stages and completed by 1889. The terrace retains almost all of its original details as late 19th century purpose-designed boarding houses that are the best example of their type in Rhyl. The terrace displays the characteristic multi-storeyed form with prominent bay windows that served as a model for the sea-side boarding house in the area in the later 19th century. Drawing rooms are located at the front of each house and on each floor to command a sea view.

The final designated asset in this CMU is Foryd Bridge (14322), which is a Grade II Listed steel arch 'bowspring' bridge of two spans that dates to 1932. It replaced an earlier bridge dated 1862 that operated as a toll bridge. The present bridge was designed by the county surveyor of Flintshire, Mr D G Whitley, in association with the engineering firm Rendel, Palmer and Tritton, and was constructed by the British steel producer and bridge-builders Dorman, Long & Co. It is designated as an example of British civil engineering which forms a notable landmark at the mouth of the River Clwyd.

Non-designated Assets

⁷¹ Denbighshire County Council (2013) Supplementary Planning Guidance Note 27 West Rhyl Regeneration Area. Available at: <https://www.denbighshire.gov.uk/en/planning-and-building-regulations/local-development-plan/supplementary-planning-guidance.aspx>

⁷² Denbighshire County Council (2013) Supplementary Planning Guidance Note 27 West Rhyl Regeneration Area, 20.

⁷³ Denbighshire County Council (2013) Supplementary Planning Guidance Note 27 West Rhyl Regeneration Area, 22.

There are 39 non-designated assets in the HER within the study area around this CMU (see Figure 3 in Appendix A of the Heritage Desk-based Assessment in Appendix X). One asset dates to the Mesolithic (524773), one asset refers to the Roman coin of Rhyl (17613), which has been discussed, and the remainder of the assets date to the post-medieval or modern period.

The closest assets to the coastal frontage of the Site are located within the Sunnyvale Caravan Park. Records indicate that most are no longer extant as the area was developed into holiday parks in the earlier 20th century. Two parts of the Liverpool and Holyhead Telegraph (300825; 300827) were built in 1828 and 1848, respectively, and there are no remains of either building at their respective locations. The location of the modern Foryd Bridge Holiday Camp (30022) is recorded within the Sunnyvale Caravan Park, approximately 80m to the south of the coastal frontage of the Site. The later caravan park may have incorporated some of the buildings from the earlier holiday camp that began operation sometime in the 1930s or immediately after the end of the Second World War.

Three late 19th to early 20th century rifle ranges (141797; 141798; 141856) are recorded approximately 100m-160m to the south of the Site within the Sunnyvale Caravan Park are also no longer extant. A fourth rifle range dating to the First World War (141850) is recorded just to the north of Foryd Road near the Asda Rhyl Superstore approximately 220m to the south of the Site and is no longer extant. Similarly, the former locations of a First World War army camp (132170) and the No 3 manoeuvring area of the camp (132184) are recorded at the northern side of the Winkups Holiday Camp, just to the south of the railway, but both are no longer extant.

There are ten shipwrecks recorded within this CMU. Kinmel Bay Wreck 8243 (64185) is reported as measuring 17m in length and is approximately 350m to the north of the Site. Four further shipwrecks (271628; 271598; 524837; 524878) are recorded between 400m and 625m to the north and northeast of the proposed scheme. Four are recorded at Foryd Harbour (271360; 34276; 442; 34274), approximately 200m to the south of the eastern end of the Site. A potential fifth (506949) was recently visible in photographs of Foryd Harbour dating to July 1987, but its remains have not been further explored or identified. Its coordinates are also approximately 125m to the south of the eastern side of the proposed scheme.

There are a number of records within the CMU that refer to assets that are no longer extant as follows:

- The old Foryd breakwaters (83080) that correspond to the OS Second edition map of 1899 are recorded approximately 50m to the west of the eastern part of the Site. The area is now the Rhyl Harbour Car Park and Aqua Marine Solutions boat service company.
- The post-medieval Foryd railway (83559) is recorded approximately 180m to the west of the eastern end of the Site. This was a temporary structure located on the former Foryd beach on land owned by Hugh Robert Hughes of Kinmel Hall, a shareholder of the Vale of Clwyd Railway, who also constructed a terminal station at Foryd Pier (Wright 2017). This closed in 1959 and nothing remains of the former railway or the Foryd Pier Station at the former Foryd Pier, which has since been redeveloped.
- The site of a post-medieval landing stage and pier (83520) built by Hugh Robert Hall sometime before the mid-1850's is recorded approximately 200m to the southwest of the Site but it has since been redeveloped in the modern period as a quay and adjacent slipway (83521)⁷⁴.
- The site of a post-medieval ford (81548) depicted on the 1839 tithe map is recorded approximately 250m to the south of the Site. It is no longer extant as the shoreline has been redeveloped.

⁷⁴ CPAT (2007b) Foryd Harbour Infrastructure Works, Denbighshire. CPAT Report No 879. Available from: <http://www.walesher1974.org/herumd.php?group=CPAT&level=3&docid=301360897> [Accessed February 2022].

- A modern shipyard (34292) and two landing stages (83523; 83516) recorded across the river approximately 150m to the east of the eastern end of the Site are no longer extant as the shoreline has been redeveloped.
- Foryd Hall in Rhyl (35826) and the Bettws Private Hotel (422476) in Kinmel Bay have both been demolished.

The remaining assets recorded within the study area around this CMU include the following:

- The potential Mesolithic or earlier remains of submerged forest at Rhyl that was exposed near the mouth of the River Clwyd (524773). This area is recorded approximately 400m to the northeast of the eastern end of the Site. It produced a mattock and other lithic tools below the peat, and an axe was also found within the peat;
- The Kinmel Bay Boundary Stone (101567) approximately 275m to the south of the Site, within the northern area of the Lyons Winkups Holiday Camp, just to the south of the railway line;
- The record for Foryd Harbour (34277), which was built by Hugh Robert Hall prior to 1850 and is depicted with a pier on a number of 19th century photographs and on the OS 1877 maps, is recorded approximately 250m to the south of the Site;
- The location of the Foryd former timber yard (83522) is approximately 50m to the west of the eastern part of the Site but very little remains, as the yard has been levelled. One building was retained for a re-development project⁷⁵;
- A post-medieval former industrial brick building at Foryd Harbour (128646) located approximately 80m to the west of the eastern end of the Site. It was once used to facilitate the narrow-gauge railway nearby; and
- Elements of the 19th century Foryd timber yard wharf (83555) and quay (83521), the latter in partly ruinous condition (CPAT 2007b), which are approximately 60m and 185m to the southwest of the eastern end of the Site, respectively.

Insecure findspots within the study area around this CMU include an incomplete finger ring of likely post-medieval date (122728), a copper alloy finger ring of uncertain date (122769), a post-medieval lead alloy musket ball (122767), and the aforementioned copper Roman coin (17613). The first three objects were recovered between 150m-315m to the north of the Site, while the lost Roman coin of Rhyl, which has been discussed, is reported to have been found somewhere in approximately 450m to the east of the eastern end of the Site⁷⁶.

8.4 Assessment Methodology & Assessment Criteria

The assessment methodology is based on the Principles for Cultural Heritage Impact Assessment⁷⁷. The basis for assessing impacts on the historic environment is an understanding of the heritage assets that might be affected by a proposal. Planning policy and guidance emphasise the need to understand the cultural significance of heritage assets, including their setting, reflecting that the primary purpose is to preserve significance rather than no change. The process of gaining this understanding can be broken down into three distinct stages:

Description: Research leading to a preliminary factual statement that establishes the location, nature and setting of the asset.

Cultural significance: Analysis of what we value about the asset and the contribution made by its setting, leading to a statement of cultural significance. Cultural significance is not scaled but can be expressed in terms of four key 'heritage values' as outlined in Conservation

⁷⁵ CPAT (2007a) Ports and Harbours in North-east Wales, 17

⁷⁶ Davies (1983) Coinage and settlement in Roman Wales and the Marches, 81

⁷⁷ IEMA (2021) Principles of Cultural Heritage Impact Assessment. [Online] Available from: <https://www.iema.net/resources/blog/2021/07/20/launch-of-principles-of-cultural-heritage-impact-assessment>

Principles for the sustainable management of the historic environment in Wales (Conservation Principles)⁷⁸:

Evidential value: every historic asset has a unique story to tell. The surviving historic fabric and detail — whether above or below ground — helps us to understand when and how each historic asset was made, how it was used and how it has changed over time. Pictorial and documentary sources may also increase our understanding.

Historical value: historic assets may illuminate particular aspects of the past. They can help us to understand how people lived and worked, and the beliefs and values they cherished. They may be associated with notable people or events. Through evocation and association, historic assets can connect past people, aspects of life and events with the present.

Aesthetic value: we may value historic assets for their visual qualities, whether they result from conscious design and craftsmanship, or from the fortuitous effect of change over time. Tastes alter and so do historic assets: earlier records and careful analysis of what survives may help in appreciating aesthetic value.

Communal value: historic assets may be cherished by the people and communities who relate to them, and they may play an important part in collective experience or memory. Historic assets can have economic as well as social value with the capacity to provide a valuable source of income or employment.

Importance: A conclusion regarding the level of protection or consideration that the asset merits in planning policy and cultural heritage legislation. A judgement on importance is scaled and can therefore be expressed in terms of the following criteria:

Table 8-1: Importance criteria

Importance	Examples
High	Scheduled Monuments Listed Buildings Conservation Areas Registered Historic Parks and Gardens Registered Historic landscapes Places or structures of international importance due to their 'outstanding universal value' Non-designated heritage assets of equivalent national importance or potential to contribute significantly to national research objectives
Medium	Non-designated assets of regional or high local importance with potential to contribute significantly to regional and local research objectives. This includes assets which have particular regional associations or may have important associations in a local context (e.g. they have significance to local population or embody something of the special identity of a locality).
Low	Non-designated assets which are relatively poorly preserved or have limited importance in a local context and low potential to add to local and regional research objectives.
Negligible	Assets that have very limited or no archaeological, historical or cultural importance.
Uncertain	Sites where there is evidence that a heritage asset may exist, but where there is insufficient information to determine its nature, extent and degree of survival given current knowledge.

⁷⁸ Cadw (2011) Conservation Principles for the sustainable management of the historic environment in Wales. Available from: <https://cadw.gov.wales/advice-support/conservation-principles/conservation-principles>.

Having understood cultural significance, the next step is to understand the proposed change(s) and the impact they would have on cultural significance. The process of evaluating the consequences of change can be usefully broken down into three distinct analytical stages:

Change: A factual statement of how a proposal would change an asset or its setting including physical, visual appearance, scale, nature and duration.

Impact: An assessment of the degree to which any changes would increase or decrease the cultural significance of an asset. Impact is scaled and the magnitude of impact reflects the extent to which the cultural significance of an asset is changed by a proposal. A judgement of magnitude of impact can be made based on the following criteria:

Table 8-2: Magnitude of impact criteria

Magnitude of Impact	Criteria
Major Negative	Causes total destruction, or change to, most key elements of the asset that results in substantial loss of integrity and cultural significance. Comprehensive change to the setting of the asset, which is a critical aspect of the cultural significance of the asset. Any such change would not normally be reversible.
Moderate Negative	Causes change to, or loss of, many key elements which result in a moderate loss of integrity and cultural significance of the asset. Moderate changes to the setting of the asset where this makes an important contribution to the cultural significance of the asset.
Minor Negative	Change to some elements which lead to a limited loss of integrity and cultural significance of the asset. Change to the setting of the asset where this makes a limited contribution to the cultural significance of the asset.
Negligible / No change	No appreciable change to the cultural significance of the asset or its setting.
Minor Positive	Change to some elements which leads to limited improvement in integrity and cultural significance of the asset, or arrests decline. Change to the setting of the asset where this makes a limited contribution to the cultural significance of the asset.
Moderate Positive	Causes change to many key elements which result in a moderate enhancement to integrity and cultural significance of the asset or reverses decline. Moderate changes to the setting of the asset where this makes an important contribution to the cultural significance of the asset.
Major Positive	Causes significant change to most key elements of the asset that results in substantial enhancement of cultural significance. Comprehensive change to the setting of the asset which this is a critical aspect of the asset's cultural significance.

Effect: A conclusion regarding whether an impact matters or not, reflecting the importance of the affected heritage asset. The effect is the measure that brings together the magnitude of the impact and the heritage asset's importance. This a critical stage of the assessment process as this determines the weight that should be given to the matter in either influencing the design of the proposal or ultimately in the test as to whether the proposal will be acceptable and permitted. The effect can be articulated through the use of a matrix which brings together the importance of an asset and the magnitude of impact on the assets significance. Where there are two options for a level of effect it is a matter of professional judgement which should be articulated in the text description as to the level of effect appropriate:

Table 8-3: Level of effect criteria

Importance of Asset	Magnitude of Impact			
	No Change	Minor	Moderate	Major
Negligible	Not Significant or Neutral	Slight/Neutral	Slight/Neutral	Slight/Neutral
Low		Slight/Neutral	Slight	Moderate/Slight
Medium		Slight	Moderate	Moderate/Large
High		Moderate/Slight	Large/Moderate	Large

8.4.1 Assessment of Significance and Assessment of Archaeological

The baseline study identified no heritage assets considered likely to be directly physically impacted by the proposed scheme and nine heritage assets considered likely to be indirectly impacted by the proposed scheme. As these are the only heritage assets considered likely to be impacted by the scheme, they are the only heritage assets considered below in the significance and impact assessment. The remaining heritage assets are all sufficiently distant from the CMUs and proposed scheme areas that they will not be physically impacted. The CMUs make no contribution to the settings or significance of these assets and therefore the proposed scheme will not have an impact upon them.

CMU3-5C Kinmel Bay Beach

The River Street Conservation Area (311) in Rhyl holds historical and evidential value for being a good example of 19th century town planning. It exhibits aesthetic value through its characteristic rectilinear gridded streets, which also reflects its history as a seaside resort. This is further evidenced within the Conservation Area through its key buildings that retain later Victorian, Arts and Crafts, Edwardian and Art Deco styles, material forms, and construction techniques. The Conservation Area has communal value as it has been identified as a key strength for attracting a wider range of residents into West Rhyl. The River Street Conservation Area has high importance.

The Grade II Listed Nos 72–75 West Parade (14334–14337) in Rhyl each retain historical and evidential value by exhibiting architectural styles, material forms and construction techniques that served as a model for the sea-side boarding house in the area in the later 19th century. The views of the sea afforded from the front drawing rooms of each floor of each building have aesthetic value and are characteristic of the coastal location. Each building has communal value to the people who utilise them today as residential housing. Together they constitute a rare historical group survival that retain almost all of their original details. The assets were built in stages with the goal of functioning as a single terrace (along with No 71, which is outside of the study area) and should therefore be treated as a group. Nos 72–75 West Parade (14334–14337) as a group has high importance.

The Grade II Listed Foryd Bridge (14322) retains historical and evidential value by exhibiting architectural styles, material forms and construction techniques of British civil engineering of the early 20th century. The view of Foryd Bridge from Rhyl Harbour has aesthetic value and is characteristic of its location as a landmark at the mouth of the River Clwyd. It has communal value as a landmark and a recognisable historic link to the internationally renowned British bridge-builders Dorman Long & Co. Foryd Bridge has high importance.

The post-medieval brick building at Foryd Harbour (128646) and the Foryd timber yard wharf and quay (83555; 83521) are non-designated assets and each hold historical and evidential value by evidencing common industrial activities that took place around the Foryd coast and

Foryd Harbour in the 19th and 20th centuries. The views towards the River Clwyd and the harbour at each asset have aesthetic value and are characteristic of their locations, which reflect their history as part of industrial development around Foryd and its relationship to the wider area of Rhyl and north Wales during the late 19th and earlier 20th centuries. The historical value of the brick building is reduced due to its condition and because limited evidence remains of its purpose. The historic value of the wharf and quay are reduced as few elements of the wharf remain in situ and much of the quay is in poor condition. The post-medieval brick building at Foryd Harbour (128646), timber yard wharf and quay (83555; 83521) each have low importance.

8.4.2 Archaeological Potential

The potential for a Palaeolithic submerged forest at Kinmel Bay Beach (524773), which also produced a mattock, an axe, and other lithic tools, contributes rare early archaeological evidence within the study area. However, the findspots, as a single asset, has negligible heritage importance as the removal of the artefacts from their context has reduced its heritage significance. Similarly, the HER indicates that there is a potential for geoarchaeological and palaeoenvironmental evidence for the Palaeolithic or early Mesolithic period associated with an ancient, submerged forest present at the foreshore at Kinmel Bay Beach (524773). However, no evidence was observed during the walkover survey, including within the Site boundary. Further, as the coastline has been subject to increased storminess since the Palaeolithic and early Mesolithic period it is likely that coastal erosion will have removed earlier deposits, making it unlikely that a full stratigraphic sequence would be obtained. Any finds are therefore likely to be unstratified and redeposited. Overall, it is considered to be a low potential to encounter artefacts or identify archaeological deposits of Palaeolithic or Mesolithic date within the Site.

There are a number of shipwrecks recorded within the study area. Shipwrecks hold evidential and historical value of the post-medieval maritime period through the study of their remains to enhance our understanding of historic maritime life, transport and trade. There is aesthetic and communal value in the study of shipwrecks particularly for those who associate with maritime life, the coastal community and the families of individuals who lost their lives when the ships were lost. There is one confirmed wreck within the study area (64185). However no evidence of shipwrecks was observed during the walkover survey, including within the Site boundary. Overall, it is considered to be a low potential to encounter shipwrecks within the Site.

There are a number of insecure findspots within the HER. This includes an incomplete finger ring of likely post-medieval date (122728), a post-medieval lead alloy musket ball (122767) and copper alloy finger ring of uncertain date (122769). As the Roman coin (17613) can only be said to have been found in Rhyl the historic value of its findspot is negligible. Likewise, the locations of the findspots of the other artefacts have negligible historic value as the removal of the artefact has removed its heritage significance, therefore there is expected to be no impact to those locations as a result of the proposed scheme. Overall, it is considered to be a low potential to encounter artefacts of Roman to post-medieval date within the Site.

8.5 Potential Impacts & Significant Effects

When assessing the impacts on heritage assets for the proposed scheme, there are three aspects to consider as follows: assets that may be directly impacted by construction of the works through the installation of rock armour and excavation for the new defences; assets that are located outside the permanent construction footprint but are within the construction corridor and may be impacted by construction activities; and impacts on the setting of heritage assets.

8.5.1 Construction-related impacts

There are no direct, physical impacts on any World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, Conservation Areas, Protected Wreck Sites, Registered Battlefields, non-designated heritage assets, or archaeological environment deposits expected as a result of the proposed scheme.

Construction activities, such as plant movement and material storage for the proposed new defences have the potential to impact assets negatively on some heritage assets when located within or close to the Site boundary on the foreshore. The following identifies heritage assets that may be impacted and can be utilised to feed into the Construction Environment Management Plan for construction activities.

8.5.2 CMU3-5C Kinmel Bay Beach

The River Street Conservation Area (311), the Grade II Listed Nos 72-75 West Parade (14334-14337), also within the River Street Conservation Area, are outside of the construction footprint. During the construction stage, long views to the Site from the Conservation Area, including 72-75 West Parade, will be temporarily altered due to the addition of a construction area within this view as the project proceeds. This will not be in keeping with the natural seafront aesthetic from views that take in the Site. However, the change to the setting will be limited and the overall appreciation of the wider coastal location and context will remain legible. Therefore, the effect is considered to be a minor adverse impact. On assets of high importance this will result in a temporary slight adverse significance of effect during the construction phase that will cease once construction is completed. The overall residual impact on the setting of the River Street Conservation Area and the Grade II Listed Nos 72-75 West Parade from construction activities is neutral.

The Grade II Listed Foryd Bridge (14322) is also outside of the construction footprint. During the construction stage, long views to the Site from the bridge will be temporarily altered due to the addition of a construction area within this view as the project proceeds. This will not be in keeping with the harbour aesthetic from views from the bridge that take in the Site. However, the change to the setting will be limited and the overall appreciation of the wider harbour location and the context in which the bridge is located will remain legible. Therefore, the effect is considered to be a minor adverse impact. On assets of high importance this will result in a temporary slight adverse significance of effect during the construction phase that will cease once construction is completed. The overall residual impact on the setting of the Grade II Listed Foryd Bridge (14322) from construction activities is neutral.

The post-medieval brick building at Foryd Harbour (128646) and the Foryd timber yard wharf and quay (83555; 83521) are both non-designated and outside of the construction footprint. This area of the Site is to be utilised as an access route for vehicles to reach the northern side of the Site along the coastal frontage. Therefore, there will be temporary minor adverse impacts on the settings of each asset arising from increased vehicle movement and noise associated with the construction phase of the scheme. On an asset of low importance, the minor adverse impact will result in a slight adverse significance of effect during the construction phase. The impact will cease once construction is completed. The overall residual impact on the settings of the non-designated post-medieval brick building at Foryd Harbour and the non-designated Foryd timber yard wharf and quay from construction activities is neutral.

8.5.3 Site compounds

The locations of works compounds have yet to be confirmed. However, the locations for compounds have been proposed utilising existing hardstanding and access from the construction compounds to the foreshore and are expected to utilise slipways. As a result, no impact on any buried archaeological remains is anticipated. One potential exception is a compound location in CMU 3-5B to the east of Knightly's Fun Park. This compound location is

on grass and may therefore result in impacts on previously unrecorded archaeological remains.

8.6 Mitigation Measures

There is a low potential that buried archaeological deposits or artefacts may be discovered during works on the foreshore within the Site boundary. A toolbox talk (TBT) should be given as part of the works induction process and form part of the Construction Management Plan to help familiarise the project team with the cultural heritage of the area. The TBT should have an associated protocol for archaeological recording and reporting to the relevant authorities in the event of an unexpected discovery of archaeological deposits or artifacts.

No mitigation in relation to temporary effects on the setting of heritage assets is recommended.

The potential for introducing unanticipated impacts on the settings of heritage assets may be avoided through careful consideration of materials and finishes to be used. For example, it is recommended that the rock armour be of a type that fits in with the geology of the locality.

8.7 Residual Effects

8.7.1 CMU3-5C: Kinmel Bay Beach

The Grade II Listed Foryd Bridge (14322), the River Street Conservation Area (311) and the Grade II Listed Nos 72-75 West Parade (14334-14337), the latter of which are within the River Street Conservation Area, are all outside of the construction footprint. The construction will result in little change to the views which contribute to the settings of all of these assets during the operation period of the Site. The effect of the proposed works on Foryd Bridge, the River Street Conservation Area and the Grade II Listed Nos 72-75 West Parade is therefore assessed as neutral.

All impacts to the non-designated post-medieval brick building at Foryd Harbour (128646) and the non-designated Foryd timber yard wharf and quay (83555; 83521) are limited to the construction period as there are no views to permanent effects to the coastal frontage from these locations. The effect of the proposed works on these assets is therefore assessed as neutral.

8.7.2 Scheme-wise operational impacts

One goal of the proposed scheme is to help preserve the built heritage assets along the northwest coast of Wales. As the proposed changes are in keeping with the beach settings of the known heritage assets within the study area, it is unlikely that any will experience any alteration to their current baselines.

The proposed scheme is unlikely to increase the protection from flooding of the heritage assets because their locations are at a distance from the proposed upgrades that they are unlikely to experience an alteration from their current baseline. This includes Foryd Bridge (14322), the River Street Conservation Area (311), the Grade II Listed Nos 72-75 West Parade (14334-14337), the post-medieval brick building at Foryd Harbour (128646) and the Foryd timber yard wharf and quay (83555; 83521). The overall residual impact of the proposed scheme on the heritage environment is therefore assessed as neutral. The impacts of the proposed works should be weighed against the benefits provided from flood protection not just to heritage assets but to the study area as a whole.

The Proposed scheme is assessed as having the following impacts to heritage assets within the study area as shown in Table 8-4.

Table 8-4: Assessment of Impact and Significant Effects

Heritage Asset	Importance of Asset	Construction		Operation	
		Magnitude of impact	Significance	Magnitude of Impact	Significance
River Street Conservation Area (311)	High	Minor adverse	Slight adverse	No Impact	Neutral
Nos 72-75 West Parade (14334–14337)	High	Minor adverse	Slight adverse	No Impact	Neutral
Foryd Bridge (14322)	High	Minor adverse	Slight adverse	No Impact	Neutral
Post-medieval brick building at Foryd Harbour (128646)	Low	Minor adverse	Slight adverse	No Impact	Neutral
Foryd timber yard wharf and quay (83555; 83521)	Low	Minor adverse	Slight adverse	No Impact	Neutral

9 Contaminated Land

9.1 Introduction

The purpose of this contaminated land assessment is to consider the contaminated land baseline relevant to the scheme and assess the potentially significant issues scoped in as part of the scheme. The assessment includes consideration of the risks to human health and environmental receptors associated with the proposed construction and operation of the scheme. The assessment identifies the predicted environmental effects and proposes management and mitigation measures to negate or minimise those effects. A description of the proposed scheme is included in Section 2.5.

A Phase1 Contaminated Land Desk study was completed for the original scheme extent. This assessment can be found Appendix G.1.

9.2 Legislative and Planning Policy Framework

The main legislative framework regarding geology and soils (including contaminated land) is set by the following Act and Regulations:

9.2.1 Land-based

The main legislative framework regarding land-based resources is set by the following Acts and Regulations;

- Environmental Protection Act 1990: Part IIA Contaminated Land Statutory Guidance;
- The Contaminated Land (Wales) Regulations 2006.
- Wildlife and Countryside Act 1981 (England and Wales) (Amendment) Regulations 2016;
- Agriculture Act (Wales) Regulations 2020;
- Town and Country Planning Act (North Wales) 1971;
- Environmental Protection (Duty of Care) (Amendment) (Wales) Regulations 2003;
- Council Directive 1999/31/EC of 1999 on the landfill of waste;
- Control of Pollution (Oil Storage) (Wales) Regulations 2001;
- Control of Substances Hazardous to Human Health (COSHH) 2002;
- Landfill (England and Wales) Regulations 2005;
- Hazardous Waste (England and Wales) Regulations 2005;
- Contaminated Land (Wales) Regulations 2006;
- Construction (Design and Management) (CDM) Regulations 2015; and
- Environmental Permitting Regulations (England and Wales) 2010.

Part IIA of the Environmental Protection Act (EPA) 1990

The statutory process for dealing with contaminated land in England and Wales is set out in Part IIA of the Environmental Protection Act 1990 (EPA 1990). Part IIA sets in place a regime whereby contaminated land can be identified, a decision made as to how the land would be remediated and where responsibility for this would fall. The Act sets out categories for potentially contaminated sites from Category 4, describing land that is not contaminated land, in the legal sense to Category 1, describing land where there is a significant possibility of significant harm. The primary legislation is supported by several secondary legislative instruments including the Contaminated Land (Wales) Regulations 2006 and Defra Circular 01/2006 'Contaminated Land'.

Town and Country Planning Act 1990

The Town and Country Planning Act 1990 provides local authorities with the ability to require developers to investigate contamination and, if necessary, remediate the land.

There are also several waste related regulations which serve to protect soils from contamination by waste management:

- Hazardous Waste (England and Wales) Regulations 2005;
- Environmental Protection (Duty of care) (Amendment) (Wales) Regulations 2003;
- Waste Management Licensing (Amendment) (Wales) Regulations 2004;
- Environmental Permitting Regulations (England and Wales) 2010;
- Landfill Directive 1999; and
- Landfill (England and Wales) Regulations 2002.

Under the Control of Substances Hazardous to Health Regulations 2002 and the Construction (Design and Management) Regulations 2015, where a developer knows or suspects the presence of contaminated soil, provision should be made to ensure that risks to the public and site workers are minimised.

9.2.2 Water-based

The main legislative framework regarding water resources is set by the following Acts and Regulations;

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- Water Act 2003 (Wales);
- Protection of Groundwater against Pollution and Deterioration (2006/118/EC); and
- Water Resources Act 1991 (Amendment) (England and Wales) 2009.

Environmental Permitting Regulations 2010

The Environmental Permitting Regulations 2010 regulate pollution control by requiring permits for emissions to, for example, air and water. During construction of the scheme, there may be requirements for environmental permits if dewatering of excavations or re-use of soils is required.

The Environmental Permitting Regulations 2010 regulate landfills under the Landfill Directive (99/31/EC). It sets tough operational and technical requirements for disposal of waste by landfill, with the aim of reducing the negative effects of landfilling.

9.2.3 Planning Policy Wales

Planning Policy Wales (PPW) is the Welsh Government's primary statement of planning policies, the most recent Edition (11) published on 24th February 2021.

The planning policy in relation to the contaminated land is presented in paragraphs 16 to 21 of section 6.9 of the PPW. This section deals with Development and Contaminated Land and provides a framework with which unacceptable risks from pollution to human or environmental health must be accounted for, with remediation as appropriate. The planning system should guide development to reduce the risk from natural or human-made hazards affecting the land surface or sub-surface. The PPW also states what the focus of the local planning authority (LPA) should be when considering if land is acceptable for the proposed use.

Planning Policy Wales makes clear that:

- Planning decisions need to consider:
 - The potential hazard that contamination presents to the development itself, its occupants and the local environment; and
 - The results of a specialist investigation and assessment by the developer to determine the contamination of the ground and to identify any remedial measures required to deal with any contamination.
- Where significant contamination issues arise, the LPA will require evidence of a detailed investigation and risk assessment prior to the determination of the application to enable beneficial use of land. Where acceptable remedial measures can overcome such contamination, planning permission may be granted subject to conditions specifying the necessary measures. If contamination cannot be overcome satisfactorily, the authority may refuse planning permission.

Proposals requiring planning are submitted to the LPA who may then consult with others before deciding whether to approve the plans and, if approval is granted, any necessary conditions relating to remediation measures should be attached to the consent.

A site owner may decide to undertake remediation work on a voluntary basis and quite often will require planning permission to do so.

9.2.4 Guidance

The following guidance has informed the assessment of effects within this Chapter:

- BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of Practice;
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- Building Regulations 2010 Approved Document C Site preparation and resistance to contaminants and moisture;
- Welsh Government, 2012 Environmental Protection Act 1990, Guidance Document: Contaminated Land Statutory Guidance: 2012; and
- Natural Resources Wales's Land Contamination: Risk Management (LCRM), which formally replaces the archived Contaminated Land Research Report 11 (CLR 11), for completion of preliminary contaminated land risk assessment and the development of a conceptual model.

The conceptual model is described in terms of the contaminant sources, transport pathways and possible receptors that may be present, and the potential pollutant linkages between them, as defined in the relevant legislation and guidance.

9.2.5 Environmental Impact Assessment Methodology

NRW provides guidance on EIA with regard to land contamination issues. For land contamination Natural Resources Wales's key role is to advise local authorities during the planning process on the risks to, and protection of, the water environment. There is a considerable amount of guidance that has been prepared to assist both local authorities and practitioners in assessing the degree to which land is contaminated and deciding whether such land is contaminated within the meaning of the Part IIA of the Environmental Protection Act 1990 (as amended, hereon after, as amended for each piece of legislation where appropriate) and associated guidance.

The Environmental Protection Act 1990 provides a statutory definition of contaminated land: "Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- Significant harm is being caused or there is a significant possibility of such harm being Caused; or

- Significant pollution of controlled waters is being, or is likely to be caused.”

Underpinning the guidance is a source-pathway-receptor methodology, which is used to identify Significant Pollutant Linkages (SPLs). The following definitions apply:

- Source/hazard: contamination identified (exceeding corresponding guideline values);
- Pathway: the means by which the hazardous contamination can come into contact with the receptor; and
- Receptor: the entity which is vulnerable to harm from the source.

Without a significant pollutant linkage, the contamination source may be a hazard but does not constitute a risk to human health or the environment.

When the potential for contamination to cause a significant effect was assessed, the extent and nature of the potential source or sources of contamination were assessed, the pathways identified, and any sensitive receptors or resources identified and appraised. This was completed to determine the receptor value and sensitivity to contamination related impacts.

When a significant hazard was identified and potential sensitive receptors noted as present, then the potential effects were determined by considering the pathways whereby the hazard may affect the receptors. During the assessment it was assumed that there would be (either during or after construction) a pathway present between the source and the receptor, unless there is a clear indication that this would not be the case.

The strength of a pathway between a source and receptor is a function of the distance between the two and the ease or otherwise of transport along the migration pathway. For example, on sites underlain by impermeable clays, the migration pathway via groundwater would be weak, even over short distances. When sites overlie sands, the migration pathway would be stronger for receptors near a source and weak for receptors at some distance from the source.

For a scheme such as this where much of the ground is covered in hard surfacing, the migration pathway for soil or water contamination is generally moderate or weak. This is because the hard surfacing breaks any direct contact pathways associated with human health and reduces or minimises the extent of infiltration and mobilisation of any contamination bound to soils, which could have an impact on environmental receptors.

The pathway is invariably strong for construction workers on contaminated sites, because they are likely to be in close proximity to the soils, particularly during ground works. However, the effect may be weaker as the effects are acute (short term), as opposed to being chronic (long term).

The combination of the sensitivity of the receptor and the magnitude of the impact was used to provide an indication of the level of contamination risk on the site and the nature and severity of possible effects.

The assessment of risk presented here has been based upon the procedure outlined in DEFRA Circular 01/2006. In addition, DEFRA, with the Collaborative Centre of Excellence in Understanding and Managing Natural and Environmental Risks, Cranfield University, has published guidance on risk assessment (Guidelines for Environmental Risk Assessment and Management). A guide to good practice for contaminated land risk assessment has also been produced by CIRIA (CIRIA C552 2001). This guidance from DEFRA and CIRIA states that the designation of risk is based upon a consideration of both:

- The severity of the potential consequence [considers both the potential severity of the hazard and the sensitivity of the receptor].
- The likelihood of an event (probability); [considers both the presence of the hazard and receptor and the integrity of the pathway].

Table 9-1 provides a classification of the sensitivity of affected receptors by contamination risks occurring at the site, while Table 9-2 summarises the criteria used to assess the

magnitude of change. This table is specifically for assessing the magnitude of potential effects on human health, geology and controlled waters.

Table 9-1: Criteria for classifying receptor sensitivity

Level of Sensitivity	Description
High Receptor of national or international importance	Human health: Residential and uses where children are present; Surface water: WFD Surface Water status High; Groundwater: Source Protection Zone (SPZ) 1; Ecology: Special Areas of Conservation (SAC and candidates), Special Protection Areas (SPA and potentials) or wetlands of international importance (RAMSAR); Buildings: World Heritage Site or Conservation Area.
Medium Receptor of county or regional importance	Human health: Employment and Construction workers; Surface water: WFD Surface Water status Good or Moderate; Groundwater: Source Protection Zone 2 or 3 or Principal aquifer; Ecology: SSSI, Areas of Outstanding Natural Beauty (AONB), National or Marine Nature Reserve (NNR or MNR) or County Wildlife Sites (CWS); Buildings: Area of Historic Character.
Low Receptor of low importance	Human health: Transient or Limited Access; Surface water: WFD Surface Water status Poor; Groundwater: Secondary aquifer; Ecology: Local nature reserves and local habitat resources; Buildings: Area of Historic Character.
Negligible	Human health: Unoccupied/Industrial land use; Surface water: WFD Surface Water status Bad; Groundwater: Unproductive strata (Strata with negligible significance for water; supply or river baseflow) (previously Non-aquifer), Secondary B (water-bearing parts of non-aquifers), Secondary undifferentiated (previously minor or non-aquifer, but information insufficient to classify as secondary A or B); Ecology: No designation; Buildings: Replaceable/local value.

Table 9-2: Criteria for classifying the magnitude of change

Classification	Definition of probability
Large	Short term acute effect on human health affecting both Site users and users of sites in the vicinity, arising from contamination on the Site, or Chronic damage to human health affecting users of both the Site and other sites in the vicinity arising from contamination on the Scheme. Persistent or extensive effects on water quality, closure of an abstraction, major damage to agriculture. Persistent or extensive effects to ecosystems. Catastrophic damage to buildings or property on or in the vicinity of the Site arising from contamination on the Site.
Medium	Chronic damage to human health of users of the Site. Substantial effect on water quality e.g. notification required to abstractors, substantial damage to agriculture, reduction in amenity value. Substantial damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Substantial damage to crops, buildings or property
Small	Non-permanent effects to human health e.g. short-term intermittent nuisance such as odours not hazardous to human health. Minor or short-lived damage to water quality or ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest.

Classification	Definition of probability
	Minor damage to crops, buildings or property.
Negligible	No observed effect on human health. Poor vegetation growth, choice of landscaping species restricted. Repairable effects of damage to buildings, structure and services e.g. staining or discolouration of building materials. No observed effects on water quality or ecosystems.

Once the classification of the receptor sensitivity and magnitude of change has been assigned to a pollution linkage, the level of impact associated with it can be evaluated. The level of effect attributed has been assessed based on the magnitude of change due to the Proposed Scheme and the evaluation of the sensitivity of the affected receptor. The level of effect has been based on of professional judgement and the EIA method of assessment outlined in Section 3.2.

9.3 Baseline Conditions

The following background studies have informed this Chapter:

- Phase 1 Contaminated Land Desk Study, JBA 2022;
- Envirocheck report commissioned in 2022 comprising geological and environmental data and historical OS mapping.

The data used in the desk study were obtained from the following sources:

- Topography and general mapping:
 - OS Open Data, Terrain 50 DTM, LiDAR 1/2m DTM (EA Open Data), and
 - Aerial photography (Google Earth and Bing Maps).
- Geology and Soils:
 - British Geological Survey (BGS) 1:50,000 Geology Mapping
 - BGS digital geology mapping,
 - BGS online borehole database (BGS website),
 - BGS online Lexicon (BGS website),
 - 1:250,000 soils mapping (Soil Survey of England and Wales, 1983),
 - Soil Landscapes Online Viewer (DEFRA, 2022),
 - DEFRA's Magic Map, The National Soil Resources Institute (NSRI), and
 - Coal Authority online viewer.
- Hydrogeology:
 - Aquifer classification (Envirocheck Report),
 - Groundwater vulnerability (Envirocheck Report),
 - Source Protection Zones (Envirocheck Report),
 - Flood Risk Online Viewer (<http://lle.gov.wales/catalogue/item/NationalFloodRiskMaps/?lang=en>), and
 - BGS 1:625000 Hydrogeology Mapping of Wales.
- Landmark EnviroCheck Report, 2022.

9.3.1 Site Location and Topography

The Application Site comprises the coastal frontage between the village of Towyn and the seaside resort of Kinmel Bay, on the North Wales coast (Map 1). The site lies between approximately 3km and 0.8km west of the town of Rhyl, Denbighshire. The Application Site

includes the town of Kinnel Bay and surrounding areas, a section of the river Clwyd (up to NGR 303317, 376180) and also the line of sea defences stretching to Towyn Revetment (NGR 297245 , 379922).

The existing coastal frontage comprises hard coastal defences, a combination of rock revetment, cobbled beach, sea walls and floodgates, with a shingle beach and timber groynes. Access to the beach is via the public highway A55 (North Wales Expressway) and road A548 (Towyn Road) which run alongside the beach from Towyn to Kinnel Bay.

The ES Scoping Opinion confirms that the study areas are based on the Zones of Influence (ZoI) of the environmental effects of the Scheme. The ZoI used for the assessment of construction and operational effects (for hydrology, hydrogeology and land contamination) show a phase buffer of 1km around the Site Boundary.

The site topography is relatively flat, with an elevation of 1 to 10 mAOD across the site (Figure 7-1). In the wider area ground levels gradually dip northwards towards the Irish Sea.

9.3.2 Surface Water

Error! Reference source not found. shows the initial screening of water bodies within the Application Site and surrounding area and their overall status under the WFD's classifications.

Table 9-3: Initial screening of WFD Water Bodies

Water Body Type	Name	Overall Status
Transitional	The River Clwyd	Moderate
River	The River Clwyd	Moderate
	The River Elwy	Good
	The River Gele	Moderate
Coastal	Coastal North Wales Water	Moderate
Groundwater (Quantitative)	Clwyd Permo-Triassic Sandstone	Good
Groundwater (Chemical)	Clwyd Permo-Triassic Sandstone	Good

Surface water bodies and abstractions have been identified from a desk-based study of OS mapping and online record data of Natural Resources Wales. An assessment of surface water bodies for ecological and chemical quality is maintained by the NRW under the Water Framework Directive and is viewable through their online Catchment Data Explorer.

The main watercourses in the area are River Gele, River Clwyd, Ffynnon-y-ddol Channel and Coastal North Wales waterbody (Figure 7-2).

The River Gele, a tributary of the River Clwyd, flows north-eastwards approximately 1.5km to the southern site boundary before joining the River Clwyd. The watercourse is approximately 12km in length and joins River Clwyd at approximately 1.5km south of the south-east edge of the site. The river used to empty into the sea direct through the town of Abergele, but the Rhuddlan Marsh embankment act of 1794, diverted the river from the south of the town in an eastward direction across the south of Rhuddlan Marsh and into the River Clwyd at Towyn. A short distance of the river mouth is tidal. The River Gele waterbody belongs to the Conwy Catchment and has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications.

The River Clwyd, the easternmost watercourse, rises in the Clocaenog Forest, 8km northwest of Corwen. Its total length is 56km. Around 2km north of St Asaph, the river is joined by a tributary as large as the main river, the River Elwy. At the confluence of the Elwy and the Clwyd, the river becomes tidal and enters a narrow estuary with much wildlife before meeting the Irish Sea at Rhyl. The River Clwyd marks the boundary between Rhyl and Kinnel Bay. The transitional (between riverine and coastal) water body near the river mouth has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's

classifications. The river waterbody of the River Clwyd has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status and the tributary, River Elwy, has 'good' ecological status, 'good' chemical status and 'good' overall status.

The Ffynnon-y-ddol Channel (and its tributaries) flows eastward approximately 1km to the south of the southern boundary. The Ffynnon-y-ddol is 5.69km in length, a tributary of the Afon Clwyd and runs broadly parallel to the coast of North Wales. It discharges into the Afon Clwyd via the Clwyd pumping station. The tributaries all discharge under gravity into the Ffynnon-y-ddol with the exception of the Pensarn Drain which is pumped into the Ffynnon-y-ddol via the Belgrano pumping station. There is no WFD classification for this waterbody.

The coastal North Wales waterbody within and adjacent to the study area has 'moderate' ecological, 'failing' chemical and 'moderate' overall status under the WFD's classifications.

There are also a number of ponds surrounding the area. These ponds are very small, shallow, freshwater ponds.

There are 3 surface water abstraction licences from River Gele recorded by the EA within 2km of the site boundary. All three abstractions are used for general agricultural purposes (spray irrigation). The nearest surface water abstraction is situated at 1850m from the site boundary.

9.3.3 Groundwater

The 'Clwyd Permo-Triassic Sandstone' groundwater overall status for the study area is 'Good', quantitative status is 'Good' and the chemical status is also 'Good' (as of 2021).

9.3.4 Geology and Soil

Information on the soils and geology of the application site and surrounding area has been derived from the Soil Survey of England and Wales (1970), 1:50,000 BGS geology mapping (BGS online map viewer), 1:50,000 BGS geology mapping (Sheet 95 Rhyl) and the BGS online borehole archive (GeoIndex).

Bedrock

The BGS GeoIndex indicates the site is exclusively underlain by Early Triassic Kinnerton Sandstone Formation. The Kinnerton Sandstone Formation comprises up to 150m thick red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified sandstone which is dominantly aeolian formed approximately 247 to 252 million years ago in the Triassic Period (Figure 7-3).

Superficial Deposits

The BGS GeoIndex indicates that the superficial deposits across and the site and surrounding area comprise Beach (Marine and Storm Beach), Tidal Flat and Blown Sand Deposits (Figure 7-4).

The majority of the site is underlain by Beach Deposits with some Blown Sand Deposits in the south and Tidal Flat deposits in the south-west of the site. The uppermost area of the northern boundary is dominated by Marine Beach Deposits.

The BGS records very limited Made Ground deposits across the site, including firm to stiff, red-brown becoming slightly red-brown, silty, fine sandy clay with sub-angular to sub-rounded fine, medium and occasional coarse gravel and also brown sand, limestone chips and dust.

The BGS borehole (BGS Ref. SH97NE2) located approximately 850m to the south from the site, shows around 30m thick superficial deposits including 17.8m post-glacial clays, sands and peats and 12.1m glacial clays and sands (Figure 7-5).

BGS borehole records covering the superficial deposits found within the site boundary described the following characteristics:

- Modern Beach Deposits (mainly Storm Beach Deposits) – Loose to moderately loose, light-brown, fine, medium and coarse sand, sub-angular to rounded, fine, medium and coarse gravel, cobbles and boulders. The Modern Beach Deposits are formed up to 3mya in Quaternary Period.
- Blown Sand – Coarse, medium and fine sand with medium and fine gravel and traces of shells formed up to 3mya in Quaternary Period.
- Tidal Flat Deposits – Soft to firm light brown/grey/red-brown silty sandy clay and peat formed up to 2mya in Quaternary Period.

Soils

The Soil Landscapes Online Viewer (DEFRA, 2022) indicates that the site is exclusively covered by Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater. The landcover is arable with some grassland. The soils are mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to land. These soil types are defined as deep soils which can be easily dug to a depth of more than 1 metre.

A summary of geological stratigraphy beneath the Application Site is given in Table 9-4.

Table 9-4: Geological stratigraphy on site

Age	Formation/Group		Description	Thickness
Quaternary Period	Topsoil		Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater.	No data available
	Made Ground		Inferred due to the urban land use present within the site boundary (natural deposits, imported materials, etc.).	No data available
	Superficial Deposit	Marine Beach Deposits - Sand	Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks; in association with the marine environment.	No data available
		Storm Beach Deposits - Gravel	Low rounded ridge of coarse materials (gravels, cobbles and boulders) piled up by very powerful storm waves at the inland margin of a beach, above the level reached by normal spring tides.	No data available
		Tidal Flat Deposits – Clay, Silt and Sand	Tidal flat deposits, including mud flat and sand flat deposits, are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty	No data available

Age	Formation/Group	Description	Thickness
		clay, with layers of sand, gravel and peat. Characteristically low relief.	
	Blown Sand Deposits	Blown sand is sand that has been transported by wind, or sand consisting predominantly of wind-borne particles.	~20m**
Triassic Period	Bedrock Geology Kinnerton Sandstone Formation – Sandstone	Sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified. Dominantly aeolian.	Up to 150m*

Sources:
*BGS Online Lexicon of Named Rock Units

Coal and Non-coal Mining

The Coal Authority's online interactive viewer has been reviewed for the area. The site is located within North Wales Coal Mining Reporting Area. The Coal Mining Reporting Area, also known as CON29M Coal and Brine Consultation Areas, is the known extent of coal mining activity and is used to determine whether a coal mining report is required for property transactions and the conveyance process. There is no identified coal mining activity within the site area.

9.3.5 Hydrology

Aquifer Properties

The geological strata summarised in the Geology and Soils section have been assessed for their hydrogeological properties using the BGS aquifer designation mapping. Table 9-5 summarises the Environment Agency's (EA) hydrogeological classification of the bedrock and superficial deposits.

The Superficial Deposits covering the site including Beach Deposits and Blown Sand Deposits are classified as a 'Secondary A Aquifer', which is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The Tidal Flat Deposits, located in western edge of the site, are designated Secondary Undifferentiated aquifers – meaning it has not been possible to attribute either category A or B. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the geology type.

The underlying bedrock unit of the Kinnerton Sandstone Formation is classified as Principal aquifer, which is described as layers of rock that have high intergranular and/or fracture permeability, meaning it usually provides a high level of water storage and transmission. It may support water supply and/or river base flow on a strategic scale. In most cases, Principal aquifers are aquifers previously designated as major aquifers.

Table 9-5: Hydrogeology of the bedrock and superficial geology at the site

Group	Formation	Classification
Superficial (drift) Deposits	Modern Beach Deposits (Storm and Marine Beach Deposits)	Secondary A Aquifer
	Blown Sand Deposits	Secondary A Aquifer
	Tidal Flat Deposits	Secondary Undifferentiated Aquifer

Group	Formation	Classification
Bedrock	Kinnerton Sandstone Formation	Principal Aquifer; Highly productive aquifer

Explanation of aquifer classes (from Environment Agency website)

Principal aquifers - "may support water supply and/or baseflow to rivers on a strategic scale."

Secondary A aquifers - "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers."

Secondary B aquifers - "predominantly lower permeability layers which may store and yield limited amounts of groundwater."

Secondary Undifferentiated aquifers – "the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."

Aquifer Vulnerability and Groundwater Quality

The BGS's aquifer vulnerability mapping indicates underlying superficial deposits and bedrock lithologies are marked as having high vulnerability, meaning they are high priority groundwater resources that have limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Operations or activities in these areas are likely to require additional measures over and above good practice pollution prevention requirements to ensure that groundwater isn't impacted.

The underlying bedrock unit in this area falls under the WFD groundwater body 'Clwyd Permo-Triassic Sandstone Water Body'. The water body is classified as having 'good' chemical status, 'good' quantitative status and 'good' overall status as of 2021.

Groundwater Abstraction

There are no groundwater abstraction licences within 2km of the site boundary.

Discharge Consents

The EnviroCheck Report lists 37no. discharge consents within 1km of the site, 9 of which lie within the site. All of the 9 consents (2 effective) are for the same location at Coventry Camp Sewage Pumping Station and discharge to controlled sea (coastal waters of Irish Sea). From 37 discharge consents 18 consents are effective. All the discharge purposes are for sewage discharge or public sewage, issued to controlled sea (coastal waters of Irish Sea) or freshwater stream (Kinnel Bay drain or Clwyd) receiving water bodies.

Although these discharges are deemed to be active consented, it is possible that many are now out of use, given that only three (3no.) of the discharges were issued in the last ten years. All three active discharge consents are for the same location at Westbourne Avenue Pumping Station located approximately 90m from the site boundary and discharge to controlled sea (coastal waters of Irish Sea).

There are no discharge consents discharging to groundwater within 1km of the site boundary. None of the discharges receiving waterbody locations are likely to have their flows or water quality altered by the proposed scheme.

Aquifer Properties and Groundwater Flow

The Kinnerton Sandstone Formation belongs to undifferentiated Permo-Triassic rocks comprising sandstone with some conglomerated and is a highly productive aquifer. The aquifer yields up to 25 L/s in Eden and Clwyd valleys.

The general regional groundwater gradient can be expected to reflect the topographic gradient, with groundwater flowing north towards the coast.

Groundwater Source Protection Zones

Source Protection Zones (SPZs) are used to protect areas of vulnerable groundwater that is used for abstraction and where water quality is of high importance (such as drinking water abstractions). SPZs are categorised into three zones, 1-3, with 1 being of highest risk of contamination, and 3 representing the lowest risk but still within the groundwater catchment. There are no SPZs recorded within 1km of the site. The nearest SPZ is located approximately 8km to the south-east of the eastern edge of the site boundary.

Ecological and other designations

Ecological designations are sites that contain water-dependant features that could be affected by the development.

Site of Special Scientific Interest are the finest sites for wildlife and natural features, supporting many characteristics, rare and endangered species, habitats and natural features. There are no SSSI within 1km of the site.

The Special Protection Area of 'Liverpool Bay SPA' is located approximately 200m to the north of the whole northern boundary through the coastline.

The Local Nature Reserve of 'Kinmel Dunes LNR' is located within the site boundary. There are no Ancient Woodlands within 1km from the site boundary.

There are no Special Areas of Conservation (SAC) within 1km of the site boundary. The nearest SACs are 'Dee Estuary (Wales) SAC', 8km to the east of the eastern site boundary.

The 'Dee Estuary (Wales) SPA/RAMSAR' is located approximately 8km to the east of the eastern site boundary

Site History

Analysis of potential contamination sources has been completed through review of various data sources. This includes regulatory data (such as waste management licences, trade directories and pollution incident records), historical mapping and the National Hazard Directory. Historical maps show the development of the Application Site from 1872⁷⁹.

A summary of the regulatory and environmental data concerning the site and local area is given in Table 9-6 which is sourced from the Envirocheck Report.

Table 9-6: Summary of regulatory and environment data

Data source	Details
Explosive sites	None within 1km.
Contaminated land register entries	None within 1km.
BGS Recorded Mineral Sites	1 blown sand quarry situated between 501-1000m from the site (ceased).
Landfill sites	5 historical landfill sites and 2 BGS recorded landfill sites situated between 501-1000m from the site: Marsh Road Tip (BGS); No threat to ground/surface water; NGR 300093 380131 Kinmel Bay, Land Near Clwyd Bank; Deposited Waste included Inert, Industrial and Household Waste; Last input 1945; NGR 299399 380143 Marsh Road, Rhyl, Flintshire; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input 1985; NGR 300093 380131 Marsh Road Tip (BGS); No threat to ground/surface water; NGR 300196 380287 Kinmel Bay, Land Near Clwyd Bank; Deposited Waste included Inert, Industrial and Household Waste; Last input 1945; NGR 299406 380207

⁷⁹ Landmark (2022) EnviroCheck Report. [Online] Available from: <https://www.landmark.co.uk/products/envirocheck/>

Data source	Details
	Marsh Road, Rhyl, Flintshire, Marsh Road Tip; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input 1985; NGR 300310 380501 Rhydwen Drive, Rhyl Cut; Deposited Waste included Industrial and Household Waste; Last input not supplied; NGR 300477 380511
Other waste management sites	2 licensed waste management facilities (locations) situated within 250m, and 10 locations situated between 501-1000m from the site.
Hazardous substances	None within 1km.
Planning Hazardous Substance Consents	None within 1km.
Registered Radioactive Substances	None within 1km.
Fuel station entries	3 entries situated between 251-500m from the site.
Contemporary trade directory entries	2 entries situated within 250m of the site (both active), 99 other entries situated between 251-1000m from the site.
LAPPC	2 permits situated between 251-500m, and 2 permits situated between 501-1000m from the site.
IPC/IPPC	None within 1km.
Discharge consents	9 discharge consents located within the site boundary (2 effective), 27 other discharge consents between 251-1000m from the site.
Recorded pollution incidents to controlled waters	2 pollution incidents (1 major, 1 significant) situated within 250m, 5 incidents (1 significant, 4 minor) situated between 251-500m, and 10 incidents (2 significant, 8 minor) situated between 501-1000m of the site.
Radon	None within 1km.
Notes: IPC = Integrated Pollution Control; IPPC = Integrated Pollution Prevention & Control; LAPPC = Local Authority Pollution Prevention & Controls	

Detailed information on the site history is included in the Phase 1: Contaminated Land Desk Study. The most pertinent historical developments relating to potential contamination sources are shown in Table 9-7 and Figure 9-1.

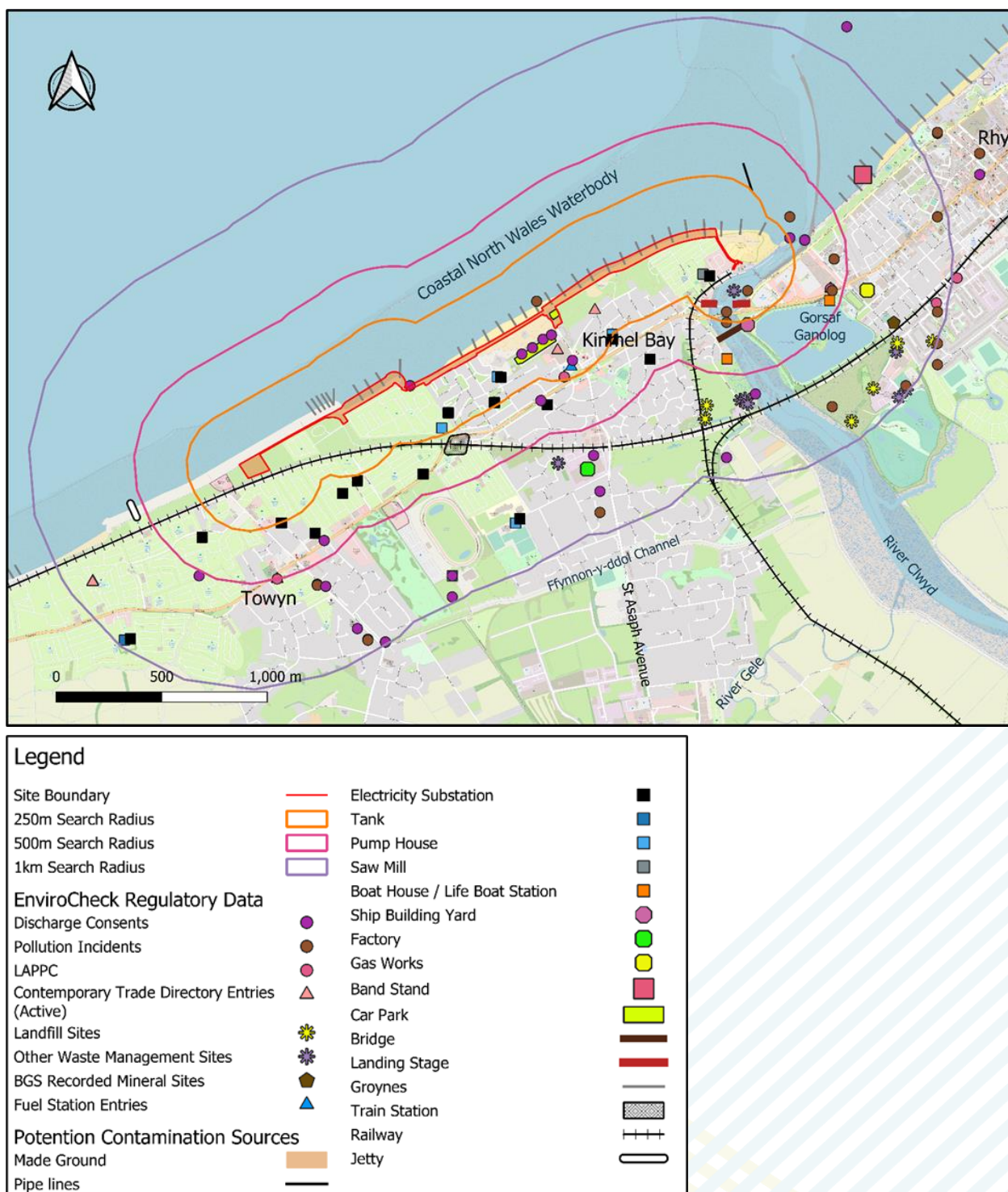


Figure 9-1: Location of potential contamination sources

Table 9-7: Potential contamination sources based upon historical land use

Map year	Land use on site	Land use off site (within 1km)	Potential contamination sources
1875; 1879- 1880; 1899	Shingle and sandy beach; Footpath along and across the beach in some sections; Sloping masonry along the beach in west part; Rough grassland along the coastline in some areas.	Predominantly agricultural land, farms, cottages, roads and footpaths of Towyn village (in west) and Foryd village (in east) surrounding the site; Foryd harbour approximately 200m to the south; L&NWR railway and embankments adjacent to the south-western boundary running south-eastward; Foryd railway passes southwards from south-eastern edge of the site; Foryd and L&NWR junction approximately 800m to the south; Foryd saw mills approximately 75m to the south; Rhyl village within 500m to the south-east with cottages, farms, roads and wooded area; Gas works and boat house approximately 500m to the south-east; Ship building yard approximately 250m to the south; Two landing stages within 250m to the south; Ryle bridge and lifeboat station approximately 500m to the south; Vale of Clwyd railway passes southwards within 250m to the south from the site boundary.	Made Ground associated with residential properties, sloping masonry, lifeboat station and landing stages; Railways, stations and embankments; Saw mill; Gas works.
1900	No significant changes.	Footpaths and footbridges within 250m to the west and south; Jetty approximately 500m to the west; A number of springs up to 1km to the west and south; Foryd station approximately 300m to the south from the site boundary; Morfa isolation hospital near to the Foryd station.	Made Ground associated with residential properties and jetty; Railway stations.
1913; 1914- 1915	No significant changes.	Breakwaters between 250m and 500m to the west; Groynes and breakwaters approximately 50m to the north; Sheepfolds within 1km in the farms; Urban development of Rhyl village; Band stand within 1km to the east from the site boundary; Lifeboat station is removed.	Made Ground associated with breakwaters, groynes, residential and commercial properties, band stand and former lifeboat station.
1937; 1938- 1953	No significant changes.	Urban development of Foryd village including residential properties, roads, caravan parks and tennis courts; Slight urban development of Towyn village including road, school and church; Holiday camp adjacent to the southern site boundary; Holiday/caravan camps within 250m to the south from the site boundary; Foryd station is removed; Ryle bridge is deconstructed and moved approximately 50m northwards;	Made Ground associated with residential properties, caravan parks/holiday camps, former Foryd station, former Ryle bridge, former gas works and former ship building yard.

Map year	Land use on site	Land use off site (within 1km)	Potential contamination sources
		Continuing urban development of Rhyl including residential properties, roads, play grounds; Gas works is removed; Ship building yard is removed.	
1953-1954; 1957; 1959	No significant changes.	Urban development of Towyn and Foryd villages including residential properties, Sandy Cove estate, roads, police station, holiday camps and caravan sites; Boat house is removed.	Made Ground associated with residential and commercial properties and former boat house.
1961; 1964; 1969	The promenade in small section along the beach; Drains passes across the site; More footpath along the beach; Breakwaters and groynes along the beach.	Majority of cottages along the beach is converted to holiday camps/caravan parks; Happy Days holiday camp adjacent to the southern boundary; Towyn village urban development including more residential properties, play grounds, roads and drains; Level crossing approximately 80m to the south; Small pond approximately 250m to the west from the site boundary; Extensive urban development of Foryd (AKA Kinmel Bay) including residential properties, factories, small ponds, drains, parks, holiday/caravan camps; Pipeline within 250m to the north-east into the sea; Jetty is deconstructed; One of the landing stages are deconstructed; Band stand is replaced by residential properties.	Made Ground associated with promenade and footpaths, breakwaters, groynes, level crossing, urban development, deconstructed landing stand, deconstructed jetty, former band stand; Pipeline.
1967-1970; 1972-1978; 1977-1987; 1971-1989	More footpath along the beach; Groynes along the coastline.	Continuing Towyn and Kinmel Bay urban development; 12 electricity substations between 200m and 300m to the south west and south; Pumping station approximately 200m to the south; Tank and one electricity substation approximately 1km to the south-west; Two pumping stations and one electricity substation approximately 900m to the south; Factories (industrial estate including car repairs, car body repairs, industrial services, building material supplier, construction site) approximately 750m to the south from the site boundary; Vale of Clwyd railway is dismantled; Foryd railway is dismantled.	Made Ground associated with urban expansion, factories, groynes and dismantled railways; Electricity substations; Pumping stations and tank.
1989; 1990; 1991-1992	No significant changes.	Electricity substation approximately 200m to the south from the site boundary; Continuing urban development of Kinmel Bay including roads, residential properties, caravan parks, car parks; Saw mill is deconstructed.	Made Ground associated with residential properties, caravan sites, car parks, groynes, towers within Gwrych Castle Wood and deconstructed saw mill;

Map year	Land use on site	Land use off site (within 1km)	Potential contamination sources
			Electricity substation.
1993	No significant changes.	Pump house approximately 250m to the south; Extensive urban development in Kinmel Bay; Groynes adjacent to the northern site boundary.	Made Ground associated with urban development and groynes; Pump house.
2000	Car park at the end of St Asaph Ave., and cycle track.	Car park next to St Asaph Ave. approximately 60m to the south; More ponds are formed near Kinmel Bay within 1km to the south from the site boundary.	Made Ground associated with car parks and cycle track.
2022	Promenade (tarmac footpath) and National Cycle Route 5 along the beach.	No significant changes.	Made Ground.

9.4 Assessment Methodology & Assessment Criteria

9.4.1 Scope of Assessment – SPR Model for Contaminated Land

The following section is based on the Phase 1 Contaminated Land Desk Study, JBA 2022 which is included as Appendix G.1.

A Source-Pathway-Receptor (SPR) model has been used to assess the linkages between the proposed activities on site and the identified receptors. A preliminary contaminated land conceptual model has been developed based on the information available as the basis for understanding the contaminant sources, transport pathways and possible receptors that may be present, and the potential pollutant linkages between them, as defined in the relevant legislation and guidance.

Identified Sources

The potential sources of contamination have been identified from regulatory data and historical and current land uses on the site and surrounding area. The primary potential sources are shown in Table 9-8.

Table 9-8: Identified potential contamination sources

Source	Potential contaminants of concern	Location and Likely / Anticipated Distribution
On Site		
Made Ground	General contamination that may be present from historical land uses: Heavy metals. Total petroleum hydrocarbons (TPH). Polycyclic aromatic hydrocarbons (PAH). Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Asbestos containing materials (ACMs) in non-natural soils.	Potentially contaminated Made Ground underlying: the holiday/caravan parks and car parks adjacent to the beach the promenade and cycle path, breakwaters, jetties and groynes
Off site, up to 1km from the site.		

Source	Potential contaminants of concern	Location and Likely / Anticipated Distribution
Historical landfills	A range of potential metallic, inorganic and organic (hydrocarbon-based) contaminants may be present. Potential fugitive ground gases (e.g. carbon dioxide, methane).	7 historical landfills between 501-1000m from the site boundary – to the south-east (5 are on the other side of River Clwyd).
Historical quarry infilled with Made Ground		One blown sand BGS recorded mineral site approximately 750m to the south east from the site on the other side of River Clwyd.
Industrial Works (historical and current)	General contamination that may be present from historical land uses: Heavy metals. Total petroleum hydrocarbons (TPH). Polycyclic aromatic hydrocarbons (PAH). Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).	the historical electrical substations the historical pumping station and water works the historical pipeline the historical gas works multiple railways in close proximity to the southern boundary historical factory (industrial estate)
Made Ground	Asbestos containing materials (ACMs) in non-natural soils. PCBs (electrical substation).	Potentially contaminated Made Ground underlying: the line of residential and commercial properties, holiday/caravan parks and car parks historical ship building yard, boat house, band stand, life boat station, saw mill, factory and Ryle bridge railway and road embankments historical railway stations and landing stages

Pathways and Receptors

Potential receptors and possible pathways for contaminants to reach these receptors are summarised below:

- Current and future site users including members of the public and construction workers [direct contact, inhalation, accidental ingestion, migration of fugitive gases onto site];
- Groundwater (superficial Secondary A and Secondary Undifferentiated aquifers and bedrock Principal Aquifer) [migration via leaching and infiltration to permeable strata]; and,
- Surface water (River Gele; River Clwyd; Ffynnon-y-ddol Channel; Coastal North-Wales waterbody; small ponds) [overland flow, migration via drainage, groundwater baseflow].

Conceptual Site Model

A preliminary conceptual model for the site and surrounding environment has been developed based on the information available and described in the section below. The conceptual site model is used to identify potential pollutant linkages by identifying the following:

- Potential contamination source(s) - a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution;
- Environmental pathways - a route by which a receptor is or could be affected by a contaminant; and,
- Environmental receptors - that could be adversely affected by a contaminant, e.g. construction workers, future site users, controlled waters, ecological receptors etc.

A pollutant linkage must be present for there to be a Source-Pathway-Receptor linkage. Without a pollutant linkage, there is not a risk - even if a potential source of contamination is present.

The main features of the conceptual model are as follows:

- Within the site boundary, deposits of Made Ground are likely to be found at:
- Cycle path and tarmac footpath (promenade),
- Car park,
- Water breaks and groynes.

There is potential for the ground in these areas to be contain contaminated materials. Construction workers involved in coastal defence improvements, or future site users could be exposed to residual contamination from such sources, were they to be present.

- Within 1km of the site boundary, contaminated Made Ground is also likely to be found at:
 - Residential and commercial properties, holiday/caravan parks and car parks,
 - Water breaks, groynes and jetties,
 - Historical ship building yard, boat house, band stand, Ryle bridge and landing stages,
 - Historical factory,
 - Historical saw mill,
 - 7 historical landfills,
 - The blown sand historical quarry (ceased). The quarry is likely to be backfilled with material of an unknown nature.
- Historical industry within 1km including:
 - 15 electricity substations

- 5 pumping station (pump house) and one tank
- Pipeline
- Factory (industrial estate)
- Gas works
- Multiple railway lines and stations
- Materials within the infilled sand quarry upgradient of the site may potentially contain non-natural Made Ground deposits. However, this quarry is likely to have no impact on site since it is located on the other side of River Clwyd.
- Superficial deposits underlying the site are categorised as:
 - Modern Beach Deposits: moderate-high permeability secondary A aquifer
 - Blown Sand Deposits: moderate-high permeability secondary A aquifer
 - Tidal Flat Deposits: low-moderate secondary undifferentiated aquifer
- The bedrock deposits underlying the site are categorised as:
 - Kinnerton Sandstone Formation: high permeability, highly vulnerable Principal aquifer and is therefore classified as a highly sensitive receptor
- The hydrology in the area comprises the catchment areas of three watercourses which are likely to capture most overland flows: Ffynnon-y-ddol Channel and River Gele in the south and River Clwyd in the east of the site. River Clwyd flows northwards to where it discharges at the coastline. River Gele and Ffynnon-y-ddol Channel flow eastwards and discharges at the River Clwyd and consequently at the coastline. Groundwater within the bedrock aquifer is likely to flow towards the coast to the north and towards the River Clwyd to the north-east.
- Groundwater within the superficial aquifers is likely contained within localised perched aquifer systems, where higher permeability sandy horizons are interbedded with lower permeability clay dominated layers. It is likely that a groundwater pathway exists between the superficial deposits and underlying bedrock, through the higher permeability sand dominated layers.
- Groundwater movement within the bedrock aquifer is likely to broadly follow the regional topography, flowing towards the north and north-east. It is possible that there is some hydraulic connection between surface waters, the local perched water tables within the superficial deposits, and the shallow bedrock aquifer where it is not overlain by superficial deposits.
- Designated sites include:
 - Liverpool Bay SPA approximately 200m north along the northern site boundary
 - Kinmel Dunes LNR within the site boundary

Potential Contaminant Pollutant Linkages

Based on the conceptual model presented above the following potential contamination sources have potential pollutant linkages and are identified to be considered with the qualitative risk assessment:

- On-site:
 - potentially contaminated Made Ground due to beach development including cycle path, tarmac footpath and car park
 - Made Ground associated with water breaks and groynes
- Off-site (within 1km):
 - Historical landfills (potential for fugitive gases although situated >500m from site)

- Historical quarry infilled with Made Ground
- Historical gas works
- Historical electricity substations, pumping stations and pipeline
- Historical and current railway lines and stations
- Potentially contaminated Made Ground due to urbanisation and beach development including road embankments, holiday/caravan parks and car parks
- Made Ground underlying historical electricity substations and pumping stations
- Made Ground associated with groynes and jetty.

Receptor Sensitivity

A summary of environmental receptors that may be present in or near to the site is given in Table 9-9. This shows receptor types and their associated sensitivity.

Table 9-9: Summary of potential environmental receptors

Receptor Type	Receptor	SPR Linkage	Sensitivity	Reasoning
Human receptors	Current and future site users and workers involved in site development	Yes	Medium	Proposed works may potentially involve excavation and other ancillary groundworks.
Groundwater	Secondary undifferentiated aquifer (Tidal Flat Deposits)	Yes	Low	High vulnerability secondary (undifferentiated) aquifer underlying soil/Made Ground.
	Secondary A aquifer (Marine and Storm Beach Deposits and Blown Sand Deposits)	Yes	Medium	High vulnerability secondary A aquifer underlying soil/Made Ground.
	Principal aquifer (Kinnerton Sandstone Formation)	Yes	High	High vulnerability Principal aquifer, exposed under the superficial deposits of Blown Sand, Tidal Flat and Beach deposits. Potential for infiltration of contaminants from Made Ground into the aquifer.
Surface water	River Gele	No – upstream and out of Zol	Medium	Flows past the site's southern boundary approximately 2km eastwards towards River Clwyd. Potential for contaminants to reach receptor via surface and groundwater flow. Ecological status: Moderate Chemical status: Good Overall status: Moderate
	Ffynnon-y-ddol Channel	No – upstream and out of Zol	Low	Flows past the site's southern boundary approximately 1100m eastwards towards River Clwyd. Potential for contaminants to reach receptor via surface and groundwater flow. There is no WFD classification for this waterbody

Receptor Type	Receptor	SPR Linkage	Sensitivity	Reasoning
	River Clwyd	Yes	Medium	Flows past the site's eastern boundary at its outlet on the coast. Potential for contaminants to reach receptor via surface and groundwater flow. Ecological status: Moderate Chemical status: Good Overall status: Moderate
	Coastal North Wales Waterbody	Yes	High	Located immediately offshore of the site. Potential for contaminants to reach this receptor via surface runoff. Ecological status: Moderate Chemical status: Failing Overall status: Moderate
	Abstractions	No – upstream and out of ZOI	Medium	Three surface water abstraction licences from River Gele within 2km of the site boundary. All three abstractions are used for general agricultural purposes (spray irrigation). The nearest surface water abstraction is situated at 1850m from the site boundary.
Ecological Receptors	Liverpool Bay SPA	Yes	High	Located immediately offshore of the site (north). Potential for contaminants to reach this receptor via surface runoff.
	Kinmel Dunes LNR	Yes	Low	Located within the site. Potential for contaminants to reach this receptor via surface runoff.

Implications of climate change

The UK Climate Change Projections 2018 (UKCP18) project the following:

- Temperatures are projected to increase, particularly in summer;
- Winter rainfall is projected to increase and summer rainfall is most likely to decrease;
- Heavy rain days (rainfall greater than 25mm) are projected to increase, particularly in winter;
- Near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant effects of winds; however, the increase in wind speeds is projected to be modest;
- The frequency of winter storms over the UK is projected to increase; and
- Changes in seasonal recharge rates as a response to variations in rainfall patterns.

The existing/baseline hydrological regime may change as a result of the predicted impacts of climate change, irrespective of any development. River flows, tide levels, and rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off, flood flows within watercourses, and flood levels associated with a breach of flood defences would increase. In addition, the seasonality of rainfall and river flows is likely to become more pronounced. The ES (supported by the Flood Consequence Assessment FCA) takes account of the potential future changes in the

hydrological regime by incorporating appropriate allowances for climate change, as published by the EA⁸⁰.

The existing/baseline hydrogeological regime has the potential to change as a result of the predicted impacts of climate change, given the nature of the geology and aquifers in relation to recharge rates.

The two main influences on the future hydrological and hydrogeological regime of the site, and surrounding area are climate change and local land use change, which have the potential to change the river flow regime (through changes in rainfall patterns and storm surges as a result of climate change and sea level rises) and ground permeability and runoff/infiltration (through changes in land use).

9.4.2 Embedded Mitigation

All construction work has the potential to impact on the environmental receptors, through spillages, mobilisation of contaminants and sediment by disturbance of contaminated ground or surface run-off.

Mitigation measures either reduce the likelihood of an event's occurrence or reduce the magnitude of its consequences.

Construction Phase

The Construction (Design & Management) Regulations (CDM 2015) are for managing the health, safety and welfare of construction projects and will apply to the Proposed Scheme. A Principal Designer and Principal Contractor will be appointed to plan, manage, monitor and coordinate health and safety during the pre-construction and construction phases respectively. The Principal Contractor will have responsibility for ensuring legislative compliance and obtaining all permits/licences as required. Notably, the Principal Contractor will undertake a risk assessment to determine whether the works are required to comply with the Control of Asbestos Regulations 2012/16 (CAR).

During the construction phase, it is anticipated that spillages of substances (i.e. oil, fuel, cement) and soil erosion or the generation of suspended solids during construction activities (i.e. through excavations and plant/wheel washing) would be controlled through the implementation of a Construction Environmental Management Plan (CEMP). This would refer to appropriate Guidance for Pollution Prevention (GPP) (and the older Pollution Prevention Guidelines) such as GPP 5: Works and maintenance in or near water and GPP 6: Working at construction and demolition sites.

The CEMP will be in place to manage environmental risks and will include prevention measures such as: bunded storage; designated wheel washing areas; settling basins; screening stockpiles of materials; dampening exposed soils as appropriate; and set out requirements for ongoing monitoring and liaison (with the local community and NRW as appropriate).

The CEMP will include site waste and materials management measures in accordance with the Definition of Waste: Development Industry Code of Practice.

The CEMP will also include measures to be taken in the event that unexpected ground conditions, including potentially contaminated materials, are encountered during the construction works.

It is assumed that material moved around the site or imported onto site during the construction phase (e.g. to obtain required ground elevations) will have been subject to appropriate chemical testing to demonstrate its suitability for its intended use and will therefore not present a risk to controlled waters (e.g. via leaching of potential contaminants)

⁸⁰ Environment Agency (2016) Guidance Flood risk assessments: climate change allowances. [Online] Available from: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

or human receptors. Also, works involving movement of materials (including both disposal and importation) will be undertaken in accordance with relevant waste legislation and guidance (e.g. CL:AIRE Contaminated Land Definition of Waste: Development Industry Code of Practice).

It is assumed that future construction works at the site will be undertaken in accordance with legislative requirements, statutory and regulatory guidance and industry best practice e.g. Personal Protective Equipment (PPE) will be used appropriately for construction workers, and visitor access will be restricted during works.

Operational Phase

Key features of the proposed scheme during operational phase include:

- Impact to human health of site users, neighbouring land users and maintenance workers from potential contaminants via direct contact, ingestion and inhalation;
- Impact to controlled waters (groundwater which may discharge to surface waters) through a potential spillage event (e.g. tanker crash) leading to impact of spill material and potentially firefighting foam (if used), to potable abstraction points and public water supply.

9.5 Potential Impacts & Significant Effects

9.5.1 Construction phase

Human Health from Potential Exposure to Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)

During the construction phase, workers will be introduced as the primary human health receptor. Due to the Scheme and surrounding area's historical land uses, there is the potential for contamination to be present in the ground and groundwater. In the worst-case scenario, there is the potential for presence of a variety of human health hazards including a range of potential metallic, inorganic and organic contaminants, asbestos, the accumulation of ground gases in services and confined spaces and unforeseen ground (including known and potential hazards such as metals and PAHs).

During the construction phase, soils and groundwater beneath the Site will be exposed through removal of hardstanding, excavation etc. and the probability of contact (i.e. through ingestion of dust/soil, inhalation of dust/vapours/gases or by dermal contact and absorption) is increased. Additional mitigation will require working in accordance with CDM 2015 and CAR and includes working to a CEMP and toolbox talks for encountering potentially contaminated land.

The sensitivity of construction workers is considered to be Medium. The magnitude of change is considered to be Negligible. Therefore, there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.

Surface Water, Groundwater and Ecological Receptor Pollution from Leaching and Migration of Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)

Due to the Scheme and surrounding area's historical land uses, there is the potential for contamination to be present in the ground and groundwater. During the construction phase, the near surface soils will be disturbed and there is potential for mobilisation of soil contaminants including run-off and leaching into the groundwater beneath the Scheme as well as the ecological receptors and onsite waterbodies. The adoption of additional mitigation as described above for controlled water will negate the increased magnitude of effect of mobilisation.

It should be noted that a worst-case scenario approach has been adopted for this assessment. The receptors of relevance when considering this effect are Coastal North Wales waterbody (Liverpool Bay SPA), River Clwyd, the underlying shallow superficial (Beach and Blown Sand Deposits) Secondary A aquifer, the bedrock Kinnerton Sandstone Principal aquifer and Kinmel Dunes LNR.

- The sensitivity of the surface water bodies including River Clwyd is Medium (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the groundwater bodies including deep bedrock Principal aquifer (Kinnerton Sandstone) is High (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the groundwater bodies including shallow superficial Secondary A aquifers is Medium (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the Coastal North Wales waterbody is High (noting a worst-case scenario). This waterbody is classified as the Liverpool Bay SPA ecological receptor. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the Kinmel Dunes LNR ecological receptor is Low. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.

Ground Gas Migration and Accumulation in Confined Spaces

In the worst-case scenario, potential sources of ground gases might be identified (including Made Ground and soils). Ground gases have the potential to migrate into temporary construction facilities and services through service entry points, cracks in concrete slabs etc, and if allowed to accumulate, have the potential to impact human health (construction workers).

The Scheme does not currently include plans for deep excavations or sub surface structures where ground gas would pose a high risk. Should such amendments be made to the scheme in the future, then additional mitigation in the form of case-by-case risk assessment would be adopted.

The sensitivity of construction workers is considered to be Medium. The magnitude of change is considered to be Small (noting a worst-case scenario). Therefore, there is likely to be a direct, temporary, short-term adverse effect which is considered to be Minor. It should be noted that whilst exposure to ground gases (for construction workers) is temporary, some human health effects are permanent.

Pollution of Land and Surface Water/ Groundwater/ Ecological Receptors Contamination

During the construction phase of the Proposed Scheme, there is the potential for localised spillages of fuel, which may be led to contamination of the soils as well as being carried to surface watercourses, underlying groundwater and ecological receptors through surface run-off (i.e. leaching through the soil profile). Contaminants from fuel spillages are likely to occur on hardstanding areas such as car parking. It is anticipated that spillages of substances (i.e.

oil, fuel, cement) and soil erosion or the generation of suspended solids during construction activities (i.e. through excavations and plant/wheel washing) will be controlled through the CEMP, which will include prevention measures such as: bunded storage; designated wheel washing areas etc.

The receptors of relevance when considering this effect are the Coastal North Wales waterbody (Liverpool Bay SPA), River Clwyd, the underlying shallow superficial (Beach and Blown Sand Deposits) Secondary A aquifer, the bedrock Principal aquifer and Kinmel Dunes LNR.

- The sensitivity of the River Clwyd surface water body is Medium (noting a worst case scenario). The magnitude of change is considered to be Small. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Minor**.
- The sensitivity of the deep bedrock Kinnerton Sandstone Principal aquifer groundwater body is High (noting a worst-case scenario). The magnitude of change is considered to be Small. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Minor to Moderate**.
- The sensitivity of the groundwater bodies including shallow superficial Secondary A aquifers is Medium (noting a worst-case scenario). The magnitude of change is considered to be Small. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Minor**.
- The sensitivity of the Coastal North Wales waterbody is High (noting a worst-case scenario). This waterbody is classified as the Liverpool Bay SPA ecological receptor. The magnitude of change is considered to be Small. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Minor to Moderate**.
- The sensitivity of the Kinmel Dunes LNR ecological receptor is Low. The magnitude of change is considered to be Small. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible to Minor**.

9.5.2 Operational phase

Human Health from Potential Exposure to Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)

In the worst-case scenario, soil contamination including asbestos might be present within the near surface soils at levels with the potential to impact future users of the Site (site users, maintenance workers and neighbours).

The sensitivity of future site users and third parties is considered to be High. The magnitude of change (considering the embedded mitigation) is considered to be Negligible. Therefore, there is likely to be a direct, permanent, long-term adverse effect which is considered to be **Negligible**.

Surface Water, Groundwater and Ecological Receptor Pollution From Leaching and Migration of Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)

Due to the Site and surrounding area's historical land uses, there is the potential for contamination to be present in the ground and groundwater. The surface water bodies, underlying groundwater body and ecological receptors have the potential to be impacted by pathways including direct run-off and by indirect recharge via groundwater.

Due to lack of geochemical data, a worst-case scenario approach has been adopted for this assessment. The receptors of relevance when considering this effect are the Coastal North

Wales waterbody (Liverpool Bay SPA), River Clwyd, the underlying shallow superficial (Beach and Blown Sand Deposits) Secondary A aquifers and the bedrock, Principal aquifer and Kinmel Dunes LNR.

- The sensitivity of the surface water bodies including River Clwyd is Medium (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the groundwater body of deep bedrock Principal aquifer (Kinnerton Sandstone) is High (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the groundwater bodies including shallow superficial Secondary A aquifers is Medium (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the Coastal North Wales waterbody is High (noting a worst-case scenario). This waterbody is classified as the Liverpool Bay SPA ecological receptor. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.
- The sensitivity of the Kinmel Dunes LNR ecological receptor is Low. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse effect which is considered to be **Negligible**.

Ground Gas Migration and Accumulation in Confined spaces

In the worst-case scenario, potential sources of ground gases might be identified including Made Ground and superficial deposits. During the operational phase, ground gases have the potential to ingress through belowground pipework, cracks in slabs, service entries, voids etc., resulting in the potential adverse effects on human health of future site users (residents, employees and maintenance workers) and users of neighbouring properties through inhalation of ground gases.

The sensitivity of future site users and third parties is considered to be High. The magnitude of change is considered to be Negligible. Therefore the level of effect is **Negligible**.

9.5.3 Limitations and Assumptions

To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

- It is assumed that the proposed temporary and permanent design drainage strategies will be implemented appropriately.
- It is assumed that material moved around the Scheme or imported onto the Scheme during the construction phase will have been subject to the appropriate management of materials (via the CEMP). It will therefore not present a risk to controlled waters (e.g. via leaching of potential contaminants) or human receptors.

9.6 Mitigation Measures

The mitigation measures required as summarised in Table 9-10:

Table 9-10: Mitigation measures for both construction and operation phases

Potential impact	Mitigation proposed	
	Construction phase	Operation phase
Human Health from Potential Exposure to Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)	No additional mitigation measures identified.	No additional mitigation measures identified.
Surface Water, Groundwater and Ecological Receptor Pollution from Leaching and Migration of Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)	No additional mitigation measures identified above the listed embedded mitigation.	No additional mitigation measures identified above the proposed embedded mitigation.
Ground Gas Migration and Accumulation in Confined Spaces	Where required, temporary confined spaces/construction buildings would include void space below them to allow for passive ventilation.	No further mitigation required.
Pollution of Land and Surface Water/ Groundwater/ Ecological Receptors Contamination	No additional mitigation or enhancement has been identified.	N/A

9.7 Residual Effects

The residual effects associated with the construction and operational phases of the proposed scheme are summarised in Table 9-11.

Table 9-11 Residual measures as both construction and operational phases

Potential impact	Residual effects	
	Construction phase	Operation phase
Human Health from Potential Exposure to Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)	The sensitivity of human health (construction workers) is considered to be Medium. The magnitude of change, following embedded mitigation, is considered to be Negligible. Therefore, there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible .	The sensitivity of future site users and third parties is considered to be High (noting a worst-case scenario). The magnitude of change, following embedded mitigation, is considered to be Negligible. Therefore, there is likely to be Negligible residual effect.
Surface Water, Groundwater and Ecological Receptor Pollution from Leaching and Migration of Contamination Associated with Historical Land Uses (including potentially contaminated Made Ground)	As there are no additional mitigation measures, the effects are as above, with effects to all receptors identified as negligible and Not Significant .	As no further mitigation is proposed, the residual effect remains as above, with effects on all receptors assessed to be negligible. This effect is considered to be Not Significant .
Ground Gas Migration and Accumulation in Confined Spaces	The sensitivity of construction workers is considered to be Medium. The magnitude of change following additional mitigation, is considered to be Negligible. Therefore, there is likely to be a direct, temporary, short-term, adverse effect which is considered to be Negligible. This effect is considered to be Not Significant .	The sensitivity of future users and third parties is considered to be High. The magnitude of change is considered to be Negligible. Therefore, there is likely to be a Negligible residual effect. This effect is considered to be Not Significant .
Pollution of Land and Surface Water/ Groundwater/ Ecological Receptors Contamination	The residual effect, following initial control through the CEMP, for the receptors of relevance when considering this effect is: The sensitivity of River Clwyd surface water body is Medium (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible . The sensitivity of the deep bedrock Kinnerton Sandstone Principal aquifer groundwater body is High (noting a worst-case scenario). The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible . The sensitivity of the groundwater bodies including shallow superficial Secondary A aquifers is Medium (noting a worst-case scenario). The	N/A

	Residual effects	
	magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible. The sensitivity of the Coastal North Wales waterbody is High (noting a worst-case scenario). This waterbody is classified as the Liverpool Bay SPA ecological receptor. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible. The sensitivity of the Kimmel Dunes LNR ecological receptor is Medium. The magnitude of change is considered to be Negligible. Therefore, the realistic worst-case scenario there is likely to be a direct, temporary, short-term, adverse residual effect which is considered to be Negligible. This effect is considered to be Not Significant.	

9.8 Summary

An assessment has been undertaken to assess the likely significant environmental effects arising from the Proposed Scheme in relation to ground conditions and land contamination. None of the effects is considered to be Significant.

10 Socio-Economic

10.1 Introduction

This chapter assesses the potential for the scheme to result in likely significant effects on the health and wellbeing of the population and local economy of Kinnel Bay.

10.2 Baseline Conditions

10.2.1 Population Demographics

Kinnel Bay is within the County of Conwy in North Wales. Conwy County had an estimated population of 118,184 in mid-2020⁸¹. The population of Conwy is increasing slightly year on year, having increased by less than 1% from mid-2019 to mid-2022. The population has increased from an estimated 107,951 in mid-1991 to 118,184 in mid-2022, a roughly 9.5% increase. The estimated 118,184 people living in Conwy made up around 16.8% of the estimated 703,361 people living in North Wales in mid-2020. The ward of Kinnel Bay is within the scheme area and has a population of 6,100⁸² roughly 5.1% of the population of Conwy County.

Conwy County has an aging population, with the highest percentage of residents aged over 65 in North Wales (28%). Conwy also has the lowest percentage of residents aged 0-15 in North Wales (16%) and the lowest percentage of residents aged 16-64 in North Wales (56%) see Figure 10-1. Conwy population structure. Notably, the percentage of people aged over 65 in Conwy exceeds both the North Wales and Welsh averages (24% and 21% respectively). The population structure of Conwy reflects an increasing level of outward migration from young people as they travel out of Conwy following leaving university looking for graduate employment⁸³ (Conwy County Borough Council, 2017).

According to data from StatsWales⁸⁴ on limiting long term illness and disability, 27,915 residents of Conwy are limited a little, or a lot, by a long-term illness or disability in their day-to-day activities (24.23% of the population of Conwy). This is slightly higher than the Welsh national average of 22.71%⁸⁵.

⁸¹ Stats Wales (2022) Wales population estimates by Local Authority and Age Group. [Online] Available from: <https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Estimates/Local-Authority/populationestimates-by-localauthority-age>

⁸² Conwy County Borough Council (2021) Kinnel Bay Ward Profile [Online] Available from: <https://www.conwy.gov.uk/en/Council/Statistics-and-research/Assets/documents-ward-profiles/Kinnel-Bay-ward-profile-Nov-2021.pdf>

⁸³ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837a9ef9e.pdf

⁸⁴ StatsWales (2011), Limiting long term illness or disability by local authority. [Online] Available from: <https://statswales.gov.wales/Catalogue/Census/2011/LimitingLongTermIllnessDisability-by-LocalAuthority>

⁸⁵ StatsWales (2011) Limiting long term illness or disability by local authority. [Online] Available from: <https://statswales.gov.wales/Catalogue/Census/2011/LimitingLongTermIllnessDisability-by-LocalAuthority>

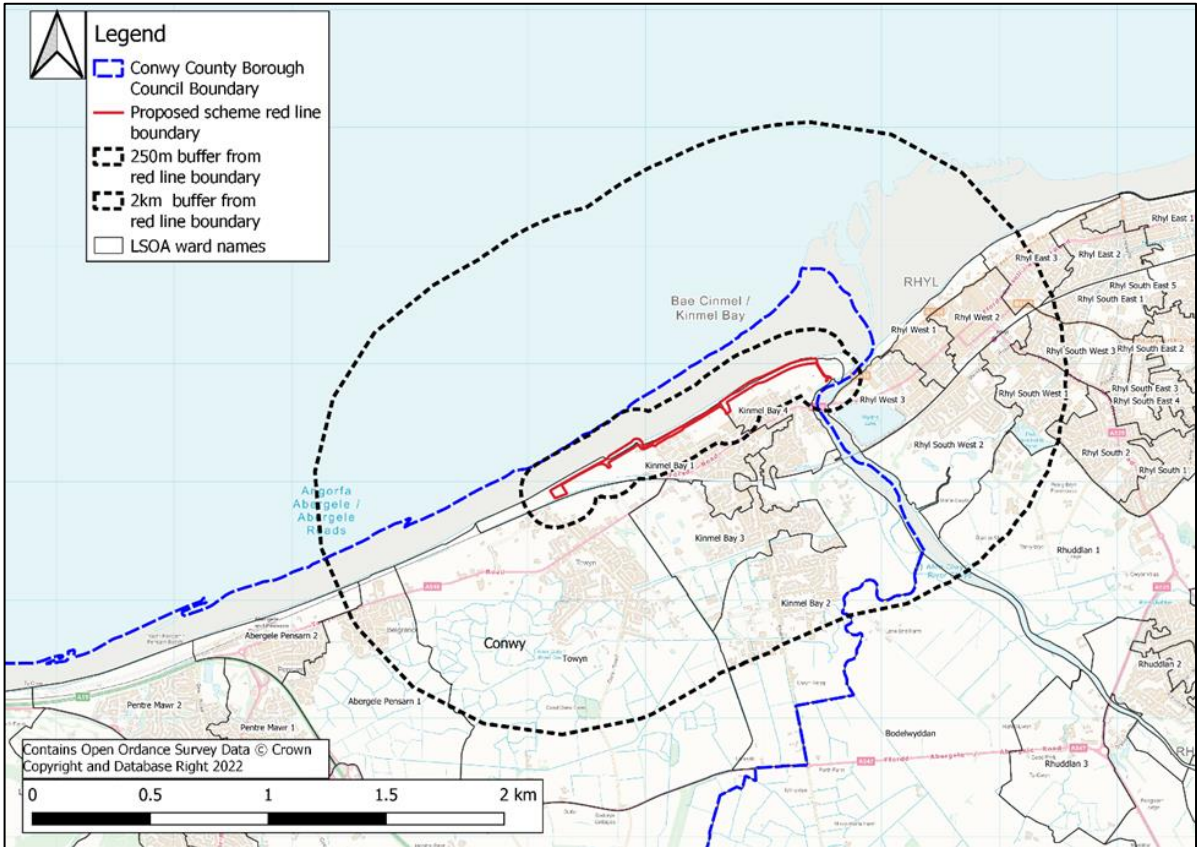


Figure 10-1: Overview of the proposed scheme with buffers, Lower Layer Super Output Area names, and Conwy County Borough Council boundary overlaid

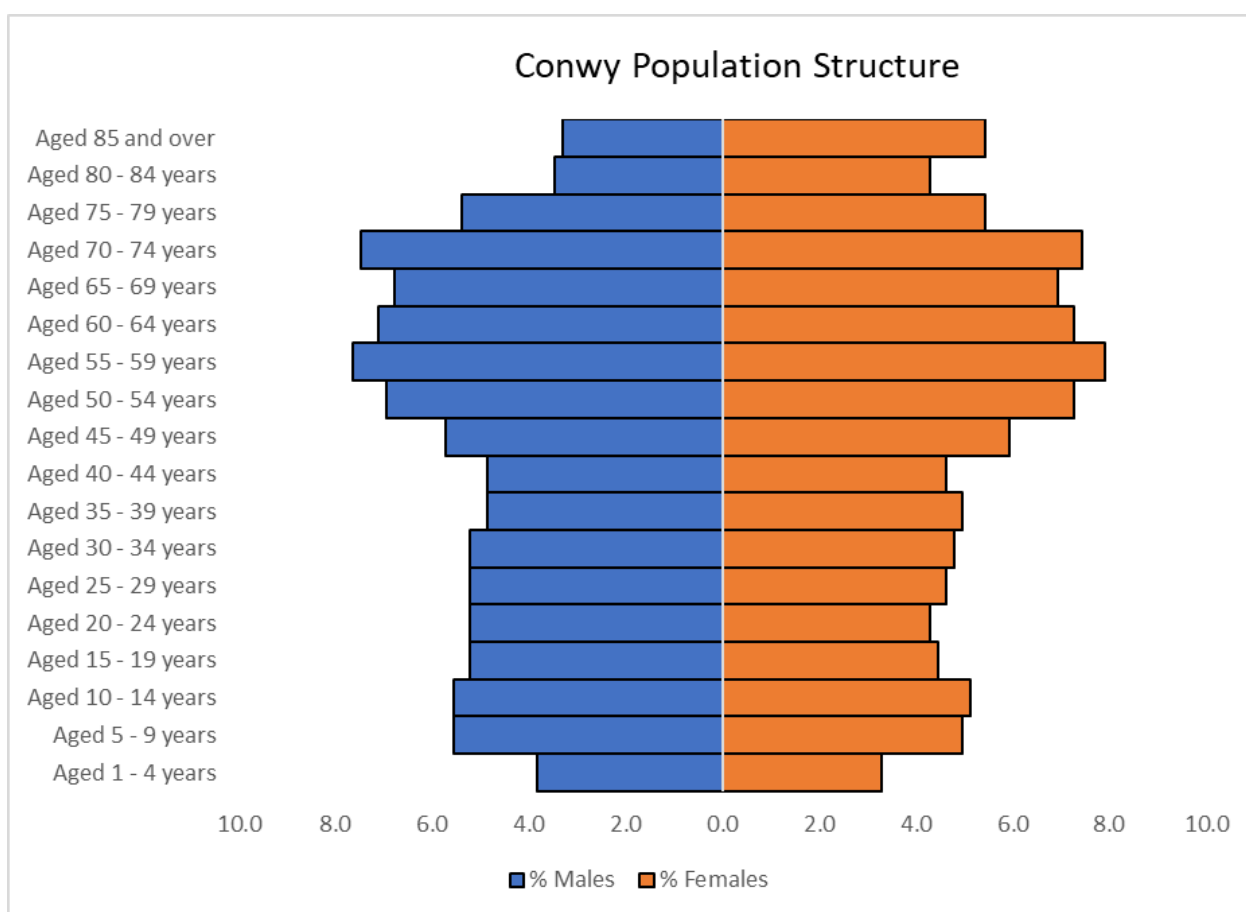


Figure 10-2: Conwy's population structure⁸⁶

10.2.2 Economy, Employment and Income

Conwy's economy is dominated by the service sector which includes tourism, accommodation, care, public sector and retail; these sectors account for 89.7% of the jobs in the county (Conwy County Borough Council, 2017). NOMIS data for Kinmel Bay from 2020 presents a labour market dominated by 'Wholesale retail and trade', 'Construction' and 'Manufacturing'. See Figure 10-4: Employment by industry for Kinmel Bay, Conwy County, Wales and England & Wales⁸⁷.

Tourism is one of the most notable sectors of the Conwy local economy and is a major sector in the economy of Kinmel Bay representing almost a quarter of the economy (28.1% of employment opportunities), with 20.6% of the workforce working in wholesale and retail trade, and another 7.5% working in accommodation and food service activities⁸⁸. Tourism has been an integral part of North Wales's economy since the 19th century. Tourist attractions in the area of Kinmel Bay include the promenade, local businesses including restaurants, cafes, pubs and shops as well as walks and cycle routes along the coast.

Unlike neighbouring sections of the North Wales coast which have struggled to adapt to changing tourism practices, Conwy has benefitted from a pivot towards outdoor activities such as walking, cycling, windsurfing and kayaking which are popular at Kinmel Bay and Pensarn. The geography of the coast also lends itself to favourable water sports conditions.

⁸⁶ Nomis (2021), <https://www.nomisweb.co.uk/reports/localarea?compare=W37000381>

⁸⁷ Nomis (2021), <https://www.nomisweb.co.uk/reports/localarea?compare=W37000381>

⁸⁸ Nomis (2021), <https://www.nomisweb.co.uk/reports/localarea?compare=W37000381>

Conwy's business base is dominated by small medium enterprises (SMEs) particularly at the micro end, with 73.7% of enterprises having 0-4 employees⁸⁹. The sector with largest volume of businesses in Conwy is the agricultural sector with over 16%, reflecting the rural nature of much of Conwy County⁹⁰.

According to the Welsh Index of Multiple Deprivation (WIMD) 2019 data, the second most deprived Lower Super Output Area (LSOA) in terms of employment in Wales, Glyn 2 (W01000144), is in Conwy. Glyn 2 is west of the scheme and is not within the study area. Of the LSOAs within Conwy 7% are among the 10% most deprived in terms of employment in Wales. In terms of overall deprivation, of the 71 LSOAs in Conwy, 4 are within the 10% most deprived in Wales (5.6% of LSOAs within Conwy)⁹¹.

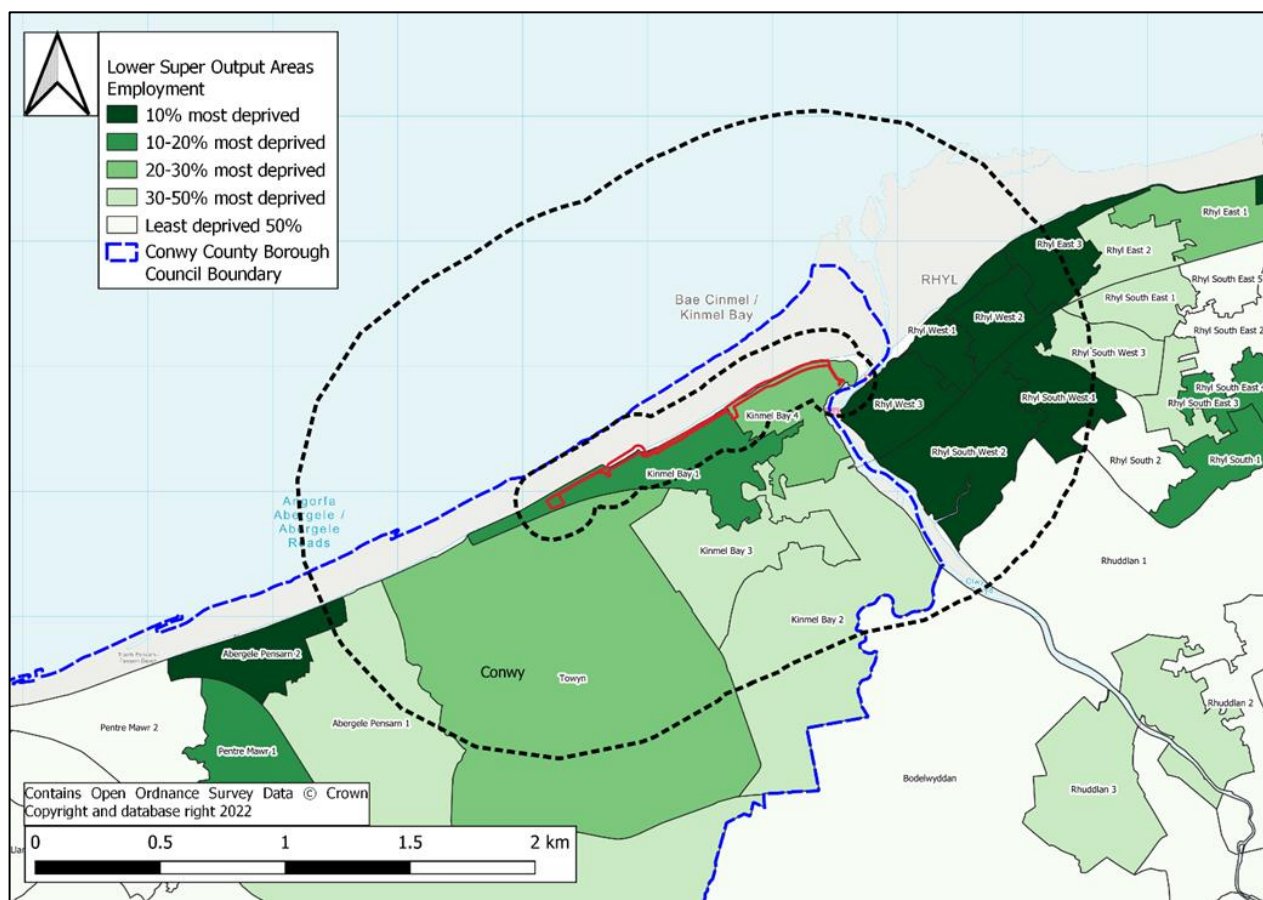


Figure 10-3: Employment in the area surrounding the scheme.

10.2.3 Housing

It is estimated that there were approximately 51,577 'households' in Conwy County Borough Council in 2011. In this context, 'household' means place of residence. Of these, 69.4% were owned either outright or with a mortgage, 18.3% were privately rented, 11.6% were rented

⁸⁹ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837adef9e.pdf

⁹⁰ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837adef9e.pdf

⁹¹ Conwy County Borough Council (2022) Welsh Index of Multiple Deprivation. [Online] Available from: <https://www.conwy.gov.uk/en/Council/Statistics-and-research/Poverty-and-deprivation/Welsh-Index-of-Multiple-Deprivation-2019-WIMD-2019.aspx#:~:text=Welsh%20Index%20of%20Multiple%20Deprivation%202019%20%28WIMD%202019%29,identify%20areas%20where%20there%20are%20clusters%20of%20deprivation.>

from a housing association and 0.7% were shared ownership Table 1. Table showing tenure of households in Conwy and Wales in 2011 and 2001⁹².

Conwy County Borough's level of occupancy was 91.1% according to the 2011 census. Meaning that 8.9% of properties were vacant in 2011, a figure 2.9% higher than the Wales average and 5.5% higher than the England and Wales average.

In February 2022 the average house price in Conwy County Borough was £209,880⁹³. This is a rise of 40% in the last five years, as in February 2017 the average house price in Conwy County Borough was £149,742⁹⁴. The average house price in Conwy has remained slightly above the Welsh average, which was £205,114 in February 2022. However, it lags far behind the English average of £295,888 for the same period.

When average salaries in Conwy County are compared to average house prices, Conwy has a relatively high ratio of 8.52⁹⁵. This exceeds the average of 8.0 for England and 7.01 for Wales. This suggests that housing is relatively unaffordable in the wider area. One explanation for

⁹² Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837a9ef9e.pdf

⁹³ Land Registry (2022) UK House Price Index . [Online] Available from:

<https://landregistry.data.gov.uk/app/ukhpi/browse?from=2017-02-01&location=http%3A%2F%2Flandregistry.data.gov.uk%2Fid%2Fregion%2Fconwy&to=2022-02-01&lang=en>

⁹⁴ Land Registry (2022) UK House Price Index . [Online] Available from:

<https://landregistry.data.gov.uk/app/ukhpi/browse?from=2017-02-01&location=http%3A%2F%2Flandregistry.data.gov.uk%2Fid%2Fregion%2Fconwy&to=2022-02-01&lang=en>

⁹⁵ ONS (2015) House price to workplace-based earnings ratio. [Online] Available from:

<https://www.ons.gov.uk/peoplepopulationandcommunity/housing/datasets/ratioofhousepricetoworkplacebasedearningslowerquartileandmedian>

this relative unaffordability could be higher levels of second home ownership which can inflate demand and lead to higher house prices in comparison to average local incomes.

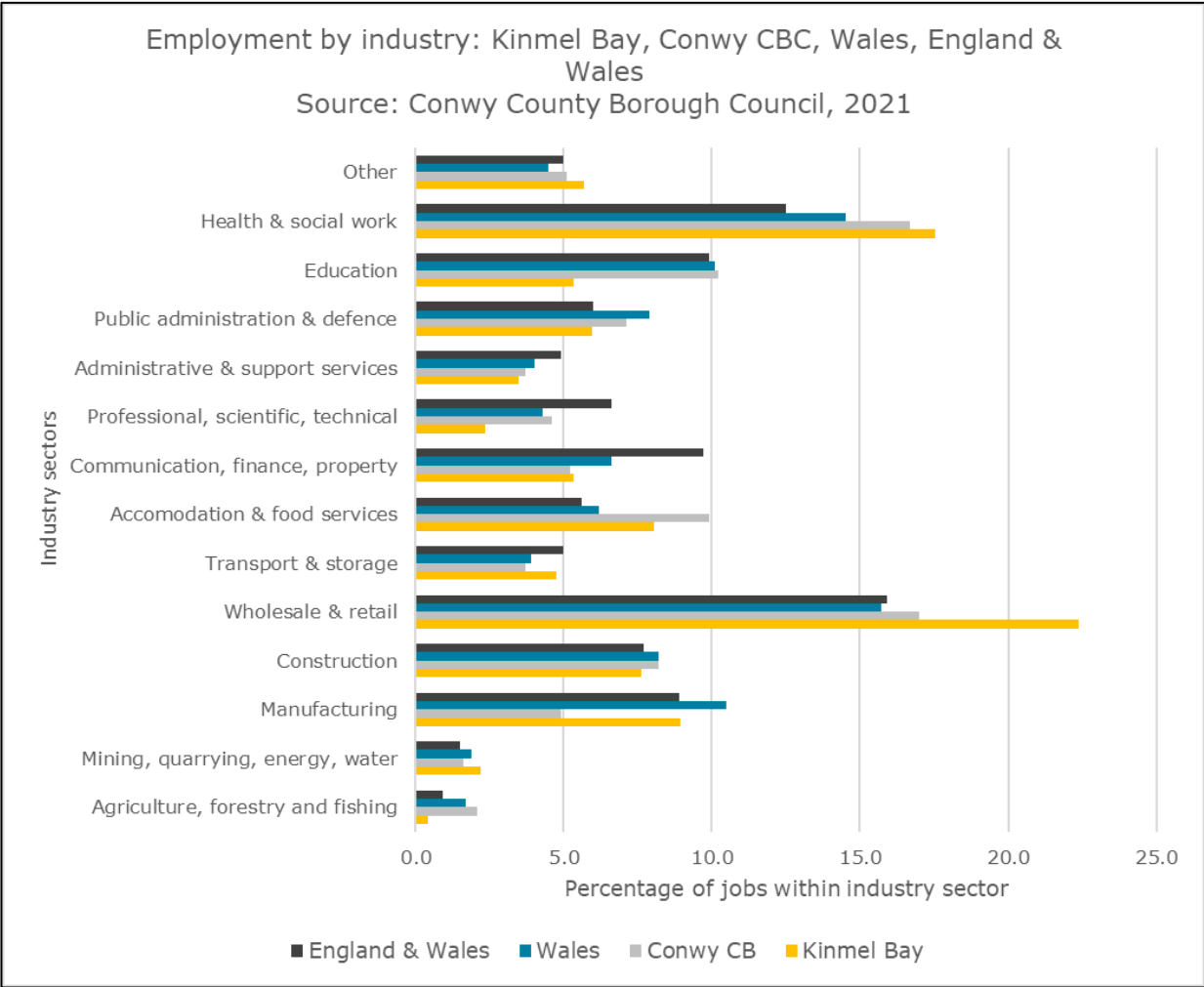


Figure 10-4: Employment by industry for Kinmel Bay, Conwy County, Wales and England & Wales

Table 10-1: Table showing tenure of households in Conwy and Wales in 2011 and 2001⁹⁶.

Table 1 Tenure (2011 & 2001) Source: Census 2011 table KS402EW & Census 2001 table KS018	Conwy		Wales		
	2011 Census		2001 Census	2011 Census	2001 Census
	Number	%	%	%	%
All households	51,177	-	-	-	-
Owner Occupied Sector	35,501	69.4%	72.2%	67.4%	68.3%
Owned outright	20,409	39.9%	38.1%	35.4%	29.5%
Owned with a mortgage or loan	15,092	29.5%	34.1%	32.0%	38.8%
Shared Ownership* Sector	378	0.7%	1.1%	0.3%	0.6%
Private Rented sector	9,352	18.3%	14.7%	15.8%	11.9%
Private landlord or letting agency	7,729	15.1%	11.4%	12.7%	8.7%
Private rented: other***	1,623	3.2%	3.3%	1.5%	3.2%
Social Rented Sector	5,946	11.6%	11.9%	16.4%	19.1%
Social rented: from the Council**	-	-	7.8%	9.8%	13.2%
Social rented: RSL/Housing Association	5,946	11.6%	4.1%	6.6%	5.9%
*Pays part rent and part mortgage					
**Conwy County Borough Council transferred all its housing stock to Cartrefi Conwy in 2008					
***Includes employer of a household member and relative or friend of a household member, or living rent free					

10.2.4 Tourism

Conwy County is a popular tourist destination for UK holidaymakers and North Wales has a long history of tourism, dating back to the 19th century and the growth of the beach holiday. As mentioned in Section 10.2.2, tourism is an integral part of the Conwy local economy and, as a result, shapes many of the local employment opportunities and practices.

Whilst Conwy County's tourism sector is strong and growing, its legacy of large guest houses serving a strong domestic tourism market up until the 1960s and 70s has led to a private sector housing market in coastal communities that has become dominated by houses in multiple occupation. Coupled with lower wage levels within the service sector, this has resulted in concentrated pockets of deprivation close to town centres with an associated decline in the economic fortunes of town centres⁹⁷.

10.2.5 Crime

Crime rates in Conwy County are higher than the Welsh average. Notable LSOAs for crime are the LSOAs of Rhyl West 3 which is the 125th most deprived LSOA in Wales in terms of community safety, Abergele Pensarn 2 which ranks as the 82nd, Rhyl West 1 which is the 29th, and Rhyl West 2 which is 7th, all of which are among the 10% most deprived in terms of community safety within Wales. Rhyl West 3 falls within 250m of the scheme, and Rhyl West 1 and 2 and Abergele Pensarn 2 fall within 2km of the scheme.

⁹⁶ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837adef9e.pdf

⁹⁷ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837adef9e.pdf

The scheme, along with the entirety of Conwy County Borough Council, falls within the jurisdiction of North Wales Police. In 2021, the crime rate in the ward of Kinmel Bay was 77.64 per 100,000 people⁹⁸. This was slightly lower than the Conwy County Borough Council average, of 82.26 per 1,000 people in the year to November 2021. The most common crimes committed in Kinmel Bay (the designated area that the scheme falls within) are violence and sexual offences (46.8%), and anti-social behaviour (15.8%)⁹⁹. Table 10-2, Table 10-3 and Table 10-4 below show the type, number and outcome of all recorded crimes that took place in Kinmel Bay from September 2021 to August 2022.

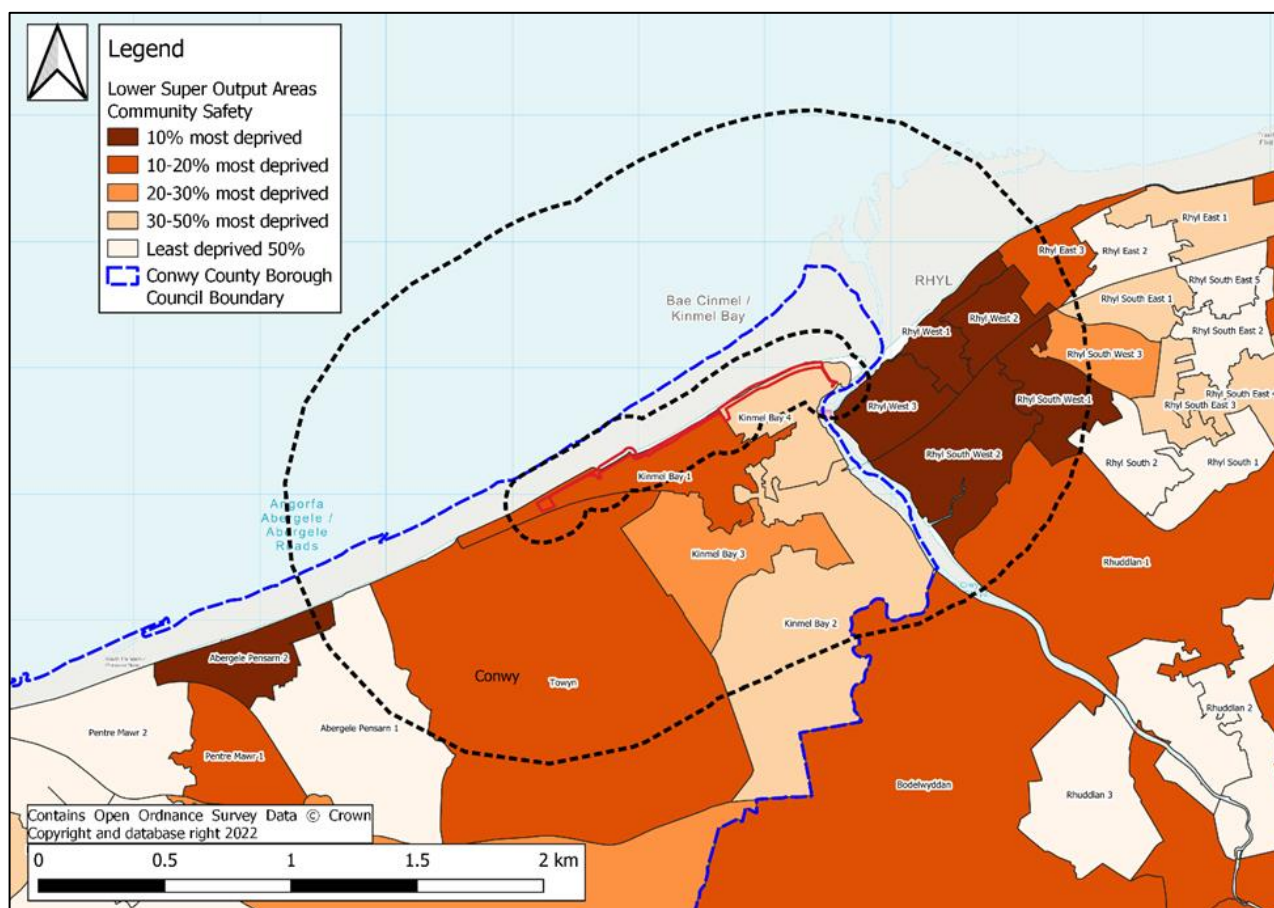


Figure 10-5: Community safety surrounding the proposed scheme.

Table 10-2: Crimes by type in Kinmel Bay from September 2021 to August 2022¹⁰⁰

Crimes by type	Number
Violence and sexual offences	383
Anti-social behaviour	129
Criminal damage and arson	85
Public order	81
Other theft	46
Burglary	26

⁹⁸ Conwy County Borough Council (2021), Kinmel Bay Ward Profile. [Online] Available at: <https://www.conwy.gov.uk/en/Council/Statistics-and-research/Assets/documents-ward-profiles/Kinmel-Bay-ward-profile-Nov-2021.pdf>

⁹⁹ Police.UK (2022) Kinmel Bay. [Online] Available from: <https://www.police.uk/pu/your-area/north-wales-police/kinmel-bay/>

¹⁰⁰ Police.UK (2022) Kinmel Bay. [Online] Available from: <https://www.police.uk/pu/your-area/north-wales-police/kinmel-bay/>

Crimes by type	Number
Vehicle crime	26
Drugs	13
Other crime	11
Shoplifting	10
Possession of weapons	1
Theft from the person	1

Table 10-3: Number of crimes a month in Kinmel Bay from Sept 2021 - August 2022.

Month	Crimes per month
Sep 2021	76
Oct 2021	68
Nov 2021	48
Dec 2021	40
Jan 2022	83
Feb 2022	52
Mar 2022	61
Apr 2022	76
May 2022	84
Jun 2022	78
Jul 2022	83
Aug 2022	70

Table 10-4: Outcome of crimes committed in Kinmel Bay from Sept 2021 - August 2022.

Crime outcome	Number of instances
Unable to prosecute suspect	267
Under investigation	168
Other	129
Investigation complete; no suspect identified	118
Status update unavailable	70
Formal action not in public interest	24
Awaiting court outcome	11
Action to be taken by another organisation	10
Court results unavailable	8
Local resolution	2
Further action is not in the public interest	2
Offender given a caution	1

10.2.6 Traffic and Commuting

Conwy is a net exporter of labour; with 66,900 people of working age in the county (58.38% of total population of county) and 41,500 PAYE jobs. Around 29% of people in PAYE jobs commute out of the county for work¹⁰¹.

Traffic levels in an area have the potential to significantly impact upon the quality of life of residents. Increased traffic levels can impact upon quality of life in the following ways;

- Increasing congestion and therefore wasting motorists' time – thereby reducing regional economic health;
- Increase in time spent in stationary vehicles increases local air pollution;
- Economic impact to individuals from wear and tear on vehicles as a result of idling in traffic;
- Impact on the health of motorists by increasing stress levels;
- Increased congestion potentially inhibiting emergency vehicles from reaching destinations; and
- Increase in the incidence of spill over effect – where drivers attempt to find alternative, less congested routes, possibly through much smaller roads, affecting neighbourhood quality of life and, in extreme cases, even house prices.

According to the 2011 Census (latest available data) 72.8% of residents of Conwy travel to work by driving a car or van¹⁰². This is above the Welsh average of 67.4% and far exceeds the English and Welsh average of 57.5%. Poor public transport links and Conwy being a net exporter of labour explain, in part, why travel by car or van is the preferred method.

10.2.7 Welsh Language

The current Conwy Local Development Plan states *"The Council will ensure that development supports and sustains the long-term well-being of the Welsh language, and will resist development which, because of its size, scale or location, will significantly harm the character and linguistic balance of a community."*

According to figures obtained from the 2011 Census (the most recent year for which data is available), Kinmel Bay has a lower proportion of individuals who can speak Welsh than the average in Wales. 11.5% of individuals in Kinmel Bay can speak Welsh (19% in Wales), 8.9% of Kinmel Bay residents say that they can read, write and speak Welsh (14.6% in Wales), 4.4% can understand spoken Welsh only (5.3% in Wales), and 5.8% of individuals have a different or other combination of Welsh language skills (6.7% in Wales). Finally, 81.7% of individuals within Kinmel Bay had no Welsh skills in 2011, (compared to 73.3% in Wales)¹⁰³.

10.2.8 Education

Kinmel Bay has 3 primary schools within 2km of the scheme, shown spatially in :

- Ysgol Maes Owen (735m)
- Christ Church Primary School (1491m)
- Ysgol Emmanuel (1745m)

¹⁰¹ Conwy County Borough Council (2017) Conwy County's Economic Growth Strategy. [Online] Available from: https://conwybusinesscentre.com/wp-content/uploads/1c76a1_05524f66b9d240c6b10c881837adef9e.pdf

¹⁰² ONS (2011) 2011 Census. [Online] Available from: <https://www.ons.gov.uk/census/2011census>

¹⁰³ ONS (2011) 2011 Census. [Online] Available from: <https://www.ons.gov.uk/census/2011census>

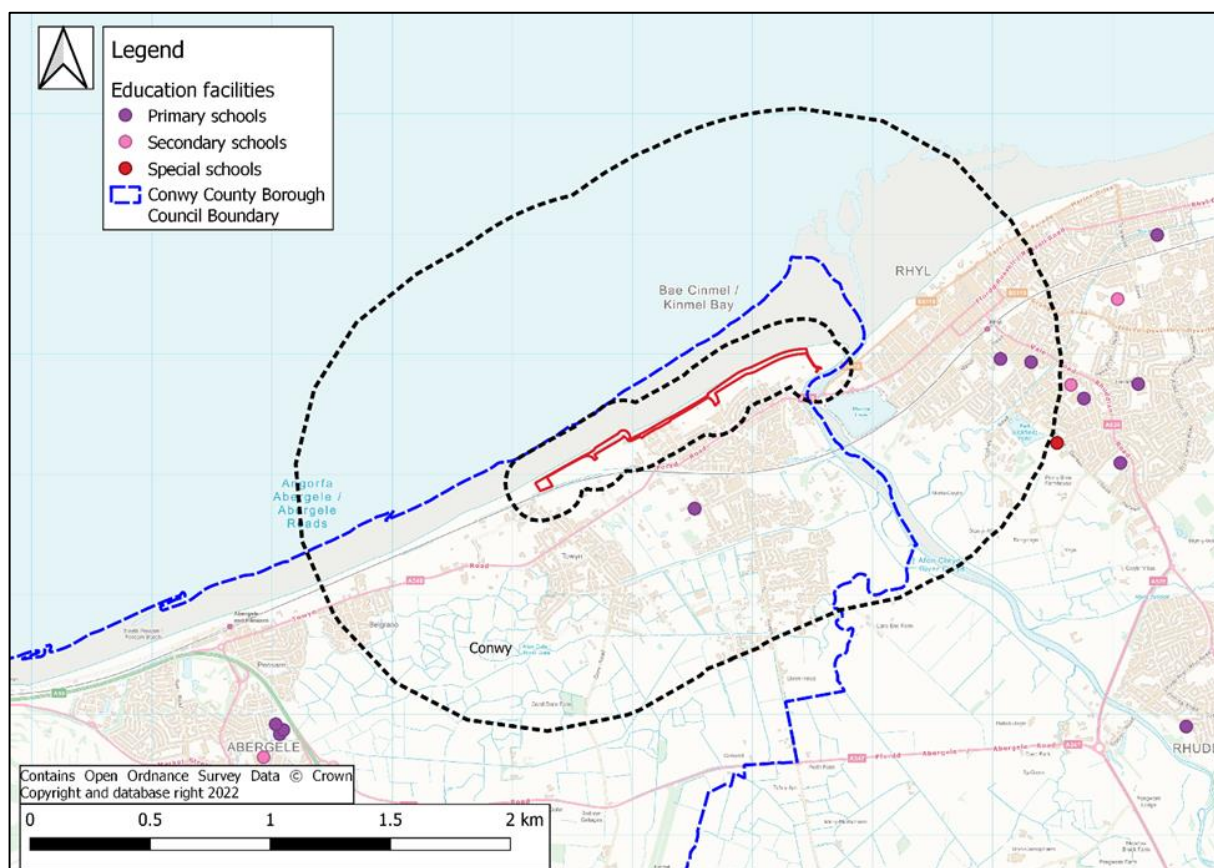


Figure 10-6: Map of education facilities in proximity to proposed scheme

10.2.9 Health facilities

Kinnel Bay has 5 General Practices or General Practice subbranches, 8 pharmacies, 5 opticians and 2 dentists within 2km of the proposed scheme. These facilities within Kinnel Bay are listed in Table 10-5 and Figure 10-7 shows the proximity of health facilities to the proposed scheme.

Table 10-5: Health facilities in Kinnel Bay

Name of health facility	Type	Distance from scheme (m)
Lloyds Pharmacy	Pharmacy	150
Kinnel Bay Medical Centre	General Practice	190
Boots UK	Pharmacy	253
Lloyds Pharmacy	Pharmacy	420
Lakeside Medical Centre	General Practice	611
Vittoria Healthcare	Pharmacy	670
Kings House Surgery	General Practice	1050
Lloyds Pharmacy	Pharmacy	1098
Elwy Dental Practice	Dentists	1143
Clarence Medical Centre	General Practice	1191
Colnons & Sons Opticians	Opticians	1207
Focus in Opticians	Opticians	1340
Scrivens Opticians	Opticians	1386

Name of health facility	Type	Distance from scheme (m)
Boots	Pharmacy	1395
Dollond & Aitchinson	Opticians	1395
Specsavers	Opticians	1413
Lloyds Pharmacy	Pharmacy	1434
Bod Heulog	Dentists	1579
Westfield Surgery	General Practice Subbranch	1892
Camella Healthcare	Pharmacy	1951
Glan Clwyd Hospital	Hospital	4801m

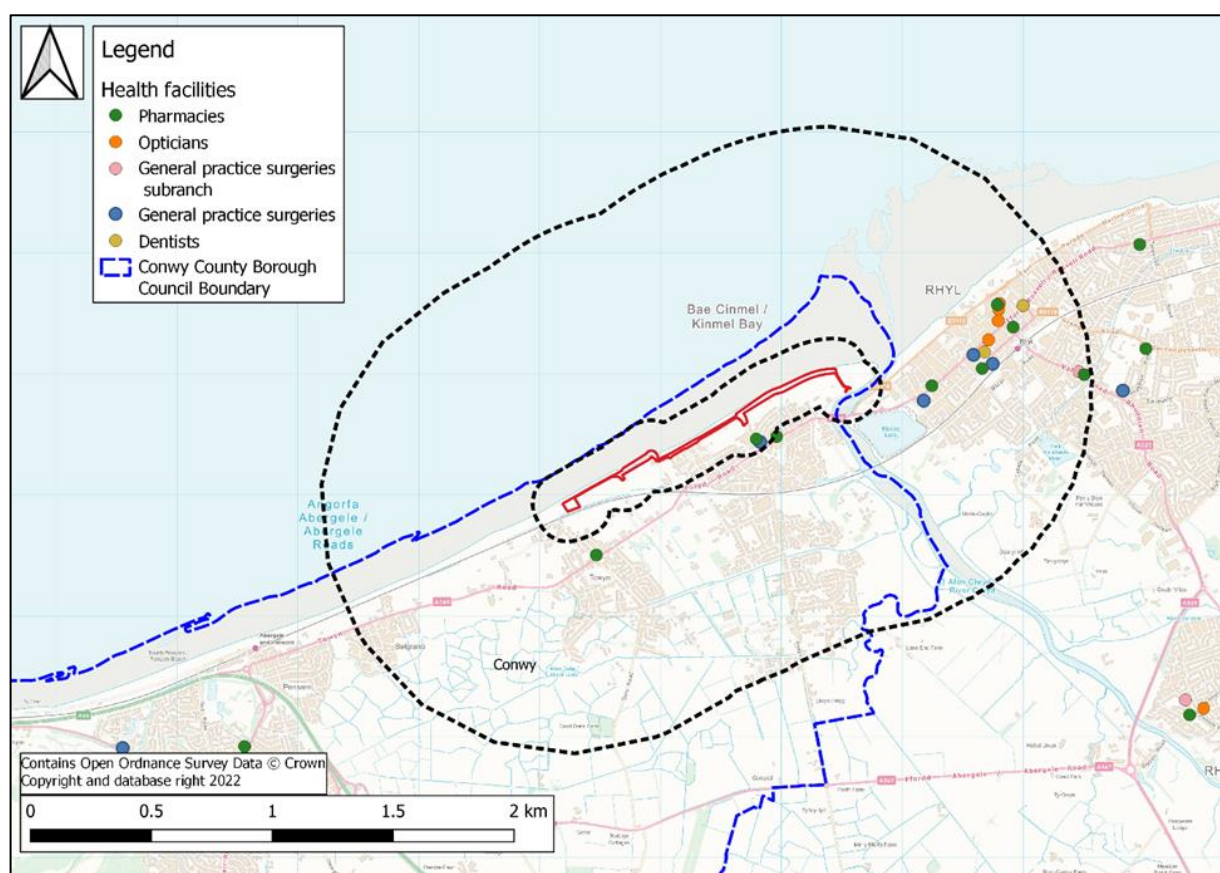


Figure 10-7: Health facilities surrounding the scheme.

10.2.10 Climate Change

Considering climate change, sea levels are currently rising, and the rate of rise is accelerating. Coastal flood and erosion risk to UK coastlines will therefore grow as climatic impacts continue to unfold and develop¹⁰⁴. Rising sea levels will increase coastal flood risk, and this has clear negative implications for socio-economic factors.

Met Office modelled predictions indicate that global sea levels have risen throughout the 20th century and will continue to rise over the coming centuries irrespective of future reductions in greenhouse gas emissions. Modelling of future sea levels based on low and high emission scenarios suggest a mean average sea level change of between approximately 0.4 and 0.7 m

¹⁰⁴ Kovats, S. and Brisley, R. (2021) Health, communities and the built environment. In: The Third UK Climate Change Risk Assessment Technical Report [Betts, R.A., Haward, A.B., Pearson, K.V. (eds.)]. Prepared for the Climate Change Committee, London

by 2100 within the area of the proposed coastal defence scheme at Kinmel Bay. These figures are subject to change depending on a range of variables including thermal expansion, increases in global temperatures and the uncertainty regarding the retreat of ice sheet masses.

To mitigate against the threats of climate change and to build resilience, coastal flood defences at Towyn and Kinmel Bay are required. Without modifying and constructing defences to protect the coastal frontage at Towyn and Kinmel Bay the likelihood is that coastal flooding will occur more regularly resulting in damage to property and infrastructure, creating a worse socio-economic scenario, as well as posing a threat to life.

10.3 Assessment Methodology & Assessment Criteria

A social impact assessment has been undertaken to assess the scheme against the baseline presented. The assessment considers the physical impacts of the scheme, together with how the communities' knowledge or understanding of the scheme may cause socio-economic impacts and affects socio-economic behaviours, aspiration and health and wellbeing.

The Coastal Community Typology Report (2015) categorises Kinmel Bay and the associated North Wales Coastline as being within a B2 "Resorts and Ports" area. Whilst providing a strategic perspective across Wales, this study also offers some benchmarks against which to analyse the situation and trends relating directly to the scheme, including economic factors, issues for vulnerable groups and change factors.

10.4 Potential Impacts & Significant Effects

10.4.1 Employment

It is anticipated that the construction of the scheme would take approximately 18 months from March 2023 to October 2024. Amey has indicated that the scheme would be registered with Considerate Contractors, one of the objectives of which is to contribute to, and support, the local community and economy.

The project offers economic opportunities to a varied group of suppliers and subcontractors. Technical compliance, quality requirements and availability will dictate the radius of the project resource footprint.

Amey anticipates a peak permanent staff contingent of 40 staff during the delivery of the scheme (excluding visiting service contractors) and they will endeavour to source labour from the local area. In Kinmel Bay 7.6% of jobs are in construction (exceeding the Great Britain average of 4.6%). Assuming that all 40 positions went to local residents this would temporarily increase the percentage working in construction to 9.3%. If all 40 jobs were taken by individuals that live in Kinmel Bay (who were not previously economically active), the proportion of economically active individuals in Kinmel Bay would rise from 58.1% to 58.4%¹⁰⁵ for the construction period of 18 months.

Analysis carried out on commuting statistics from StatsWales¹⁰⁶ suggest that within the county of Conwy, 16.28% of individuals that work in the county commute in from outside the county. This suggests that of the 40 created, 7 posts could be taken by individuals that live outside of Conwy.

In addition to the direct construction employment gained by the project itself, there will be an increase in local employment arising from indirect and induced effects of the construction activity, for example, through supply. This is particularly positive for local communities which have significant pockets of deprivation, as listed in the above section Economy, Employment

¹⁰⁵ Nomisweb (2011): Local Area Report for Kinmel Bay/Abergele Built-Up Area [Online]. Available at: <https://www.nomisweb.co.uk/reports/localarea?compare=W37000381>

¹⁰⁶ StatsWales(2022): Commuting patterns by Welsh Local Authority and measure [Online]. Available at: <https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/People-and-Work/Employment/Commuting/detailedcommutingpatternsinswales-by-welshlocalauthority>

and Income. Additionally, it is reasonable to expect that part of the disposable income of the construction workers will be spent in Kinmel Bay or elsewhere in Conwy, generating or supporting further employment. This is called the multiplier effect. The impact of the multiplier effect depends on the size of the geographical area that is being considered, the business supply chain and strength of income effects.

During its operational stage, the scheme would only negligibly contribute to local employment directly, through any necessary maintenance. However, the increased protection the structure would offer Kinmel Bay might contribute to the area becoming a more attractive place to live and work, contributing to the local economy. In this way, the scheme could indirectly contribute to local employment levels.

It is anticipated that due to the factors outlined above, the scheme would have a slight positive impact on local employment (slight impact determined as medium importance of receptor, minor magnitude, refer to Table 3-2).

10.4.2 Traffic and commuting

It has been determined in Chapter 11: Traffic and Transportation that there are no significant impacts to the local transport networks as a result of the proposed scheme.

Increased HGV traffic along the A547 and A548 as a result of construction of the scheme will have an impact on traffic and commuting patterns. Whilst this affect is likely to be minimal, given Conwy's high levels of commuting (see section on Traffic and Commuting) and the local economy's dependence on tourism (see section on Economy, Employment and Income) these factors may exacerbate the issue.

It is therefore expected that the scheme would have a slight negative impact on traffic and commuting, but it is recognised that this impact will be short-term for the duration of the construction of the scheme only and therefore no mitigation is proposed.

10.4.3 Potential diversion of the Wales Coast Path and National Cycle Network Route 5

The proposed temporary works will lead to some obstructions on the Wales Coast Path and National Cycle Network Route 5, this has potential for temporary disruption to residents and visitors. However these obstructions are to be temporary, and diversions will be managed and finalised once a contractor has been appointed. In each location there are good links to the A547/548 if required, but where possible diversions/closures to cycle and walking routes will be managed locally. There are no anticipated permanent impacts from the permanent works. Diversion routes, if required will be confirmed by the appointed contractor.

It is therefore expected that the scheme will have a slight negative impact on the Wales Coast Path and National cycle Network Route 5, but that these impacts will be short-term in nature and therefore no mitigation is proposed.

10.4.4 Tourism

As outlined in Sections 10.2.2 and 10.2.4, tourism is a major sector in the economy of Kinmel Bay representing over a quarter of employment in Kinmel Bay.

It is expected that the increase in HGV traffic along the A547 in Llanddulas, and the A548 in Pensarn and Kinmel Bay would have a temporary moderate negative impact upon tourism. However, the majority of tourism-related businesses, tourist attractions and tourist accommodation are within the town centres of Kinmel Bay. Contrastingly the scheme is in an area that is largely residential, which means that few tourism-related businesses would be directly affected during construction.

Although the construction period is expected to overlap with 'peak season' in Kinmel Bay, it is unlikely that tourism will be impacted during the construction period due to the majority of the tourism industry being located outside of the scheme area.

In the long-term, the proposed scheme will defend the existing tourist assets along the coastline. Without these additional coastal defences, frequent overtopping and subsequent flood damages are likely to significantly impact the local tourist economy. Further to this, the proposed scheme includes several public realm enhancements, including parklets, toilet blocks and improvements to the St Asaph carpark.

Overall, it therefore is expected that the scheme will have a slight negative impact on tourism in the short-term but positive impact in the long-term. Therefore, the impact is assessed as Neutral.

10.4.5 Education

The scheme is not expected to directly impact upon school provision or demand during construction or operation.

No schools are within a close enough proximity to the scheme to be directly impacted by construction. The closest school to the scheme, Ysgol Maes Own, is over 735 metres from the scheme and is therefore not close enough to be impacted by noise, construction dust or construction traffic. The catchment area¹⁰⁷ suggests that pupils are unlikely to use the Wales Coast Path or the National Cycle Network Route 5 to travel to and from school, therefore the diversion of these routes, if required, would not be anticipated to have an impact on local children or education workforce.

It is therefore expected that the scheme will have no impact upon education during construction or operation.

10.4.6 Welsh Language

It is not anticipated that the scheme will have any significant impact, positive or negative, upon the Welsh language.

There is, however, the potential for the construction to have a slight positive impact upon the Welsh language in Kinmel Bay during construction as explained below information about the scheme presented before, during and after construction will be available in both English and Welsh. It is recommended that Amey hire a Community Liaison Officer (CLO) to engage with the public. If so, they should be proficient in both Welsh and English, to answer queries from the public in both languages. Any future or ongoing stakeholder engagement should also be held in English and Welsh.

10.4.7 Healthcare

The scheme is not expected to directly impact upon healthcare provision or demand during construction or operation.

If any diversions of the Wales Coast Path are required, these would not impact upon local residents' ability to access facilities (general practices, dental practices and pharmacies in Kinmel Bay).

Broadly, frequent flooding is associated with impacts to health. A study by Public Health England assessed how communities are affected by the floods, the associated effects on people's health and living and how long this impact lasts. The study found that flooding can have significant impacts on the mental health of people whose homes are flooded as well as people whose lives are disrupted by flooding. These impacts were shown to last for at least three years.¹⁰⁸

Therefore, it is anticipated that the reduction in flood risk associated with proposed scheme is likely to reduce demand on healthcare facilities than compared to a 'do nothing' baseline

¹⁰⁷ SchoolGuide.co.uk – Catchment area for Ysgol Maes Owen, Conwy.

¹⁰⁸ Public Health England (2015) Flooding and health: national study. [Online] Available from: <https://www.gov.uk/guidance/flooding-and-health-national-study>

scenario. Overall, the impact associated with the proposed scheme on healthcare is considered as slight beneficial.

10.4.8 Open Space

It is anticipated that during construction, 1.15 hectares of beach would be temporarily closed to the public. In total this would result in a loss of 1.15 ha of open space for the public for the duration of the works. However, there are 39.29 ha of green space and 188.48 ha of beach within 2km of the scheme. As such, the temporary closure of 1.15 ha of open space would result in a loss of about 0.5% of total available open space within 2km of the scheme.

The loss of access to open space during the construction phase is therefore not anticipated to have a significant impact, given the broad availability of alternative open spaces and the small percentage of open space that will be made inaccessible to the public.

It is therefore expected that the scheme will have a slight negative impact on open space provision during construction and operation, but that this will be more than offset by the benefits provided by the scheme.

10.4.9 Noise, nuisance and disruption

It is anticipated that during construction there will be some impacts from noise and there is potential for nuisance and disruption. Impacts resulting from construction of the scheme are expected to be minor and will be temporary. However, given that the scheme is situated primarily in residential areas and given the aging population and percentage of the population that are limited by disability or long-term illness there is the potential for these factors to lead to exacerbated impacts (see Population Demographics section above).

It is therefore expected that the scheme will have a slight negative impact on noise, nuisance and disruption, but the impact will be short-term in nature and therefore no mitigation is proposed. An assessment of noise and vibration, generated as a result of the proposed scheme can be found in Section 12.

10.5 Mitigation Measures

This project and much of the subsequent procurement has been through the 'Sell 2 Wales Framework'¹⁰⁹. The Sell 2 Wales framework aims to help businesses win contracts with the public sector across Wales and to help businesses find contract opportunities in Wales.

Any required diversions of Public Rights of Way (PRoWs), the Wales Coast Path and National Cycle Route 5 will be decided on and agreed by a subsequently procured contractor. The potential diversion of any PRoW, the Wales Coast Path or the National Cycle Route 5 away from the construction site could reduce the impact caused.

Ensure the contractors are voluntary members of the Considerate Constructors Scheme (CCS). Members of the CCS abide by the Code of Considerate Practice, which outlines the Scheme's expectations with regards to individual sites and describes those areas that are considered fundamental for registration with the Scheme¹¹⁰. Some expectations that would contribute to mitigation of potential socio-economics impacts are outlined below:

- Informing, respecting and showing courtesy to those affected by the work;
- Minimising the impact of deliveries, parking and work on the public highway;
- Contributing to and supporting the local community and economy; and
- Working to create a positive and lasting impression¹¹¹.

¹⁰⁹ <https://www.sell2wales.gov.wales/Default.aspx>

¹¹⁰ <https://www.ccscheme.org.uk/ccs-ltd/code-of-considerate-practice-2/>

¹¹¹ <https://www.ccscheme.org.uk/ccs-ltd/code-of-considerate-practice-2/>

It is not anticipated that there would be any significant negative socio-economic impacts associated with the scheme.

Noise and disruption from construction works should be limited to ensure that effects on local receptors within the surrounding residential areas are minimised. Any diversions should aim to minimise impacts by keeping diversion lengths to a minimum and by providing wide diversion routes where possible. Equally, ensuring that multiple channels of communication are utilised so that as many stakeholders as possible are informed of the programme should be undertaken. This could include measures such as advertising in a newspaper, local radio stations, promotion on social media platforms as well as providing local newsletters containing translations in Welsh and Braille and placing information in local community centres such as libraries and tourist information centres. Finally, advanced notice of events and potential disruption should be given, as this will allow for those in protected groups to plan ahead and make other arrangements.

JBA Consulting and Amey are undertaking community engagement and pre-application consultation on the scheme. During stakeholder engagement sessions, local residents will have the opportunity to voice their opinions on the scheme and its construction period. This information may be used by Amey and JBA Consulting to further reduce potential impacts on the local population.

10.6 Residual Effects

Impacts upon the residents and local economy of Kinmel Bay are important and must be stated, and mitigation measures should be adopted if possible. However, socio-economic impacts must be viewed in the context of the socio-economic benefits that will be delivered to Kinmel Bay from the scheme. The new defences would protect 726 properties from a 1 in 200-year coastal flood event increasing to 2,289 in 2021. The proposed scheme would increase community resilience and potentially reducing mental health impacts associated with fear of flooding. This will ensure that Kinmel Bay remains a viable community now and in the future, in the face of ongoing climate change. It may also increase the economic competitiveness of Kinmel Bay as areas, helping them to prosper in future, delivering substantial socio-economic benefits.

11 Traffic and Transportation

11.1 Introduction

During the construction of the coastal defences, it is considered that there will be traffic generated by the works, associated with material and plant delivery and staff accessing the sites. This chapter will consider the impact of construction traffic generated by the works on the surrounding road network and set out plans to mitigate and monitor traffic associated with the works.

11.2 Legislative & Planning Policy Context

Planning Policy Wales: Edition 11 was published in February 2021 and sets out a system to manage the development and use of land to contribute to social, economic, environmental, and cultural interests of the Welsh public.

The policy highlights the importance of Transport Assessments in understanding the likely impacts of a development to ensure they can be planned for and managed appropriately. The policy also states the need to cover transport impacts of both construction works and the completed development.

Technical Advice Note 18 includes advice on, integration of land use and transport planning, the location of developments, regional transport plans, parking, and the design of developments.

Chapter 9, Assessing Impacts and Managing Implementation covers transport assessments.

TAN 18 sets out the requirements of a Transport Assessment and highlights the need for a Transport Implementation Strategy.

The Adopted Local Development Plan (LDP) was adopted in October 2013 and expired in 2021. The document is currently under review by Conwy County Borough Council. A replacement document has been produced covering the period from 2018 to 2033. This document is available online as a preferred strategy.

The replacement document sets out a framework for developments in Conwy and ensure that expected population growth will benefit communities and promote sustainability.

11.3 Baseline Conditions

11.3.1 Site locations

The scheme covers the coastline of North Wales either side of Kinmel Bay, Conwy. Kinmel Bay is a seaside village between Towyn and Rhyl.

This area is within the urban coastal corridor running along the strategic transport routes of the A55 dual carriageway and the railway line. The area is prone to flooding and with climate changes, flood defences are to be improved in order to better protect against severe storms & associated water levels.

11.3.2 Local Highway Network

Kinmel Bay is located just off the North Wales Expressway (A55) which runs east to west close to the coastline and will form the majority of the access route to the work sites for material & plant deliveries, as well as construction staff.

A compound is proposed on a vacant plot of land between Knightly's Fun Park and Golden Sands Caravan Park. This will be known the Towyn Revetment compound. Access to this compound will be via the coastal path from Foryd Road.

A second compound is proposed off St Asaph Avenue in Kinmel Bay on vacant land adjacent to Promenade Pay & Display Car Park which will remain open.

11.3.3 Active Travel Infrastructure

National Cycle Network Route 5 runs between Anglesey and Reading along the North Wales coastline. This route includes sections of traffic free and on road facilities. This runs along the Wales Coastal Path.

The route runs as a shared footway / cycleway from Pensarn to Rhyl.

West of Pensarn the route also forks off into Abergele via the traffic calmed Sea Road, although there are no dedicated facilities for cyclists.

NCN Route 84 joins NCN Route 5 in Kinnel Bay running along the bank of the River Clwyd to Rhuddlan then along a shared footway /cycleway on the A525 to St Asaph.

Figure 11-1 shows NCN Route 5 in the vicinity of the works. Solid orange lines represent traffic free sections of the route; solid blue on-street cycle friendly routes forming part of the NCN route and dashed blue and on-street sections which do not form part of the NCN.

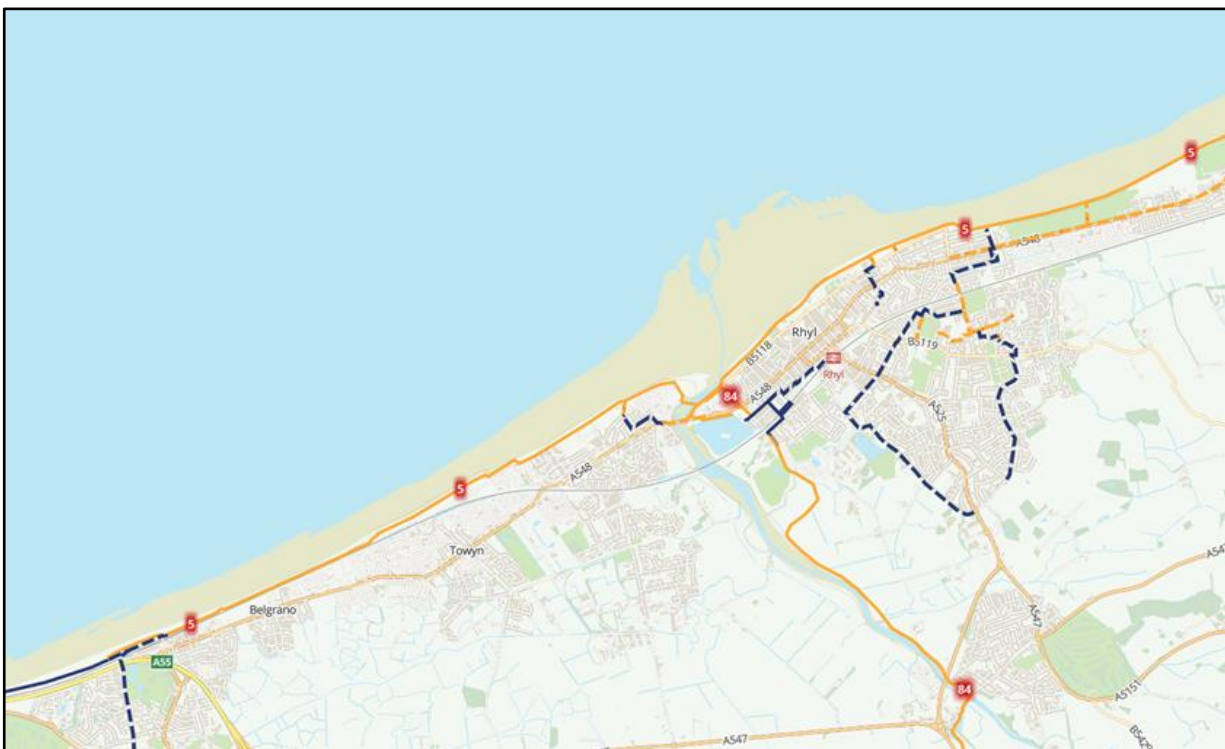


Figure 11-1: Sustrans Map of NCN Route 5 in the vicinity of the works.

11.3.4 Public Transport

Rail Services

Rail lines run close to the coastline of North Wales offering services between Holyhead, Llandudno, Manchester, and Cardiff.

Rhyl and Abergele & Pensarn stations are all relatively close to the proposed works. Rhyl station is 1.9 miles from the compound at Kinnel Bay which is approximately a 35 minute walk or 10 minute cycle.

Similarly, Abergele & Pensarn Station is 1.9 miles from the Towyn Revetment compound.

The Holyhead to Cardiff service stops at Rhyl Station 8 times a day in each direction. The same service stops at Abergele and Pensarn once towards Cardiff and 4 times towards Holyhead.

The Holyhead / Llandudno to Manchester service stops towards Holyhead / Llandudno stops at Rhyl 39 times and Abergele & Pensarn 22 times. In the opposite direction the service stops at Rhyl 45 times and Abergele & Pensarn 25 times.

Bus Services

There are six bus services covering the area of the proposed works.

The number 12 bus operates between Rhyl and Llandudno with services broadly every 15 minutes from 5:15am to 6pm. The service then operates at half hour intervals with the last bus leaving Rhyl at 11pm and leaving Llandudno at 11:10pm.

The number 13 bus operates from Llandudno to Prestatyn with hourly services between 7:30am and 8:40pm.

The number 21 service operates from Colwyn Bay to Llandudno via Betws yn Rhos and Rhyd Y Foel.

The X12 bus service operates between Rhyl and Llandudno. The service runs once in the early morning leaving Rhyl at 5:50am and three services in the evening from Llandudno between 18:27 and 23:40.

The number 45 bus service operates between Rhyl and Ysbyty Glan Clwyd via Kinmel bay four times a day in each direction. This service does not stop within 1 mile of the proposed works compound.

The number 46 bus service operates between Rhyl and Ysbyty Glan Clwyd two times a day in each direction.

The 12, X12 and 46 bus services stop at Seagull Inn on Towyn Road which is 0.7miles from the proposed site compound in Kinmel Bay, adjacent to Millers Cottage Caravan Park.

11.3.5 Future Baseline

Road traffic statistics for Wales showed a year-on-year increase in traffic levels from 2012 to 2019. Traffic then dropped of significantly in 2020 when the Covid-19 pandemic hit and the majority of residents were required to stay at home. Traffic levels rose in 2021 but did not return to pre-pandemic levels with some residents continuing to work from home.

Despite this reduction in road traffic, "Road Traffic Forecasts 2018" anticipates an increase in road traffic by between 17% and 51% over the period from 2015 to 2050.

The Office of National Statistics predicts that the UK population is set to rise by 3.2% to over 69million people by the mid 2030's. This will only mean an increase in traffic in the vicinity of the proposed works.

An increase in population will inevitably result in an increase in trips, with residents travelling to work and for shopping / leisure. Whilst there are existing public transportation options in the area, any increase in trips will in turn lead to an increase in car journeys and therefore both congestion and pollution (noise and emissions). The Climate Change Committee's 2020 document "The UK's Transition to Electric Vehicles" cited Transport as "the highest emitting sector in the UK economy, accounting for 22% of all Green House Gas emissions."¹¹²

Over time this increase may be countered given the UK governments commitment to move towards Electric Vehicles with no petrol and diesel vehicles to be sold by 2030. A move towards electric vehicles will be gradual but the percentage of UK traffic which is powered by electricity will increase over time, with noise and harmful emissions decreasing.

Without the improved coastal defences, there is increased potential for flooding in the area which will likely result in traffic problems should roads become flooded. Traffic congestion

¹¹² Climate Change Committee (2020) The UK's Transition to Electric Vehicles. [Online] Available from: <https://www.theccc.org.uk/publication/the-uks-transition-to-electric-vehicles/>

would be expected on the road network should some roads become impassable due to flooding, resulting in increased localised pollution.

11.4 Assessment Methodology & Assessment Criteria

11.4.1 Construction Staff

During the construction works, it is anticipated that 30 operatives will be on site at any one time, with a further 10 office staff. This number is considered to be the maximum and is dependent on the number of different construction sites which are active at any one time.

Construction staff accessing the sites by car will park in the site compound closest to the site being worked on at that stage in the programme in order to reduce the impact on the highway network in the vicinity of the work sites.

The works programme is based upon site operative hours of 8am to 6pm Monday to Friday and 8am to Noon on Saturdays. No work is to be undertaken on Sundays or bank holidays.

These times may vary if works are impacted by tidal patterns.

With the site working hours of 8am to 6pm Monday to Friday and 8am to Noon on Saturdays, for a worst-case scenario, it has been assumed that all staff will arrive in the peak hour between 8 and 9am and depart between 5 and 6pm.

Whilst bus and rail options are available, they do not provide convenient access to any of the sites. As such it has been assumed that the majority of staff will travel to the work sites by private car.

It is likely that some members of staff will be unable to drive or will have no access to a private car so will choose either active travel or public transport modes. Given that no train stations or bus stops are located within convenient walking distance of the site, it is likely that the number of staff using these modes will be low. For the purposes of this assessment, it has been assumed that 90% of site staff will drive, 5% will car share and 5% will arrive by public transport.

At this stage a contractor has not been identified to undertake the works so it is not possible to confirm which areas staff will be travelling from. It is assumed that all travelling via private car will arrive via the A55.

This would result in 36 car arrivals / departures in the peak hours.

11.4.2 Construction Materials

All materials required for construction of the proposed scheme will be delivered by road.

Given the largest quantity of material is required at the Kinmel Bay East site, this has been considered to be the worst-case scenario.

There are 338 deliveries estimated for the delivery of materials for the Kinmel Bay East site which would equate to 676 one-way HGV movements.

11.4.3 Assessment Scenarios

The period which has been assessed for the Kinmel Bay East works which will be served from the Towyn Revetment compound and the Promenade Pay & Display Car Park compound, albeit the materials are to be delivered to and stored at the Towyn Revetment compound.

These works are programmed to take place in a 16-week period from October 2023 to February 2024. Assuming deliveries are made to site on weekdays only, 16 weeks equates to 80 working days however, this covers the Christmas period so it has been assumed that deliveries will be focused on a 15week period which equates to 75days.

Over the course of the reduced 15week programme, assuming an even distribution of deliveries, this would result in approximately 9 HGV movements a day.

Assuming an even distribution of HGV trips across a working day that would result in 1 HGV movement per hour.

Works at Kinmel Bay West do not require as many deliveries at Kinmel Bay East and have a 16week programme. The deliveries associated with these works will also be stored at the Towyn Revetment compound and as such will use the same approach routes as for the works at Kinmel Bay East. With a longer programme and fewer deliveries, there will therefore be fewer HGV movements than the Kinmel Bay East worst-case scenario.

11.4.4 Significance Criteria

The environmental impact of the traffic generated as a result of the construction works on this scheme has been assessed with reference to the IEMA guidelines¹¹³. In accordance with guidance, issues including severance, driver delay, pedestrian amenity and delay, fear and intimidation, accidents and safety associated with the development have been investigated. IEMA definitions are as follows:

- *Severance* – a perceived feeling of a community / area being cut off by a major route. This could as a result of crossing a heavily trafficked road or a physical barrier. Guidelines suggest increases in traffic volume of 30%, 60% and 90% lead to slight, moderate and substantial levels of severance respectively.
- *Driver Delay* – delay caused by increased traffic levels. These are likely to be significant only when traffic levels are at or close to capacity.
- *Pedestrian Delay* – this can be caused by an increase in traffic levels resulting in increased crossing times.
- *Pedestrian Amenity* – this relates to how pleasant a trip feels, with higher traffic levels, particularly HGV traffic levels reducing pedestrian amenity.
- *Fear & Intimidation* – this is linked to traffic flows, HGV composition and the proximity of traffic to pedestrians.
- *Accidents & Safety* – linked to increases in traffic volumes, particularly at junctions increasing the potential for collisions

11.5 Potential Impacts & Significant Effects

This section reviews the predicted impacts of the construction related traffic associated with this development. Table 11-1 shows the predicted traffic flows associated with the construction works.

Table 11-1: Predicted increases in Traffic Flow as a result of the construction works

Road	Direction	Count Data From	Count Data To	Total Vehicles	5-Day Ave	7-Day Ave	Estimated Percentage Increase in Traffic flow	Estimated Percentage Increase in HGV flow
A548/Kinmel Bay	Northbound	10 June 2019	17 June 2019	43,447	5,985	6,207	0.69%	2.00%
	Southbound	10 June 2019	17 June 2019	44,454	6,293	6,351	0.65%	3.00%
	Two-Way	10 June 2019	17 June 2019	87,901	12,277	12,557	0.67%	2.50%
St Asaph Avenue	Northbound	07 June 2022	13 June 2022	33,001	4,988	4,714	0.82%	1.00%

¹¹³ Institute of Environmental Management & Assessment (IEMA) (1993) Guidelines for the Environmental Assessment of Road Traffic.

Road	Direction	Count Data From	Count Data To	Total Vehicles	5-Day Ave	7-Day Ave	Estimated Percentage Increase in Traffic flow	Estimated Percentage Increase in HGV flow
	Southbound	07 June 2022	13 June 2022	33,295	4,962	4,756	0.83%	1.00%
	Two-Way	07 June 2022	13 June 2022	66,296	9,950	9,471	0.82%	1.00%

Severance

With IEMA guidelines suggesting a 30% increase in HGV traffic will result in a feeling of slight severance. With HGV traffic levels on St Asaph Avenue and the A548 anticipated to rise by up to 3% this is not expected to be an issue.

Driver Delay

Whilst it is noted that delay can occur at any point in the network, the IEMA guidelines state that effects are only likely to be significant when traffic volumes are predicted to be at or close to the network capacity.

It is not considered that the traffic generated by the construction works associated with this development will impact the operation of the highway network in the vicinity of the work sites. As such, the impact on driver delay is not considered to be significant.

Pedestrian Delay

Given that it is not anticipated that the construction traffic associated with this development will result in a major increase in traffic volumes, it is not considered that the additional vehicles will cause any significant increase in pedestrian delay in the vicinity of the works.

Pedestrian Amenity

Whilst traffic flows and HGV flows are to increase during the works, the flows are do not significantly increase compared with the existing traffic composition.

Fear & Intimidation

Similar to Pedestrian Amenity, it is considered that generally the traffic generated by the construction works will not have a significant impact in terms of Fear and Intimidation.

Accidents & Safety

IEMA guidelines suggest that a traffic flow increase of under 10% is generally considered to create no significant environmental impact.

Traffic flows on St Asaph Avenue are anticipated to increase by a maximum of 0.83% during the works and 0.69% on the A548. These increases in traffic flow are well below the threshold and it is therefore considered that this will not result in a significant impact on accidents & safety.

11.6 Mitigation Measures

The potential impacts of the construction related traffic on the local highway network around the works sites are considered to be not significant.

Any potential impacts are temporary and will be felt only during the construction works on the coastal defences. They will be mitigated through active community engagement under the Considerate Constructors Scheme. The public will be made aware of the proposed works in advance and the construction material delivery routes will be highlighted.

11.7 Residual Effects

This section has concluded that there are no significant negative impacts which will be experienced as a result of the construction works for this project.

It is not anticipated that the construction traffic will have a significant impact on the surrounding highway network.

It is therefore considered that the construction traffic will be accommodated by the local highway network without resulting in adverse effects.

It is concluded that the environmental impacts of the proposed scheme as a result of transportation are acceptable.

12 Noise and Vibration

12.1 Introduction

To determine the current environmental noise and vibration climate that exists along the coastline under consideration, baseline surveys were completed at 2 No strategic locations along the length of the proposed scheme site. The assessment results presented within this chapter of the Environmental Statement support the proposed project and are provided in order that the Local Authorities Environmental Protection staff are fully aware of the likely impacts during the construction phase of the works.

The construction phase of the development will inevitably generate noise due to plant, equipment and activities associated with the scheme proposals. However, the activities will be spread out along the length of the coast and sequenced accordingly. The works will be programmed to occur during daytime periods only, from Monday to Saturday, and last over a programmed 18-month period.

To allow for determination of the likely effect that the works will have on the nearby sensitive receptors, relevant legislation, limiting noise and vibration output from the activities, will be utilised accordingly. Where necessary mitigation methods will be employed to reduce the noise and vibration impact on the sensitive receptors to achieve the legislative limitations.

12.2 Legislative and Planning Context

The following legislations and planning policy are relevant for the consideration of noise and vibration due to construction activities to ensure that the sensitive receptors are protected accordingly.

The details below are supplementary items to those indicated within the main Environmental Statement body.

12.2.1 BS 5228-1: 2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise)

This code of practice provides guidance and recommendations on methods for the measurement of construction noise and assessing its impact on those exposed to it. It also references the legislative background to noise control on construction sites and gives recommendations for basic methods of noise control. Suitable methods are provided for the calculation of noise from construction activities, including basic information regarding noise levels from a range of construction equipment.

The standard provides guidance for the identification of the significance of noise levels from surface construction activity. Significance can be considered in relation to fixed limits for noise and vibration, or alternatively in considering the potential change in the ambient noise level with the construction noise. A significance criterion is developed from noise measurements of existing ambient noise levels at the nearest sensitive receptors to the site. Sensitive receptors are residential housing; hotels and hostels; buildings in religious use; buildings in educational use and buildings in health and/or community use. For completeness, we will also consider static holiday caravans, mobile caravan, and campsites, within this chapter, as noise sensitive dwellings, even though they are likely to be only short-term period lettings or exposures.

Measurements of the ambient noise level at the sensitive receptors are the basis of the significance criteria. The measured ambient noise level is rounded to the nearest 5 dB(A).

Section E.3.2 of BS5228:2009-1+A1:2014 provides an example of an appropriate significance methodology, based on an 'ABC' methodology (Example 1). This is an example indicating the threshold of potential significant effect at dwellings when the site noise level, rounded to the nearest decibel, exceeds the listed value. The table can be used as follows: for the

appropriate period (night, evening/weekends, or day), the ambient noise level is determined and rounded to the nearest 5 dB. This is then compared with the site noise level. If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessment then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.

Table 12-1: Example threshold of potential significant effect at buildings, BS5228:2009-1+A1:2014 (Table E.1)

Assessment category & threshold value period	Threshold Value, in decibel (dB), Laeq, T		
	Category A ^(A)	Category B ^(B)	Category C ^(C)
Night-time (2300 – 0700)	45	50	55
Evenings and Weekends (D)	55	60	65
Daytime (0700-1099) & Saturdays (0700-1300)	65	70	75
Note 1 A potential significant effect is indicated if the LAeq, T noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level			
Note 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e., the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total LAeq, T noise level for the period increases by more than 3 dB due to site noise.			
Note 3 Applied to residential receptors only.			
Category A: threshold values to be used when ambient noise levels (when rounded to the nearest 5dB) are less than these values.			
Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.			
Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than the category A values			
19:00-23:00 weekdays, 13:23:00 Saturdays and 07:00-23:00 Sundays.			

Given the size of the construction site this is a reasonable and appropriate approach to the assessment of potential construction noise impacts. The assessment will consider the averaged ambient noise levels of the baseline values recorded.

The effects of construction noise are temporary and defined by the intrusion that construction noise causes in the existing noise environment (or soundscape) of the area. If, when considering mitigation, the noise levels are still above the relevant threshold in Table E.1 of BS 5228-1 (Table 12-1), the standard states that noise insulation may be offered (using the discretionary powers provided by Regulation 5 of the Noise Insulation Regulations) if those noise levels remain for a long enough period of time (i.e. for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months).

Annex E Section E.4 of the Standard provides a further assessment example of upper limits for site activities and Table E.2 provides these limits based upon time of day/night /week that activities take place before the Noise Insulation triggers are activated.

Table 12-2: Example of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation (Table E.2)

Time	Relevant Time Period	Averaging Time, T	Noise Insulation Trigger Level dB LA _{eq,T} ^(A)
Monday to Friday	07:00 - 08:00	1 h	70
	08:00 – 18:00	10 h	75
	18:00 – 19:00	1 h	70
	19:00 – 22:00	3 h	65
	22:00 – 07:00	1 h	55
Saturday	07:00 – 08:00	1 h	70
	08:00 – 13:00	5 h	75
	13:00 – 14:00	1 h	70
	14:00 – 22:00	2 h	65
	22:00 – 07:00	1 h	55
Sunday and Public Holidays	07:00 – 21:00	1 h	65
	21:00 – 07:00	1 h	55
All noise levels are predicted or measured at a point 1m in front of the exposed of any windows and door in any façade of any eligible dwelling.			

The Standard indicates further possible remedies to protect the affected residents if the above criteria are exceeded.

Temporary rehousing or costs are to be offered by the developer, where applied for by the dwelling owner / occupier is unduly affected by the development provided that certain criteria are met. These include the following:

- A noise level 10 dB above the trigger noise levels presented in Table E.2 for corresponding times of day; **(example, above 85 LA_{eq} dB for weekday daytime periods over a 10- hour assessment period)** or
- A noise level 10 dB above the pre-construction ambient noise level for the corresponding times of day.

Whichever is the higher; (our emphasis) and for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

However, alternative mitigation methods to rehousing are available and will be considered initially to minimise the inconvenience of moving for the vast number of affected dwellings or forcing the temporary closure of holiday parks for the duration of the development.

12.2.2 British Standard BS 5228:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

Part 2 of BS5228, which covers Vibration, provides guidance in relation to the effects of construction vibration upon the surroundings. The standard provides recommendations for basic methods of vibration control relating to construction and open sites where work activities and operations generate significant vibration levels. The Standard discusses the method of measurement for characterising building vibration and sets out the significance of vibration effects, which is defined separately for human response and buildings referring and reproducing the data from BS 6472 and BS 7385-2.

Annexes C and D of the standard contain measured vibration levels for different forms of piling and ancillary operations which can be used for the estimation of vibration levels at a construction site. Annex E of the standard provides derived empirical formulae to predict the

resultant peak particle velocity (PPV) from a construction vibration activity. The formulae include several parameters specific for calculating, vibratory compaction, percussive and vibratory piling, dynamic compaction and the vibration of stone columns and tunnel boring operations. For some processes, an indicator of the probability of these figures being exceeded is included as one of the variables in the formulae.

It is important to note that some of the methods proposed to take place for this project do not have suitable calculation methodologies contained in this Standard; in this case wherever possible measured data reported elsewhere will be utilised.

Vibration nuisance is frequently associated with the assumption that, if vibration can be felt, then damage is inevitable. However, considerably greater levels of vibration are required to cause damage to buildings and structures. In any neighbourhood, some individuals will be more sensitive to vibration than others. For this reason, different criteria are used for assessing vibration on humans than vibration on buildings.

12.2.3 Vibration Annoyance (Human Response)

The effect of ground-borne vibration on people inside buildings is often assessed using the Vibration Dose Value (VDV) index, as described in BS 6472-1:2008: 'Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.'

BS 5228-2:2009 + A1:2014 states (paragraph B.2) that "Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 millimetres per second (mm/s) to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur". A table of guidance levels is provided in BS 5228-2:2009 + A1:2014 and is reproduced in Table 12-3 below.

Table 12-3: Impact for vibration annoyance (Human response)

Vibration Level, PPV ¹	Definition
>10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.
1.0 to 10 mm/s	It is likely that vibration of this level in residential environments will cause a complaint but can be tolerated if prior warning and explanation has been given to residents.
0.3 to 1 mm/s	Vibration might be just perceptible in residential environment.
< 0.3 mm/s	Vibration might be just perceptible in the most sensitive situation for most vibration frequencies associated with construction.
¹ PPV is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It is important to note that the PPV refers to the movement within the ground of molecular particles and not surface movements.	

12.2.4 Vibration on Buildings

BS 7385-2:1993: 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration' provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS 5228-2:2009 + A1:2014. Guide values for transient vibration, above which cosmetic damage could occur, are frequency dependent measured in Hertz (Hz). These are given in Table 12-4.

Table 12-4: Transient vibration guide values for cosmetic damage to buildings

Type of building	Peak component of particle velocity in frequency range of predominant pulse (Threshold criteria)	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced and heavy commercial buildings Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.
Note 1: Values referred to are at the base of the buildings. Note 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceed.		

The assessment level for cosmetic damage utilised in this assessment, has been set to 7.5 mm/s, which is half of the lower of the values from Table 4 for residential or light commercial buildings.

12.2.5 World Health Organisation 'Guidelines for Community Noise', 1999

World Health Organisation (WHO) guidance states that, in a dwelling, the critical effects of noise are on sleep, annoyance and speech interference. To avoid sleep disturbance, the current indoor guideline values for bedrooms are 30 dB $L_{Aeq, T}$ for continuous noise and 45 dB L_{Amax} for a single sound event.

To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB $L_{Aeq, T}$ for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB $L_{Aeq, T}$. Indoor noise levels should not exceed 35 dB $L_{Aeq, T}$.

At night, sound pressure levels at the outside facades of the living space should not exceed 45dB $L_{Aeq, 8-hour}$ so that people may sleep with bedroom windows open.

12.3 Baseline Conditions

To determine the pre-existing baseline noise and vibration conditions along the length of the proposed Towyn to Kinmel Bay coastline, relevant strategic locations were pre-selected and agreed with the design team, as monitoring of the entire coastline would be both impractical and irrelevant.

The pre-selected monitoring locations were agreed to be representative of the likely noise and vibration climate of the area, accounting for the various sources along the stretch of land which are affecting the existing residents.

For clarity, residents for the purposes of this chapter of the Environmental Statement are the premises in direct line of the proposed works, including permanent residential houses, flats, and bungalow's as well as static caravan parks and mobile camping and caravan sites.

12.3.1 Monitoring Locations

Two positions were selected along the length of the site between Towyn to the west and Kinmel Bay to the east. Table 12-5 shows the details of the monitoring positions selected.

Table 12-5: Monitoring location

Location Reference	Location Description	Grid Reference
A	Golden Sands Holiday Park, Foryd Road, Rhyll, LL18 5NA	53.30821° N, 3.53837° W
B	Kinmel Bay Harbour Shipyard (Sunnyvale Caravan Park) The Foryd, Kinmel Bay, LL18 5AS	53.31577° N, 3.51019° W



Figure 12-1: Map showing monitoring locations

12.3.2 Monitoring Equipment

The baseline monitoring completed included both long-term remote noise and vibration assessment and attended short-term noise monitoring.

To allow the baseline assessment to be executed monitoring stations were located at the specific positions selected. The monitoring stations included noise and vibration equipment positioned on site for a period of 1 week at each location. To efficiently complete the assessment noise and vibration monitoring stations were hired and utilised throughout. The monitoring stations comprised of the following tabulated equipment.

Table 12-6: Remove monitoring equipment details

Monitoring Station No.	Equipment	Serial Number	Calibration Certificate No.	Calibration Date
1	Castel Mirus Sound Level Meter	35771	35771/78223	12/10/21
	Svantek SV18 Pre-amplifier	47325		
	Svantek 7052E ½ ¹¹ Microphone	59071		

Monitoring Station No.	Equipment	Serial Number	Calibration Certificate No.	Calibration Date
	Castle GA607 Acoustic Calibrator	042307	042307/78223	13/09/21
2	Castle Mirus Sound Level Meter	35762	35762/81280	06/06/22
	Santek SV18 Pre-amplifier	33444		
	Svantek 7052E ½ 11 Microphone	71166		
	Castle GA607 Acoustic Calibrator	039456	039459	06/06/22

To complement the remote monitoring stations, short-term noise monitoring was completed at each of the locations to account for the sound spectrum present within the baseline noise climate. The equipment used is detailed in Table 12-7.

Table 12-7: Attended noise monitoring equipment

Set No.	Equipment	Serial Number	Calibration Certificate No.	Calibration Date
1	Svantek SVAN 979 Sound and Vibration Analyser	92932	92932/79463	19/07/21
	Svantek SV17 Pre-amplifier	106523		
	GRAS 40 AE ½ 11 Microphone	370153		
	RION NC74 Acoustic Calibrator	00530712	00530712/79499	15/07/21

All monitoring stations included for the following ancillary items:

- Weatherproof Sound Level Meter Casing with 12 V battery
- Tripod
- Weather Shield Microphone Protector
- Cabling
- Security Chain and Padlocks
- Cable Ties

12.3.3 Baseline survey methodology

Attended short-term noise and remote long-term baseline environmental noise and vibration assessments were conducted at two positions, noted above, along the length of the development site.

The remote noise and vibration monitoring stations were installed along the seaward facing, western, site boundaries of the individual locations selected. The sound level meter microphone was mounted on the tripod at a height of 1.8m above the floor and at least 3m from any reflective surface and secured to the relevant boundary fence post using cable ties, chained, and padlocked into position. The equipment was set to record data at the specific location for a period of 7-days using 15-minute sample time stamps.

The attended noise assessments were completed at the same location as the remote monitoring stations. Data was recorded over a typical 15-minute periods using a 1/1 Octave analysis filter. Event noise was also recorded for any specific relevant source present within the vicinity of the location.

The monitoring of the 2 No locations was completed between 17th August to 31st August 2022.

L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} sound measurements were taken using the various sound analysers.

The measurement indices noted above are defined as follows:

- L_{Aeq} – the "A" weighed equivalent continuous noise level of sample period T
- L_{A10} – the "A" weighted level exceeded for 10% of sample period T
- L_{A90} – the "A" weighted level exceeded for 90% of sample period T
- L_{Amax} – the "A" weighted maximum level during the sample period T

The meters were calibrated before and after the measurements using the calibrator to ensure accuracy of the results. No fluctuations were noted between calibrations and the results obtained can be deemed to be an accurate representation of the levels recorded.

The vibration monitoring station was located adjacent to the sound level meter station. The seismograph geophone was placed on the ground and levelled with an additional protective cover placed over the unit to minimise tampering or extraneous event recording. The seismograph unit was located within a weatherproof casing and was chained and padlocked to avoid tampering whilst left on site. The vibration equipment was set to record data with a 5 second period reporting data stamp. The vibration meter was set to recorded activity using mm/s units. The equipment was set to record data at the specific location for a period of 7-days.

Table 12-8 Prevailing weather conditions

Week	Period	Temp range °C	Relative Humidity Rh %	Barometric Pressure mb	Wind Speed mph	Wind direction	Precipitation	Cloud Cover %
17 th – 24 th August	Day	17-24	55-76	1010-1018	0-5	SW	None to Light Drizzle	20-50
	Night	13-20	65-85	1010-1018	0-5	SW	None to Light Drizzle	30-50
24 th – 31 st Aug	Day	18-23	50-65	1008-1024	0-3	E	None	20-40
	Night	13-17	65-85	1008-1024	0-5	E	None	20-60

Road surfaces were dry throughout the monitoring sessions. Where rain occurred, it was for only short periods and the ground dried quickly.

12.3.4 Baseline Results

The results of the baseline noise and vibration monitoring for the locations selected are presented in table form below. The data presented is an overview of the results recorded for the relevant period. Both day and night-time results are provided for reference purposes.

Table 12-9: Noise and vibration results location A, Golden Sands Holiday Park

Monitoring Location A Golden Sands Holiday Park

Date	Start time	Period	Noise Monitoring Results				Vibration Monitoring Results	
			L _{AFmax} dB	L _{Aeq} dB	L _{A10} dB	L _{A90} dB	Average Period mm ^s	Highest Period mm ^s
24.08.22	15:03 to 23:00	Day	91	49	45	34	0.025	0.250
	23:00 to 07:00	Night	70	40	43	30	0.025	0.100
25.08.22	07:00 to 23:00	Day	90	47	47	38	0.025	0.575
	23:00 to 07:00	Night	79	41	41	31	0.025	0.100
26.08.22	07:00 to 23:00	Day	100	57	46	35	0.025	0.225
	23:00 to 07:00	Night	71	42	44	35	0.025	0.325
27.08.22	07:00 to 23:00	Day	102	62	50	38	0.025	0.125
	23:00 to 07:00	Night	70	39	41	31	0.025	0.100
28.08.22	07:00 to 23:00	Day	97	57	52	38	0.025	0.825
	23:00 to 07:00	Night	66	39	42	31	0.025	0.100
29.08.22	07:00 to 23:00	Day	88	50	49	39	0.025	0.150
	23:00 to 07:00	Night	83	46	49	35	0.025	0.100
30.08.22	07:00 to 23:00	Day	81	48	49	40	0.025	0.325
	23:00 to 07:00	Night	82	44	46	39	0.025	0.100
31.08.22	07:00 to 11.45	Day	71	43	44	35	0.025	0.100
Period Averages 24th to 31st Aug 2022		Day	102	56	49	37	0.025	0.825
		Night	83	42	44	31	0.025	0.325

Table 12-10: Noise and vibrations results location B, Harbour Master's Ship Yard

Monitoring Location B Harbour Master's Ship Yard

Date	Start time	Period	Noise Monitoring Results				Vibration Monitoring Results	
			L _{AFmax} dB	L _{Aeq} dB	L _{A10} dB	L _{A90} dB	Average Period mm ^s	Highest Period mm ^s
17.08.22	16:46 to 23:00	Day	79	48	45	34	0.072	0.201
	23:00 to 07:00	Night	73	40	42	27	0.072	0.321
18.08.22	07:00 to 23:00	Day	78	47	48	41	0.072	0.426
	23:00 to 07:00	Night	67	44	46	41	0.072	0.297
19.08.22	07:00 to 23:00	Day	76	47	49	41	0.072	0.474
	23:00 to 07:00	Night	77	42	43	31	0.072	0.120
20.08.22	07:00 to 23:00	Day	83	53	56	43	0.072	0.651
	23:00 to 07:00	Night	66	44	46	41	0.072	0.225
21.08.22	07:00 to 23:00	Day	77	48	52	35	0.072	0.345
	23:00 to 07:00	Night	74	40	41	29	0.072	0.201
22.08.22	07:00 to 23:00	Day	77	46	48	34	0.072	0.924
	23:00 to 07:00	Night	69	39	41	30	0.072	0.169
23.08.22	07:00 to 23:00	Day	82	51	48	37	0.072	0.249
	23:00 to 07:00	Night	74	39	42	29	0.072	0.201
24.08.22	07:00 to 12:20	Day	78	49	50	36	0.072	1.125
Period Averages 17th to 24th Aug 2022		Day	83	49	51	36	0.072	1.125
		Night	77	42	45	30	0.072	0.321

Table 12-11: Attended noise survey results overview

Location	Monitoring Date & time	Linear Leq dB in Frequency Centre Band Hz								LAeq dB	LA Max dB	Primary Source
		63	125	250	500	1000	2000	4000	8000			
A	24/08/2022 16:10:47	51	51	50	49	42	39	37	33	50	64	General Activities
B	24/08/2022 15:06:12	53	48	43	42	39	38	38	41	47	68	General Activities

Inspection of the above results tables, indicate that the baseline ambient noise levels are ranging between 49 LAeq dB to 51 LAeq dB. The primary noise climate for the stretch of land under consideration is due to traffic noise from the nearby road network. The railway line, operated by Avanti West Coast, is the main North Wales railway line linking Wales to England and as such is a busy route with train passage averaging 15 minutes in both directions, clearly audible at Location A.

During the assessment period there were several days of national rail strikes. These rail strikes occurred on the 18th and 20th August 2022 and the consequence of the suspended rail activities are clearly reflected in the reduced noise and vibration occurring close to the monitoring stations for these periods.

The general noise affecting the baseline, other than those sources noted above, are due to holiday makers including children at play and site generated vehicle movements. Entertainment noise was also present in the results of Location A.

Due to the location of the monitoring equipment placed on private holiday sites, tampering of the equipment was an inevitable consequence, as such, there is evidence in the results data of the equipment being touched or moved either accidentally or on purpose. However, this was minimal over the 7-day period, and it has been possible to remove the extraneous data from the results presented.

The data presented in the above tables can be deemed as representative of the baseline conditions present for the relevant monitoring locations. The selected monitoring locations are deemed an appropriate sample of the closest sensitive dwellings to the proposed scheme works and account for the various noise and vibration sources present within the area.

12.3.5 'Do Nothing' Baseline Conditions

If the scheme does not take place, the pre-existing baseline will be unaffected and there will be no change to the noise and vibration levels recorded during this assessment.

12.4 Assessment Methodology & Assessment Criteria

The assessment methodology utilised to produce the likely noise and vibration effects that may arise as a consequence of the construction phase of the development is described below.

The sensitive recipients will be identified and their proximity to the proposed relevant works will be evaluated, accounting for the pre-existing topography of the intervening land between the source (construction works) and recipient and the closest distance to the proposed activity.

For the purposes of this chapter the sensitive recipients will be determined as the specific locations utilised within the baseline monitoring process. Where necessary additional sensitive receptor positions will be considered.

The proposed works are to be phased over an estimated 18-month period and are variable operations throughout the length of the construction site. Due to the complexity of the works, 3 No phase locations are considered along the length of the development site. Each works phase will have its own identified construction operations which will be considered for noise and vibration output at the closest sensitive locations

Since we are dealing with a construction process that, once complete, will not result in any on-going processes or operations, the construction element is the only one that will be considered as part of the noise and vibration chapter.

At the time of production of this chapter, there was no detailed construction processing available. However, use has been made of the Construction Methodology document for the proposed sequence, programme, schedule, and noise output from of construction plant and machinery proposed for the construction phase of the works.

The assessment methodology within British Standard BS 5228-1: 2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise), as detailed above, will be utilised.

Section E.3.2 of BS5228:2009-1+A1:2014 provides an example of an appropriate significance methodology, based on an 'A-B-C' methodology (Example 1). This methodology of significance criteria of the construction noise will be used in the impact assessment details that follow.

The assessment methodology within British Standard British Standard BS 5228:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration, as detailed above, will be utilised.

The assessment level for cosmetic damage utilised in this assessment, has been set to 7.5 mm-s, which is half of the lower of the values from Table 4, section 1.1.4, for residential or light commercial buildings.

12.4.1 Assessment Assumptions

For the purposes of the assessment the following assumptions have been utilised:

- The primary construction sites along the length of the development are as follows
 - Towyn Revetment
 - Kinmel Bay West (Golden Sands)
 - Kinmel Bay East
- Construction activity period will take place between 8am to 6pm Monday to Friday, 8am to 12pm Saturday and no construction work Sunday or Public Holidays
- Construction activities will take place on site for an assessed period of 7-hours per shift
- Construction will take place within the pre-defined red-line site boundaries, as detailed within the Construction Methodology document
- All site access will be via existing highways and as such no consideration is required to noise associated with their use
- No decommissioning of permanent works completed will be necessary or considered
- Noise transmission from the specific plant, equipment or activity on site is assumed to be point source.
- Noise sensitive dwellings will be any dwelling that is used for overnight accommodation. This will include houses, flats, static caravans, mobile caravans, and campsites as deemed appropriate located along the length of the development.

12.4.2 Noise and Vibration Assessment

To determine the noise and vibration likely to be experienced at the sensitive locations, as a consequence of the construction activities on site, details of the construction operations will be required, along with proposed plant and equipment used to allow the processes to be completed.

The proposed coastal defence works programme varies along the length of the coast from Towyn to the west through the Kinmel Bay to the east.

Before any impact assessment can be made, it would be prudent to determine the noise and vibration limits to be achieved at each noise sensitive location. This is performed by way of the relevant Standards and Guidance available, in this case we are dealing with construction noise and vibration, therefore BS 5228-1: 2009 +A1:2014, Parts 1 and 2 are to be used.

It is recommended that in order not to unduly affect the existing amenity of the nearby residential premises considered, the noise climate in the vicinity of the premises should not be excessively increased because of the proposed scheme.

For the Construction Phase the noise criteria limits applicable are provided within BS5228:2009-1+A1:2014. Below is a table of noise limitations applicable to the nearby residential premises because of the construction phase of the development.

Table 12-12: Daytime (0700-1900) and Saturday (0700-1300) Construction Noise Limits

Location	Average Measured dB, $L_{Aeq,T}$	$L_{Aeq,T}$ Rounded to closest 4dB as per BS5228- 1:2009+A1:2014	BS5228-1 Table E.1 Daytime Threshold Value, dB $L_{Aeq,T}$
Towyn Revetment	62	65	65
Kimmel Bay West	56	60	
Kimmel Bay East	49	50	

The vibration levels will be limited in accordance with the requirements of BS5228:2009+A1:2014 Part 2, as noted above. The vibration limit utilised will be 7.5mm-s when considered at any permanent structure, excluding static or mobile caravans. This limit represents 50% lower value than would be applicable to result in structural damage to residential or light commercial buildings, as indicated within Table 12-4.

The construction limits noted above are not to be exceeded by any plant, equipment or activities pertaining to the development of the site prior to the commissioning of the operations on site.

Provided that the above limits are adhered to there will be no effective loss of amenity for the existing residential premises within the vicinity of the site.

12.5 Potential Impacts & Significant Effects

Noise and vibration during the construction phase of the scheme has the potential to produce a significant adverse impact upon the nearby noise sensitive dwellings and properties if not fully considered at design stage.

The following section will consider the noise and vibration impact on the nearby premises.

12.5.1 Noise

As with any major construction project, the development is completed sequentially, and each area of the site will have varying works completed.

Each element of the works is located at a specific distance from the nearby noise sensitive dwellings, Table 12-13 details the assessed distances.

Given the above, the plant and equipment utilised in the noise calculations is indicated in Table 12-14, below. The primary plant and equipment complement is based on recommendations from design engineers, with specific plant noise data provided accordingly, as detailed in Section 2.6.5.

Table 12-14 is separated into columns. These are explained as follows:

Works location (Column 1); the drawing relevant to the works (Column 2); activity phase title (Column 3); the proposed activity duration (Column 4); activity contained within the Phase (Column 5); plant item identified for each operation (Column 6); The sound power level data for the specific plant under consideration provided by the client (Column 7); BS5228 plant reference, not used (Column 8). Number of plant items (Column 9); The estimated On-Time during any shift that the specific plant item will be operating is provided (Column 10).

The data provided within Table 12-14 allows for a full calculation of the anticipated site noise to be determined at specific distances from the operations. Table 12-18 details the results of the assessment.

From the plant and equipment data list it has been possible to complete a BS5228-1:2009+A1:2014 assessment of the noise levels produced by the individual phases when considered at the closest noise sensitive dwelling locations. The assessment is then defaulted to the 10-hour daytime shift period for the purposes of the Standard, even though the specific operational times on site have been advised as 7-hours daily.

Table 12-16 summarises the results of the BS5228:2009+A1:2014 Part 1 assessment and compares the values against the design target limits indicated above in Table 12-13 for the various construction time periods.

For ease of identification of the significance of the activity on the residents, the individual cells are colour coded to determine compliance with the Standard's limitations at a glance. A light green cell indicates compliance. An amber and red cell indicates non-compliance.

Table 12-13: Distance Matrix from proposed construction works to receptor (m)

LOCATION	PHASE	Closest Distance from Proposed Works Phase to Closest Receptor (m) Ground Floor Level		
		Assessment Location A	Assessment Location B	N/A
		Golden Sands Holiday Park	Sunnyvale Caravan Park	St Asaph Ave
Towyn Revetment	Rock Armour	30	1600	1050
	Beach Access	20	1600	1050
Kinmel Bay West	Beach Access	20	1100	130
	Sea Wall	20	1100	120
	Coastal Path Widening	15	1100	100
Kinmel Bay East	Rock Armour	1200	15	400
	Beach Access	900	15	130
	Coastal Path Widening	900	15	100
	Sea Wall	900	15	100
	Car park	700	400	40

The areas highlighted in grey are determined as excessive distances with little significance, however, these are included for robustness. The white cells are the closest to the relevant operations and therefore represent the most likely to result in an adverse impact from the site operations.

The tables below indicate the location and type of works to be completed using specific plant and equipment, including noise, and proposed on-time periods.

Table 12-14: Indicative plant and equipment complements

KEY LOCATION	DRAWING REF	PHASE	DURATION	ACTIVITY	PLANT DESCRIPTION	Client Provided Sound Data Lw dB	BS5228 Ref	NO	HOURS / SHIFT WORKING
Towyn Revetment	119	1	18 Weeks	Rock Armour	Tipper (40t)	104	N/A	2	4
					Excavator (36t)	101.8	N/A	1	4
					Road Wagon (Concrete and Rock) (20t)	103	N/A	4	1.5
					Tipper (10t)	106	N/A	2	4
	119	2	12 Weeks	Beach Access	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (10t)	106	N/A	1	4
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
					Sheet Piling Rig	69	N/A	1	7
Kinmel Bay West	118	1	12 Weeks	Beach Access	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (10t)	106	N/A	1	4
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
					Sheet Piling Rig	69	N/A	1	7
	118	2	6 Weeks	Sea Wall	Road Wagon (Concrete and Rock) (20t)	103	N/A	4	1.5
					Tipper (10t)	106	N/A	2	4
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
	118	3	6 Weeks	Coastal Path Widening	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (1.5t)	102	N/A	1	4
					Excavator (5t)	89	N/A	1	4
					Asphalt Spreader	92	N/A	1	7
					Vibrating Roller	100	N/A	1	3.5
Kinmel Bay East	116, 117	1	18 Weeks	Rock Armour	Tipper (40t)	104	N/A	2	4
					Excavator (36t)	101.8	N/A	1	4
					Road Wagon (Concrete and Rock) (20t)	103	N/A	4	1.5
					Tipper (10t)	106	N/A	2	4
	116, 117	1 to 3	12 Weeks	Beach Access	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (10t)	106	N/A	1	4
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
					Sheet Piling Rig	69	N/A	1	7
	116, 117	2	6 Weeks	Coastal Path Widening	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (1.5t)	102	N/A	1	4
					Excavator (5t)	89	N/A	1	4
					Asphalt Spreader	92	N/A	1	7
					Vibrating Roller	100	N/A	1	3.5
	116, 117	3	18 Weeks	Sea Wall	Road Wagon (Concrete and Rock) (20t)	103	N/A	4	1.5
					Tipper (10t)	106	N/A	2	4
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
	117	4	10 Weeks	Car Park	Road Wagon (Concrete and Rock) (20t)	103	N/A	2	1.5
					Tipper (3t)	102	N/A	1	4
					Excavator (15t)	97.5	N/A	1	4
					Asphalt Spreader	92	N/A	1	7

Using the above data, and the calculation methodology contained in BS5228-1:2009+A1:2014, Table 12-15 reports the calculated noise levels for the proposed works.

For ease of identification of the significance of the activity on the residents, the individual cells are colour coded to determine compliance with the Standard's limitations at a glance. A light green cell indicates compliance. An amber and red cell indicates non-compliance.

These calculations assume no mitigation and a direct line of sight between the construction works and the nearest receptor.

Table 12-15: Calculated construction noise levels, $L_{Aeq,T}$ dB, at various distances

1	2	3	4	5	Un-Mitigated Noise Level Contribution ($L_{Aeq,T}$ dB) at Distance (m) from Proposed Works Phase										
KEY LOCATION	DRAWING REF	PHASE	DURATION	ACTIVITY	10	15	20	30	50	100	200	500	1000	1500	2000
Towyn Revetment	119	1	18 Weeks	Rock Armour	77	74	71	68	63	57	51	43	37	34	31
	119	1, 2	12 Weeks	Beach Access	74	70	68	64	60	54	48	40	34	30	28
Kinmel Bay West	118	1, 2	12 Weeks	Beach Access	74	70	68	64	60	54	48	40	34	30	28
	118	3	6 Weeks	Sea Wall	76	73	70	67	62	56	50	42	36	33	30
	118	4	12 Weeks	Coastal Path Widening	71	68	65	62	57	51	45	37	31	28	25
Kinmel Bay East	116, 117	1	10 Weeks	Rock Armour	77	74	71	68	63	57	51	43	37	34	31
	116, 117	1 to 3	12 Weeks	Beach Access	74	70	68	64	60	54	48	40	34	30	28
	116, 117	2	12 Weeks	Coastal Path Widening	71	68	65	62	57	51	45	37	31	28	25
	116, 117	3	36 Weeks	Sea Wall	76	73	70	67	62	56	50	42	36	33	30
	117	4	10 Weeks	Car Park	71	67	65	61	57	51	45	37	31	27	25

KEY
Noise levels below 65 dBA
Noise levels between 65 dBA and 75 dBA
Noise levels above 75 dBA

Using the above data and combining the noise levels calculated at the specific distances we can determine the noise contribution at the closest noise sensitive premises to the works activities.

The results of the calculated noise levels at the nearby noise sensitive dwellings are provided in Table 12-16.

Table 12-16: Calculated un-mitigated construction noise levels at the closest residential premises

LOCATION	CONSTRUCTION PHASE	Un-Mitigated Values (L _{Aeq T} , dB) For Proposed Works Phase to Closest Receptor		
		Assessment Location A	Assessment Location B	N/A
		Golden Sands Holiday Park	Sunnyvale Caravan Park	St Asaph Ave
Towyn Revetment	Rock Armour	68	33	37
	Beach Access	68	30	34
Kinmel Bay West	Beach Access	68	33	52
	Sea Wall	70	36	54
	Coastal Path Widening	68	31	51
Kinmel Bay East	Rock Armour	34	74	37
	Beach Access	34	70	50
	Coastal Path Widening	31	68	51
	Sea Wall	32	73	56
	Car Park	35	37	60

The predicted construction noise levels highlighted in red, and amber exceed the ABC Example 1 Threshold Values of 65 L_{Aeq} dB as derived from Table 12-12. Values highlighted in green are below the Threshold Values and noise is not a detrimental consideration during the construction phases.

Table 12-16 shows limited operations exceeding the threshold values of 65 L_{Aeq} dB. Where an operation results in an amber significance value, these operations should consider additional mitigation measures to reduce the noise at source. Mitigation measures will be considered later.

12.5.2 Vibration

The types of works proposed in these sections are not included in the calculation methodologies provided in BS5228-2:2009+A1:2014, and therefore it is appropriate to consider the measured levels within the same Standard.

The limited piling proposed for the site will use the Giken vibration free piling method of installation. The specific piles are pressed into position without use of any impact or vibratory excitation. Annex C of the Standard reveals that at 24m, vibration levels of <0.5mm^{-s} Peak Particle Velocity might be expected for installation of pressed piles into a sand-based ground condition (Table C.1 item 1 of BS5228-2:2009+A1:2014).

From the above and the guidance contained in BS5228-2:2009+A1:2014, the estimated vibration level for the piling will therefore be <0.5mm-s at the closest receptors. This will not be noticeable to nearby residents when compared against the pre-existing baseline conditions and is not likely to give rise to complaints. This statement has assumed that the ground

encountered is free of obstruction, large cobbles, or boulders. If such obstructions are encountered during piling, pneumatic intervention may be required to break the material up and remove it. This would have the potential to result in higher levels of vibration, and potential disturbance to residents.

In line with the criteria in BS 7385-2:1993 (reproduced in Table 3), in terms of cosmetic damage to buildings the lowest level where damage may occur to buildings is 15 mm-s and if the level does not exceed the project assessment level of 7.5 mm-s for risk of cosmetic damage. At all buildings the predicted levels are well below 7.5 mm-s and therefore no damage to buildings is anticipated.

12.6 Mitigation Measures

During the construction works for the scheme, the predicted adverse effects are expected to be mitigated and minimised using Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974). These are required to be adopted on-site to reduce construction noise levels. Also, where practicable the control measures set out in BS 5228-1:2009+A1:2014 Annex B will be implemented. These include, but are not limited to:

- The quietest available plant or machinery should be used;
- All equipment should be maintained in good mechanical order and fitted with appropriate silencers, mufflers, or acoustic covers;
- Acoustic barriers consisting of site materials such as bricks, earth mounds or proprietary types should be constructed when noise cannot be sufficiently reduced by careful siting of noise sources to provide low level shielding to absorb and deflect noise from the site operations;
- All workers on site, including sub-contractors, self-employed staff and employees must be made aware of the need to keep noise and disruption to a minimum from building works, equipment, plant and machinery, radios, music, vehicles, or any other sources;
- The movement of vehicles to and from the site must be controlled to minimise noise and disturbance to nearby residents;
- Careful selection of working methods and programme;
- Shutting down of equipment when not in use, i.e., maintain a 'no idling policy'.
- Directing noise emissions from plant, including exhausts or engines, away from sensitive positions. Orientating the plant to face away from the residential properties during operations, where possible, may reduce noise by up to 5 dB;
- Handling of all materials in a manner which minimises noise, including minimising drop heights into hoppers and lorries;
- Switching all audible warning systems to the minimum setting required by the health and safety executive and using banksmen as an alternative to audible alarms wherever practicable. The use of broadband sounders can also reduce the effective impact of sounder noise on residents;
- Engaging in community liaison to explore ways of minimising noise impacts and increasing local tolerance to noise.

It is recognised that there will be challenges encountered in attempting to reduce these levels through mitigation due to the short distances between the receptors and activities in some locations. Noise from various activities can be controlled to some extent by the provision of temporary noise barriers, which according to BS5228-1:2009+A1:2014 may be expected to provide up to -10 dB attenuation.

It should be noted however that the noise exceedances would be transient as the activities would not be localised for a long period of time at a single point. Many of the activities will

only take place over a relatively short period, but it must be accepted that other activities may well take place over more elongated periods (perhaps in terms of weeks), and in this instance if mitigation is insufficient and noise levels still exceed acceptable limits, providing temporary resting facilities for residents during times when the activities are occurring may form the only option to protect residents.

If we consider specific activities and the possible mitigation methods available, we can indicate the potential noise reduction values from their inclusion.

Below are possible mitigation methods available for the specific activities.

Table 12-17: Possible construction mitigation methods

LOCATION	PHASE	Possible Mitigation Methodology	Potential Mitigation, dB
Towyn Revetment	Rock Armour	Acoustic screening of plant. Isolate plant when not operating	10 dB
	Beach Access		
Kinmel Bay West	Beach Access	Acoustic screening of plant. Isolate plant when not operating	10 dB
	Sea Wall		
	Coastal Path Widening		
Kinmel Bay East	Rock Armour	Acoustic screening of plant. Isolate plant when not operating	10 dB
	Beach Access		
	Coastal Path Widening		
	Sea Wall		
	Car Park	None Required	0 dB

If we assume that the above mitigation measures can be implemented the exposure values can be re-calculated as follows.

Table 12-18: Calculated mitigated construction noise levels at the closest residential premises

LOCATION	PHASE	Mitigated Values ($L_{Aeq,T}$, dB) For Proposed Works Phase to Closest Receptor		
		Assessment Location A	Assessment Location B	N/A
		Golden Sands Holiday Park	Sunnyvale Caravan Park	St Asaph Ave
Towyn Revetment	Rock Armour	58	23	27
	Beach Access	58	20	24
Kinmel Bay West	Beach Access	58	23	42
	Sea Wall	60	26	44
	Coastal Path Widening	58	21	41
Kinmel Bay East	Rock Armour	24	64	27
	Beach Access	24	60	40
	Coastal Path Widening	21	58	41
	Sea Wall	22	63	46
	Car Park	35	37	60

able 12-18, shows how the mitigated noise exposure values are achieved, however, the Rock Armour activities when considered at Kinmel Bay West are close to the upper limits. Based upon this information, pre-emptive communication with these residents can be actioned to reduce the likelihood of complaints relating to noise being forthcoming.

To quantify the noise levels produced on site and the potential mitigation measures that may be required to avoid triggering the Threshold Value exceedance, it may be necessary to provide on-site noise monitoring of the works activities.

BS5228-1:2009+A1:2014 Annex G provides details of the possible noise monitoring that could be completed on site. G.2 to G.4 indicate the measurement methodology, sampling rates and correct recording of the gathered information.

12.7 Residual Effects

Whilst mitigation measures may prove successful in reducing noise levels, noise levels in open areas, balconies and gardens may still exceed acceptable noise levels for such areas of 55 dB LAeq (as per WHO guidelines).

Given the nature of the works, however, in that they are to protect residential areas from flood, residents may well accept higher short-term construction noise levels if they are kept apprised of the construction process and the works are undertaken as quickly as possible.

In addition, it is recommended that regular noise and vibration monitoring during the construction operations be undertaken to ensure that the control and mitigation measures noted in this assessment are utilised in full and that they are effective. If measurements reveal this not to be the case, works should cease, and discussions held with local Public Protection Officers regarding to how the works may progress.

Following completion of the works there will be no on-going noise or vibration because of the scheme. The pre-existing baseline noise and vibration climate will return to the exact position that they were prior to the scheme.

Future maintenance of the scheme will be minimal, however, when works are required, this should be completed with due consideration to the likely noise and vibration produced and implement the mitigation measures proposed within this document.

12.8 Climate change

The impact of climate change poses a threat to coastal communities through potential and predicted increased tidal range. As a consequence of these changes the risk of flooding is increased, hence the need to consider implementation of flood defences to alleviate the risk to the local environment, property, and ultimately life, accordingly.

To fully evaluate the impact of the scheme, with respect to the noise and vibration going forward, it is necessary to determine the likely effects. This is possible by comparison of the magnitude of the scheme against a fixed criterion. Table 12-19 below indicates the magnitude criteria proposed.

Table 12-19: Criteria for defining the magnitude of noise and vibration impacts

Magnitude score	Criteria
Major	Major change in the baseline noise and vibration values
Moderate	Moderate change in the baseline noise and vibration values
Minor	Minor change in the baseline noise and vibration value
Negligible/ No Change	No perceptible change in the baseline noise and vibration values

Below are the potential magnitude criteria that exist for the various scenarios possible for the coastline under consideration.

Existing baseline conditions

From a noise and vibration perspective, the current baseline that exists, for the coastal area under consideration, has no undue effect on the nearby residential premises / dwellings or the flora and fauna of the area.

Future baseline conditions

The proposed scheme, once completed, will provide the desired level of flood defences for the protection against tidal surges and flooding, based upon future predicted sea level rises. It will be a passive development, with minimal recharge or servicing required. Therefore, the future baseline will result in no perceivable noise or vibrational increase for the nearby residential premises or dwellings located within the vicinity of the coastal regions under consideration.

Negligible Impact / No Change.

13 Other Construction Related Effects

13.1 Introduction

This chapter includes discussion and assessment of impacts on receptors arising specifically during the construction phase, which are not considered in each of the other specialist ES topic chapters. Consideration is particularly given to impacts from construction activities including construction air quality and carbon emissions. With reference to Schedule 4 of the EIA Regulations this chapter provides where relevant *'an estimate, by type and quantity, of expected residues and emissions (such as water, air, oil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction phase'*.

A noise and vibration assessment has been undertaken and presented in Section 12, and a Traffic and Transportation assessment has been undertaken and presented in Section 11. Based on the location and nature of the proposed works, all construction works will be undertaken during daylight hours. As a result, it is assumed that artificial lighting will not be required and therefore assessment of light spill has not been undertaken and it is not considered further within this assessment. Therefore, the scope of this chapter includes the construction related effects to air quality and carbon.

The requirement to consider carbon has resulted from the 2014 amendment to the EIA Directive (2014/52/EU), the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 and the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Moreover, since 2017 climate change (and in parallel greenhouse gas assessment & mitigation) has moved up to the national (and international) agenda with local authorities across the UK declaring a climate emergency (Conwy County Borough Council declared a climate emergency on the 9th of May 2019); and setting net zero emissions targets (Conwy County council has pledged to become a net-zero Local Authority by 2030)¹¹⁴. Devolved administrations in Scotland and Wales have also set net-zero targets.

13.2 Baseline Conditions

13.3 Air Quality

Air quality is routinely monitored on in Conwy, this is achieved through the annual North Wales Combined Authority Air Quality Progress Report¹¹⁵. The most recent report in 2021 stated that no Air Quality Management Areas have been declared in North Wales. There are 19 non-automatic monitoring sites in CCBC which are predominantly located along roadsides. In 2020, Nitrogen Dioxide (NO₂) was monitored at all 19 sites in CCBC and there was no exceedance of the annual mean Air Quality Objectives (AQO) at any monitoring sites. Annual mean concentrations were generally lower than previous years, however, this is likely due to the Covid-19 pandemic.

The Air Quality in Wales (2021)¹¹⁶ found that air quality across the country was broadly improving but local-level variations and inequalities exist. Air pollution in the most deprived areas was consistently higher than in the least deprived areas.

¹¹⁴ Climate Emergency UK (2022) Conwy County Borough Council. [Online] Available from: <https://data.climateemergency.uk/councils/conwy-county-borough-council/>

¹¹⁵ Conwy County Borough Council (2021) North Wales Combined Authority Air Quality Progress Report 2021. [Online] Available from: <https://www.conwy.gov.uk/en/Resident/Environmental-problems/Air-Quality-Monitoring.aspx>

¹¹⁶ Welsh Government (2021) Air Quality in Wales 2021. [Online] Available from: https://airquality.gov.wales/sites/default/files/documents/2022-10/AQ-Wales-2021_English_Final.pdf

Construction activities can generate significant quantities of airborne particulate matter (dust) because of plant movements on bare ground, movement and tipping of material, as well as the exhaust of diesel-powered machinery. These activities have the potential to cause soiling to local properties and vehicles. It is also recognised that in coastal areas, salt spray gives rise to elevated levels of fine particulate matter. Given this, there is the potential for construction works to exacerbate dust impacts. The predominate wind direction in Conwy is South-South-West as shown in Figure 13-1.

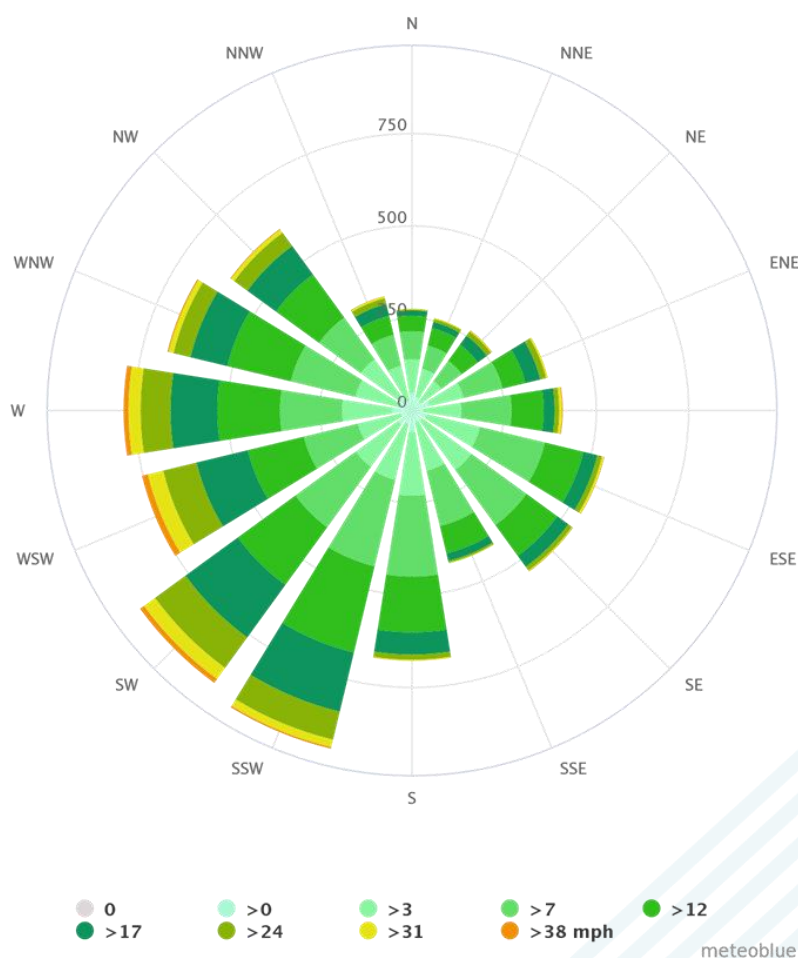


Figure 13-1: Wind rose for Conwy (y axis refers to average number of hours per year)¹¹⁷

Climate change

Both climate change and air pollution occur as a result of anthropogenic emissions into the atmosphere. Climate change influences air pollution by altering the environment, which influences the duration and frequency of heatwaves, and local and regional meteorology. This can affect the source, transfer and loss of air pollutants.¹¹⁸

As air quality and climate change are driven by shared sources, the future baseline with worsening climate change would be indicative of a broad decrease in air quality. However, due

¹¹⁷ Meteoblue (2022) Conwy. [Online] Available from: https://www.meteoblue.com/en/weather/week/conwy_united-kingdom_2652426

¹¹⁸ Akasha, H. Ghaffarpasand, O. and Pope, F. (2021). Climate Change and Air Pollution. Foreign, Commonwealth and Development Office. [Online] Available from: <https://www.gov.uk/research-for-development-outputs/climate-change-and-air-pollution>

to a lack of location-specific information, it is not possible to justify a future air quality baseline for Conwy.

13.3.1 Carbon

It is generally difficult to determine the baseline GHG emissions of existing coastal defences as there are limited operational emissions associated with the existing assets (timber groynes, rock revetment cobbled beaches, sea walls and floodgates). Therefore, for this scheme, current baseline emissions are **negligible**.

IEMA (2022) Greenhouse Gas Guidance¹¹⁹ acknowledges that for some study areas it may not always be possible to report on current baseline emissions ('particularly with projects situated in areas with no physical development or activity').

However, given the interconnected nature of the proposed scheme to the local authority (and local infrastructure) and direct contribution to local emissions, reference to local authority figures have been added;

According to the Department of Business, Energy & Industrial Strategy (2021), during 2019, the current GHG emissions within the scope of influence of the Conwy local authority are 544.7 kt CO₂, and 4.6 t CO₂ per person.

In comparison, neighbouring local authorities Gwynedd & Denbighshire had emission totals of 661.3 ktCO₂ (5.3 tCO₂ per person) and 474.5 ktCO₂ (5.0 tCO₂ per person) respectively.

The Department of Business Energy and Industrial Strategy's Local Authority emissions statistics do not at this time provide non-CO₂ emissions data at the regional level. Given the absence of robust non-CO₂ data for the site boundary and the lack of non-CO₂ emissions within the scheme, these emissions have not been considered within the current or future baseline.

Alternative Emissions

In the context of FCERM (Flood and coastal erosion risk management) proposed scheme, it is important to consider the alternative future baseline emissions as a result of the proposed scheme not being constructed. The GHG emissions associated with the impacts of flooding if the proposed scheme were not to be constructed can be significant.

These emissions could result from:

- Repairs to buildings damaged by flooding.
- Replacing the contents of buildings damaged by flooding.
- Constructing replacement infrastructure and buildings following flooding.

An Environment Agency (EA) report from 2010 estimated that the annual carbon emissions arising from FCERM activities (delivering of traditional flood defences) were 0.53 Mt CO₂e per year, whereas flood and coastal erosion damages were estimated to be 1.90 Mt CO₂e per.

These figures were calculated using a proxy approach, linking estimates of economic damage costs to carbon emissions, using a multiplier similar to that calculated for the Thames Estuary Plan 2100¹²⁰.

The report concluded that net emissions would be greater without FCERM activities due to the impacts of greater flood damage. This highlights that whilst the works taking place here may have carbon emissions associated, in the longer term, they may result in lower emissions than if flooding were to occur. However, it is important to balance this apparently positive situation with the fact that emissions from construction will occur in the near future and have an

¹¹⁹ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

¹²⁰ Halcrow (2008). Thames Estuary 2100. Greenhouse gas implications of flood damages. Phase 3 Studies – Work Element 2.11a

immediate impact. Possible future reductions are not certain and may be of much lower magnitude because the global economy is decarbonising.

Future Baseline

The proposed Kinnel Bay Coastal Defence Improvement scheme is a response to frequent wave over-topping of the primary defences, flooding nearby homes and local infrastructure. This risk is expected to increase as the effects of climate change are realised.

It is well recognised that emissions of carbon dioxide (CO₂) and other greenhouse gases (GHGs) such as methane (CH₄) and nitrogen dioxide (NO₂) from human activities have caused global warming and climate change. The impact from all greenhouse gas impact is captured by presenting it as carbon dioxide equivalent (CO₂e) which is the amount of carbon dioxide that would give the same global warming as the sum of the individual gases. This representation is used throughout this section.

As well as a response to climate change it is recognised that CO₂ emissions would also result from the construction of the coastal defence schemes, as a result of the transport of materials via heavy vehicle movements, embodied carbon within the materials used and the use of plant for construction. These emissions will contribute to the area's carbon budget.

The Tyndall Centre for Climate Change Research has undertaken Carbon Budget Reports Setting Climate Commitments for Local Authorities; including Conwy. The report provides Conwy with budgets for carbon dioxide (CO₂) emissions and from the energy system for 2020 to 2100¹²¹.

These are based upon the application of "well below 2°C and pursuing 1.5°C" global temperature target and equity principles in the United Nations Paris Agreement to a national UK carbon budget. Which are, therefore, compatible with the UK's commitments under the Paris Agreement.

To stay within the recommended carbon budget Conwy will, from 2020 onwards, need to achieve average mitigation rates of CO₂ of around -13.7% per year¹²².

Table 13-1: Percentage reduction of annual emissions for the recommended CO₂ only pathway out to 2050 in relation to 2015.

Year	Reduction in Annual Emissions (based on recommended pathway)
2020	21.2%
2025	62.2%
2030	81.9%
2035	91.3%
2040	95.8%
2045	98.0%
2050	99.0%

13.4 Assessment Methodology & Assessment Criteria

13.4.1 Air Quality

¹²¹ Conwy County Borough Council (2019). Conwy's Decarbonisation Plan. [Online] Available at: <https://www.conwy.gov.uk/en/Council/Strategies-Plans-and-Policies/Climate-Change/Decarbonisation-Plan.aspx>

¹²² Kuriakose et al. (2022) Setting Climate Commitments for Conwy. [Online] Available from: <https://carbonbudget.manchester.ac.uk/reports/W06000003/>

A construction dust assessment has been undertaken using the Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction (2014), to determine whether air quality impacts are likely to arise from the construction of the proposed scheme. Under the IAQM guidance, where there are existing human receptors within 350m an assessment is required to determine potential dust impacts.

The assessment then determines the magnitude of dust impact from the works associated with earthworks, and other construction activities. Vehicle tracking out of site is also assessed, this considers the impact of the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The approach taken to the assessment of dust impacts is a risk assessment, where risk of impacts from dust is identified using Table 1-2, which compared with the sensitivity of receptors is used to determine the best practicable means that should be recommended to reduce the risk of dust impacts.

The matrix of significance of effects scoring terms provided in Table 13-1, has been used to define the resulting significance of effect of potential dust on sensitive receptors. Where the significance of effect scoring term is split (i.e. slight or moderate), then the location of sensitive receptors in relation to the prevailing wind direction (with reference to Figure 13-1) has been used to determine which significance score is most appropriate.

Table 13-2: Sensitivity of the area around the site to dust soiling impacts on people and property.¹²³

Receptor Sensitivity	Number of Receptors	Distance from the Source (m) ^c			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

13.5 Carbon

Baseline assessment

The baseline for the GHG assessment has been determined based on current GHG emissions at the site. Due to the nature of the sites, there are no proportionate means of calculating current GHG emissions (due to the absence of any significant GHG emissions during current land use), therefore a qualitative assessment has been presented, emphasising the low (negligible) levels of GHG emissions.

This ensures a reasonable worse-case approach in establishing the net GHG effect of the project.

Emissions calculations

GHG emissions have been calculated using the Environment Agency's e:Mission Carbon Planning Tool. This tool calculates the GHG impacts of construction activities in terms of CO₂e. It does this by calculating the embodied CO₂e of materials plus the CO₂e associated with their transportation.

¹²³ IAQM (2014) Guidance on the assessment of dust from demolition and construction. [Online] Available from: <http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

It also considers personnel travel, site energy use and waste management. The tool was developed by the Environment Agency for fluvial and coastal schemes. The IEMA guidance on assessing GHG emissions and evaluating their significance has also been used¹²⁴.

13.6 Potential Impacts & Significant Effects

13.6.1 Air Quality

Following the IAQM guidance, consideration has been given to the potential impacts of dust associated with the construction of the proposed scheme on sensitive receptors¹²⁵.

Potential dust emissions are considered across different elements; demolition, earthworks, construction and trackout. The potential impacts from dust emissions will be assessed for each activity which is likely to take place.

Earthworks

Earthworks primarily involve excavating material, haulage, tipping and stockpiling. This can involve the site and landscaping. Excavation will be required at Towyn Revetment, and Kinmel Bay east.

At Towyn Revetment, the maximum excavation depth of approximately 2.5m to place rock armour. Approximately nine vehicles will be required for the earth works, and the expected volume is over 10,000m². According to the guidance, the magnitude dust emissions from earthworks are assessed as medium. There are between 10-100 residential receptors within 50m of the scheme to the SSW, therefore they are classified as of high sensitivity. Due to the temporary nature of the works the potential effect of dust from earthworks is assessed as temporary slight adverse.

At Kinmel Bay east, the maximum excavation depth will be approximately 6m. The total site area is greater than 10,000m² and approximately nine vehicles are required for the earthworks. According to the guidance, as the soil type is of large grain size (sand) dust emission magnitude is medium. There are approximately 10-100 residential receptors within 50m, to the SSW of the scheme, therefore they are classified as of high sensitivity. Due to the temporary nature of the works, the potential effect of dust from earthworks is assessed as temporary slight adverse.

Trackout

Consideration has also been given to the potential dust impacts associated with trackout: where the vehicles leaving each of the sites may transfer dust or dirt onto the road having travelled over unpaved access tracks across the beach. The proposed scheme will utilise existing highways to access each of the construction sites.

At Towyn revetment, access is obtained from the unpaved track extending to the east, joining the A548. The route is within 50m between 10-100 residential properties, therefore the magnitude of dust generation from trackout is considered to be medium. Due to the temporary nature of the works, and the proximity to highly sensitive receptors, the potential dust from trackout is assessed as **temporary slight adverse**.

At Kinmel Bay, access is obtained from two points. To the west, access will be obtained from carpark at the end of St Asaph Avenue, and to the east, access will be obtained from the paved road extending from Horton Nose Lane. There are approximately 10-100 residential properties within 50m to both routes to site. The western access point also accesses a construction compound containing wheel washing facilities. Therefore, the potential dust from trackout from the western access point is considered not significant, however, the potential dust effect from trackout from the eastern access point is assessed as **not significant**.

¹²⁴ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

¹²⁵ IAQM (2014) Guidance on the assessment of dust from demolition and construction. [Online] Available from: <http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

Demolition

There are several elements of demolition required for the proposed scheme, these are located within the CMU3-5C Kimmel Bay. The following demolitions are proposed:

- Baysville café frontage will be demolished and rebuilt on a new alignment.
- A length of wooden fencing along the frontage of Golden Sands caravan park.

According to the IAQM guidance, due to the small building volume and some elements with low potential for dust released. The demolition activities are less than 10m above ground. Therefore the potential dust emission magnitude is small and the effect of potential dust from demolition is assessed as not significant.

- Secondary concrete wall from Golden Sands caravan park to the west wide of Sunnyvale Caravan Park is being demolished to ground level. The existing wall is approximately 1m by 1m, extending for 1.7 km.
- Concrete beach accesses on Kimmel Bay beach sea wall.

According to the IAQM guidance, due to the potential dusty construction material, the potential building volume, the potential dust emissions magnitude is medium. Due to the adjacent residential receptors, the effect of potential dust from demolition is assessed as **temporary slight adverse**.

13.6.2 Carbon

Although there are no agreed thresholds for determining what levels of GHG emissions are significant, IEMA Greenhouse Gas Guidance provides practitioners with examples of how to distinguish different levels of significance¹²⁶:

- **Major adverse:** *'the project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.'*
- **Moderate adverse:** *'the project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.'*
- **Minor adverse:** *'the project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.'*
- **Negligible:** *'the project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.'*

Minor adverse and negligible effects are not considered to be significant. The beneficial effects of the project cannot be considered to be significant, whilst the scheme does reduce the effects of climate change risk it does not reverse the effects of climate change.

IEMA guidance also states that significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG

¹²⁶ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

emissions relative to a comparable baseline consistent with a trajectory towards net zero. Therefore, the assessment for GHG emissions has been completed based on:

- The magnitude of GHG emissions calculated to be generated through construction.
- Considering the magnitude in the local context of current emissions
- The IEMA Greenhouse Gas Guidance.¹²⁷
- Compatibility with possible net zero trajectories.

Assumptions and Limitations

At this stage, the absence of available data is a limitation, particularly for calculating the embodied carbon of the proposed scheme. Where data has not been available, estimates (using professional judgment and knowledge from similar coastal schemes) have been used.

The list below details the assumptions and limitations associated with the GHG assessment:

- The Environment Agency's e:Mission Carbon Planning Tool assumes that transporting material by road emits GHGs at a rate of 0.10672kmCO₂e km⁻¹kg⁻¹;
- Construction methodology has outlined key plant used during the construction of the scheme. This has been captured in the carbon calculations using EA equivalent plant types for significant plant and heavy machinery. The calculator estimates plant utilisation based on previous scheme data.

Generally, where a range of potential sources, or no source, for the material required was stated, it was assumed that the materials would be acquired locally, either through importing materials or reusing site-won materials at the proposed schemes.

Information was not provided about the source of the chosen rock armour material for the schemes. Although local provision suggests that granite will be used within the schemes and would be sourced locally.

A conservative estimate for granite rock armour is used; the carbon equivalent figure of 5.0 kg (0.005 t) CO₂e per tonne of rock armour. A distance of 50 km was chosen via HGV to represent this scenario.

Geotextile: It was not specified in the works information for the scheme where these materials would be sourced. For this assessment, it was assumed the materials would be sourced from elsewhere in North Wales, rather than further afield, a distance of 50 km was chosen via HGV.

Waste: Where specified, site won backfill and refill of material was calculated as a proportion of total excavation at any given proposed site. Although, for this scheme incorporation of all site materials within the permanent works is the preferred method - with plans to retain excavated material on site.

Otherwise, waste mitigation and management plans will entail:

- Material testing to classify the material.
- Development of a material management plan under the CL:AIRE protocol.
- Allocating suitable storage areas to process and dry out materials.

Therefore, waste equivalent carbon has been omitted from the assessment.

Greenhouse Gas Assessment: Calculations

The following section provides the results of the Greenhouse Gas assessment. For this assessment, the EA carbon planning tool was used to calculate the likely potential CO₂e resulting from construction.

¹²⁷ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

The information below has been provided to illustrate where the carbon emissions are concentrated, whether that be embodied carbon within materials, or associated with the delivery of the construction materials.

The estimated embodied GHG emissions associated with the use of materials and excavation of materials for the proposed schemes are summarised and provided in Table 13-3 and Table 13-4.

Table 13-3: Estimated embodied carbon emissions associated with the construction material for Towyn Revetment.

Material	Volume	Embodied (tCO ₂ e)
Rock – Granite (m ³)	25,938	350
Geotextile – Plastic Polyethylene (m ²)	11,128	78
Total carbon (tCO₂e)		428

Table 13-4: Estimated embodied carbon emissions associated with the construction material for Kimmel Bay East.

Material	Volume	Embodied (tCO ₂ e)
Rock – Granite (m ³)	26,712	361
Geotextile – Plastic Polyethylene (m ²)	11,614	81
Total carbon (tCO₂e)		443

In addition to the embodied carbon, there will be emissions arising from construction material delivery through vehicle and sea transport. The emissions calculated for the proposed scheme are presented in Table 13-5 below.

Table 13-5: Estimated CO₂ emissions associated with the delivery of construction materials to the sites.

Material for delivery	Volume	Mode of Transport	The estimated distance between the source of supply and the site (km)	Tonnes CO ₂ e resulting from transport
Granite	52,650 m ³	HGV	50	
Geotextile	22,891 m ²	HGV	50	
Total embodied carbon equivalent (tCO₂e)				2

When embodied carbon values and values resulting from the freight of these materials are combined, the total CO₂e emissions resulting from the materials used from the Kimmel Bay Coastal Defence Improvements Scheme are **873 tCO₂e**.

Plant Usage estimates

Plant usage (tCO₂e) estimates were estimated using the EA's carbon planning tool and assumed working hours/days per site as described by the construction methodology.

However, assumptions have been made as to the EA equivalent calculator type of plant present on-site across the scheme so that carbon estimates can be generated from machinery, plant type and utilisation.

Table 13-6: Estimated embodied carbon emissions associated with the plant type usage and utilisation for the proposed scheme.

Key Plant type	Calculator Plant Type	Approx. hours – based on quantity and days	tCO2e (rounded)
40 t Tipper	36 t Dumper	3,456	117
36 t Excavator	23.5 t Hydraulic Crawler Backacter	1,728	42
20 t Road Wagons (Concrete & Rock)	24 t Tipper	18,624	1,263
10 t Tipper	16 t Tipper	8,640	513
3 t Tipper	2 t Dumper	3,840	16
1.5 t Tipper	2 t Dumper	1,152	5
15 t Excavator	23.5 t Hydraulic Crawler Backacter	3,840	93
5 t Excavator	3.5 t Hydraulic Crawler Backacter	576	3
Asphalt Spreader	Asphalt Paver (35 KW)	960	9
Sheet Piling Rig	Piling Extractor (Giken)	1,728	38
Vibrating Roller	BW 120 AD	384	2
Total embodied carbon equivalent (tCO2e)			2100

The overall plant usage total embodied carbon equivalent estimate (tCO2e) is **2,100. tCO2e**.

In addition, emissions that would result from personnel travelling to the site to work have been assumed to be negligible when compared to other emissions arising from the scheme. This source has been omitted because there is not enough information to determine these emissions at this stage.

It is estimated that in total **2,973 tCO2e** would be emitted as a result of the construction of the proposed scheme.

Annualised emissions over the expected life cycle of the scheme (100 years) would represent an increase of **29.73 tCO2e yr-1**.

Significance

IEMA Guidance (2021) for assessing greenhouse gas emissions and evaluating their significance states that: 'GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant¹²⁸.

However, in 2022 IEMA guidance builds on these principles stating that

- 'The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible'.
- 'Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages'.
- 'Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered'.

Therefore, this section will proportionately consider these principles and the project's net impact.

¹²⁸ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

Contextualising the project's carbon footprint

To provide context for the magnitude of GHG emissions reported within this chapter, the below table has been provided.

The table displays that the projected GHG emissions for the scheme would constitute an average increase in emissions of 5.44% for the years 2025-2030 provided the 2030 Conwy Borough Council net-zero trajectory is to be maintained.

Alternatively, if not accounted for through mitigation or offset, the annualised emissions over the expected life cycle of the scheme represent an increase of 29.73 tCO₂e yr⁻¹. Although, construction activities would in practice emit a large proportion of carbon during the initial construction stage of the scheme (plant total – 2100 tCO₂e within 2023-2024).

Total project emissions would represent a 5.1% increase on the 2018/2019 baseline for Conwy County Council. Although would only represent a contribution to the Conwy County Borough Council area's CO₂ emissions of 0.63 % of annual emissions (DBEIS, 2020).

Table 13-7: Table displaying the impact of the total project carbon on Conwy Council's 2030 net zero

Year (post-construction)	Linear Decarbonisation trajectory (for Conwy) 2018/19 baseline – extrapolated to 2030 for net-zero (tCO ₂ e)	Total Project carbon (tCO ₂ 3) (2025-2029) levelised before net-zero	% Change from decarbonisation trajectory for Conwy
2018	55199		
2025	25090	595	2.4
2026	20072	595	3.0
2027	15054	595	4.0
2028	10036	595	5.9
2029	5018	595	11.9
Average % change			5.44
2030	0	0	

Baseline (2018/2019) figures are provided in Conwy's Decarbonisation Plan.¹²⁹

Therefore, although the project will have residual emissions that may provide new challenges for the local authority (especially for the short-term 2030 net zero strategy) the project is unlikely to have a net negative impact over its lifetime.

The project will likely align with a budgeted, science-based 1.5°C trajectory keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035.¹³⁰

Upon reviewing the methodological criteria, significance can be determined to be Minor adverse and fully in line with measures necessary to achieve the UK's trajectory towards net zero. Therefore, being **not significant**.

¹²⁹ Conwy County Borough Council (2019). Conwy's Decarbonisation Plan. [Online] Available at: <https://www.conwy.gov.uk/en/Council/Strategies-Plans-and-Policies/Climate-Change/Decarbonisation-Plan.aspx>

¹³⁰ IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance EIA Assessing GHG. [Online] Available from: <https://www.iema.net/resources/iema-essential-reading>

13.7 Mitigation Measures

13.7.1 Air Quality

Temporary slight adverse effect on sensitive receptors as a result of dust emissions from earthworks have been assessed.

Therefore, in accordance with IAQM guidelines, appropriate mitigation measures for medium and high-risk sites will be implemented through a Construction Environmental Management Plan (CEMP).¹³¹ These include:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of the person(s) accountable for air quality and dust issues on the site boundary.
- Display the head or regional office contact information
- Develop and implement a Dust Management (DMP) which may include measures to control other emissions, approved by the Local Authority prior to construction.
- Record all dust complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Record any exceptional incidents that cause dust and/or air emissions either on or off site and the action taken to resolve the situation in a log book. Make the complaints log available to the local authority when requested.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results and make the inspection log available to local authority when asked.
- Increase the frequency of site inspections for air quality and dust when activities with a high potential to produce dust are being carried out or during dry or windy conditions.
- Erect screens or barriers around dusty activities.
- Ensure all vehicles switch off engines when stationary – no idling vehicles.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (these speeds may be increased on long haul roads with suitable additional control measures subject to the approval of the nominated undertaker and with the agreement of the local authority when appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment.

13.7.2 Carbon

These coastal defence proposals and enhancements are a response to the adverse consequences of a changing climate. Due to this, the mitigation measures for this scheme are limited, but at this project stage, will likely have the most impact.

Below are significant mitigation measures for the scheme that should be considered at all stages:

- In general, rock used for the scheme should be as locally sourced as possible - reducing the embodied carbon of the scheme involved in the transport of heavy materials.

¹³¹ IAQM (2014) Guidance on the assessment of dust from demolition and construction. [Online] Available from: <http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

- However, where quarried rock for rock armour has an Environmental Product Declaration that suggests the rock source comes has a low embodied emissions factor – any savings maintained by using local sourcing should be disregarded as these will in most cases be outweighed by low carbon production.
- Furthermore, to integrate this mitigation further, the scheme should remain flexible as to the choice of rock within coastal defences – opting for less energy and carbon-intensive rock where possible, whilst retaining structural standards.
- Utilising different, less-emissive plant fuel types where possible to reduce the carbon intensity of the construction works.
- Recycled materials should be used where possible e.g., recycled aggregate, aluminium and steel.
- The scheme could utilise low (or non) OPC (Ordinary Portland Cement) concrete in low-risk areas, leading to significant carbon reduction where used, whilst maintaining the lifecycle of the scheme.
- Further ecological enhancement of coastal engineering structures could be explored, as some passive enhancement techniques may sequester carbon and provide biodiversity gain.

13.8 Residual Effects

13.8.1 Air Quality

Providing that the IAQM recommended mitigation measures for outlined above are applied, then the residual effect of dust at both sites would be **negligible** (not significant).

13.8.2 Carbon

The residual effects are dependent on the additional mitigation recommendations being accepted, secured and delivered in practice.

Moreover, as there is an associated uncertainty with carbon modelling there is a likelihood of residual emissions being unaccounted for following the proposed scheme.

It is therefore recommended that the proposals ensure that:

- Utilising alternative, less carbon-intensive, recycled materials where possible.
- Where relevant, materials required for the proposed defences should be sourced from as close as possible to the scheme, to minimise transport emissions.
- There is adequate compensation for 'unavoidable' residual emissions (removals, offsets etc.)
- There is general support for climate action and developing markets (within Conwy Council).

With the implementation of the additional mitigation measures and the achievement of Conwy Council's 2030 net-zero goal, the residual effect could be reduced from minor adverse to negligible or beneficial, wherein mitigation provides further positive climate impact.

Cumulative contribution to climate change

As GHG emission impacts and resulting effects are global rather than affecting one localised area, the approach to cumulative effects assessment for GHGs differs from other EIA topics. Therefore, this assessment is not limited geographically to the study area – but rather contextualised within the local authority.

The cumulative carbon dioxide equivalent emissions resulting from the Kinmel Bay Coastal Defence Improvements scheme is estimated to be 2,793 tCO₂e. Across the 100-year

anticipated design life of the schemes, this would represent an increase of 27.93 tCO₂e yr⁻¹ to the Conwy local authority.

As a result, the scheme would result in a contribution to the Conwy County Borough Council area's CO₂ emissions of 0.63% of annual emissions.¹³² Which would represent an estimated per capita increase of 4.0 tCO₂e to 4.03 tCO₂ e.

Whilst it is acknowledged that any increase is undesirable, this project should not undermine the trajectory towards a carbon-neutral Conwy. Moreover, upon scheme completion, the infrastructure will protect local communities from the effects of climate change.

¹³² DBEIS (2022). UK local authority and regional greenhouse gas emissions. Available at: <https://www.data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/uk-local-authority-and-regional-greenhouse-gas-emissions>

14 Cumulative and In-Combination Effects

14.1 Introduction

This chapter of the ES outlines potential cumulative and combined effects that may arise as a result of the construction of the proposed scheme.

In order to determine potential for cumulative effects, consideration is given to the impacts of any other committed developments where these would coincide with the temporal and spatial scope of the development proposals. The environmental impacts of the respective developments are assessed collectively on individual receptors to determine where this could give rise to likely significant effects, which would otherwise be not significant.

14.2 Legislative & Planning Policy Context

Regulation 18(3) of the EIA Regulations requires with reference to paragraph 5 of Schedule 4, a consideration of cumulative effects is included in the Environmental Statement:

'A description of the likely significant effects of the development on the environment resulting from...(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources...

The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project, including in particular those established under Council Directive 92/43/EEC(1) and Directive 2009/147/EC(2).'

14.3 Baseline Conditions

14.3.1 Cumulative effects with other committed developments

A search of the CCBC planning portal¹³³ and Denbighshire County Council¹³⁴ planning portal for submitted applications identified developments with the potential to cause cumulative effects. This search, undertaken on 4th November 2022, considered applications submitted in the past three years since, in accordance with planning law, planning permission expired after three years unless work has not begun.

Where planning applications and marine licences have been submitted for the same scheme of works, they have been considered together.

Table 14-1: Long list of planning applications with potential to generate cumulative impacts with the proposed scheme

Application Number	Address	Description	Status
0/49272 & CML2108	Old Colwyn Coastal Defence & Active Travel Improvements:	Coastal and storm defence scheme including construction of a rock revetment and improved pedestrian and cycle access with associated public realm improvement works along Colwyn Bay.	Approved With Conditions 04/01/2022

¹³³ Conwy County Borough Council (2022) Planning Explorer. [Online] Available from:

<https://www.conwy.gov.uk/en/Resident/Planning-Building-Control-and-Conservation/Planning-Applications/Planning-Explorer.aspx>

¹³⁴ Denbighshire County Council (2022) Planning. [Online] Available from: <https://planning.denbighshire.gov.uk/planning/>

Application Number	Address	Description	Status
	Porth Eirias In The West to Splash Point (By Old Colwyn Arches) In The East		
0/49274 & CML2159	Penrhyn Bay Coastal Defence and Public Realm Improvements: Penrhyn Bay Conwy	Construction of coastal defences including a T-shaped rock groyne, eastern groyne raising, repairs to the existing seawall, beach nourishment and public realm improvements including pedestrian/cycle crossing, beach access ramp, re-located and extended car parking, street furniture, promenade resurfacing and soft landscaping.	Approved With Conditions 04/01/2022
0/49306 & CML2149	The Colwyn Bay Phase 2B: Beach and Promenade at Colwyn Bay between Colwyn Bay Station and Abbey Road	The Colwyn Bay Phase 2B: coastal works, public realm promenade improvements, and landscaping works.	Approved With Conditions 18/01/2022
45/2022/0271 & CML2152	Central Rhyl Coastal Defence	New concrete stepped revetment and wall wave, with promenade raising/widening, and section with rock scour protection and concrete repairs to the existing sea defence structures.	Approved 13/07/22

The Natural Resources Wales is responsible for granting marine licences in Wales. A marine licence is required for many different activities that occur within inshore and offshore areas in Wales including construction works. As is the case for planning applications, marine licence applications are available to view on a public register. This public register (available at <https://publicregister.naturalresources.wales/>) was searched on 4th November 2022.¹³⁵

Table 14-2: Long list of marine licence applications with potential to generate cumulative with the proposed schemes

Application Number	Address	Description	Status
ORML2233	Awel-y-Mor (AyM) Offshore	An 78km2 offshore wind farm 10.5km off the Welsh coast. Construction works are expected to start after 2025. AyM export cables will be installed using trenchless technology to pass under existing coastline infrastructure including North Wales Coast Line railway, Robin Hood Holiday Park, Rhyl Coast Road A548, Rhyl golf club fairway and the promenade. Access for construction vehicles is from Dyserth Road and either Garford Road or Ferguson Avenue. The construction period will 7 months in total, potentially split into two discrete phases with a gap of many months in between. Most of the works will be during standard construction hours, but some critical activities will require 24-hour operation. Traffic generation	PAC period ended 11th October

¹³⁵ Natural Resources Wales (2022) Natural Resources Wales. [Online] Available from: <https://publicregister.naturalresources.wales/>

Application Number	Address	Description	Status
		(worst case scenario) will be maximum 73 return trips a day, but an average of 12 return trips a day.	

14.4 Assessment Methodology & Assessment Criteria

Cumulative effects are assessed with regard to (i) the environmental impacts of the development proposals when considered cumulatively with the environmental impact of other existing adjacent and approved development projects at the time of submission of the ES; and (ii) the cumulative effect of inter-relationships between multiple environmental impacts on individual receptors.

Regarding (i), the spatial and temporal scope of the EIA considers the following:

- The physical extent of the proposed works, as defined by the limits of land to be used (temporarily or permanently) as denoted in the respective planning or marine licence consents by their site boundary;
- The nature of the existing baseline environment, including the location of sensitive receptors;
- The geographical extent of impacts beyond the sites, e.g. effects from traffic, visual effects and disturbance of ecological receptors;
- The geographical boundaries of the political and administrative institutions and authorities, which provide the planning and policy context for the project; and
- The timing of the works for the respective development project.

Cumulative effects would therefore consider the impacts of any other committed developments where these would coincide with both the temporal and spatial scope of the development proposals assessed within this ES. The environmental impacts of the respective development projects are assessed collectively on individual receptors to determine where this could give rise to synergistic likely significant effects.

Regarding (ii) the cumulative effects of inter-relationships between multiple environmental impacts would consider any impacts assessed individually within this ES, the synergistic effects of which would either be made greater as a result of the cumulative effects on the individual receptors, or which otherwise would not be considered significant on its own.

The study area for the consideration of cumulative effects has been considered the predicted Zone of Influence (ZoI) for each environmental topic considered within the ES.

14.5 Potential Impacts & Significant Effects

14.5.1 Cumulative effects with other committed developments

The environmental impacts of the development proposals when considered cumulatively with the environmental impact of other existing adjacent and approved development projects at the time of submission of the ES is assessed for significance in Table 14-3.

Table 14-3: Assessment of short-list of applications for potential cumulative impacts

Application Reference	Description	Distance	Status	Within ZOI?	Temporal overlap	Scale and Nature	Significant Effects
ORML	Awel-y-Mor (AyM) Offshore project	2km	Approved	Yes, within Zol of Ecology	No, construction works are expected to start after 2025.	An 78km ² offshore wind farm 10.5km off the Welsh coast.	Potential for cumulative impact on features of Liverpool Bay SPA, however, as the proposed scheme is not expected to have any significant impact on the designation, any cumulative impacts with the offshore projects are not expected.
0/49272	Old Colwyn Coastal Defence & Active Travel Improvements	10km	Approved 17/03/22	Yes, within Zol for Coastal Processes.	Yes, expected construction period until November 2023.	The project includes a combination of coastal defences, promenade and active travel improvements.	There is potential for mobile sediment to be retained by the rock revetment as it encroaches into the intertidal zone. However, the impacts arising from the scheme are expected to be minimal based on the size of the works relative to the wider coastal sub-cell. Therefore, the cumulative impact of the Old Colwyn project is assessed as not significant,
0/49274 & RML2031 (ML)	Penrhyn Bay Coastal Defence and Public Realm Improvements	16km	Approved 09/05/22	Yes, within Zol for Coastal Processes.	Yes, expected construction period until November 2023.	The Penryn Bay project comprises of a construction of a T-shaped rock armour groyne, and increasing level of the beach.	The extension of breakwaters and groynes may act to retain sediment, which may be detrimental to the sediment regime to the east, however, some of the proposed beach recharge may migrate beyond the scheme to beaches to the east, including Towyn and Kinmel Bay. Therefore, the cumulative impact of the Penryn Bay project is assessed as not significant.

Application Reference	Description	Distance	Status	Within ZOI?	Temporal overlap	Scale and Nature	Significant Effects
0/49306	The Colwyn Bay Phase 2B: Beach and Promenade at Colwyn Bay between Colwyn Bay Station and Abbey Road	12.5km	Approved 15/03/22	Yes, within Zol for Coastal Processes.	No, construction period to be complete in June 2023.	The Colwyn Bay Waterfront project comprises of minor repairs of the existing seawall, modification of the groyne with a new groyne arm and increased elevation.	The proposed terminal groyne may be considered to impede sediment. however, the beach recharge is expected to also mobilised over time in eastward littoral drift, feeding beaches to the east including Towyn Revetment and Kinmel Bay. Therefore, the cumulative impact of the Colwyn Bay Waterfront Phase 2b is assessed as not significant.
45/2022/0271 & CML2152 (ML)	Central Rhyl Coastal Defence Scheme	400m	Pre-application consultation period ended 9 th of February.	Yes, within Zol for Traffic and Transportation, Cultural Heritage, Noise and Vibration and Hydrology and Hydrogeology.	Yes, construction period expected to commence in 2022 for a period of 2.5 years.	New concrete stepped revetment and wall wave, with promenade raising/widening, and section with rock scour protection and concrete repairs to the existing sea defence structures.	The primary traffic route proposed by the Central Rhyl project overlaps with the access routes for the proposed scheme. However, the increases in traffic flow associated with the Central Rhyl project are determined to not result in discernible delays or congestion of highways. The potential indirect impacts to historic assets from the proposed scheme have been assessed as neutral, no significant effects were identified to historic assets as a result of the Rhyl scheme. When combined with the Not Significant residual effects of the Kinmel Bay Coastal Defences construction and operational phases, the cumulative effects of the Rhyl scheme are likely to be Not Significant or Beneficial, depending on the extent of mitigation measures implemented. The Central Rhyl scheme has identified the

Application Reference	Description	Distance	Status	Within ZOI?	Temporal overlap	Scale and Nature	Significant Effects
							potential for significant impacts on Noise and Vibration, however, the proposed scheme does not anticipate any significant residual impacts. Therefore, the potential for cumulative effects is assessed as not significant.

14.5.2 Interrelationship effects between topics

The technical assessments within each of the ES chapters have identified a number of effects which would occur as a result of the construction and operation of the ten proposed schemes. Several effects on one or more receptors could theoretically interact or combine to result in a combined effect which is more or less significant. When considering combined effects, the mitigation measures set out in the ES chapters (including the construction programme) must be considered (i.e. only residual effects (after mitigation) should be considered).

Typically, receptors which are likely to experience a combined effect are those which are more sensitive to change, for example people, whilst those receptors which are more tolerant to change, for example aspects of the physical environment such as geodiversity, are less likely to experience a combined effect. Where only one effect is identified for a particular receptor or only one topic identifies effects on that receptor, there are no common receptors and therefore no potential for a combined effect to occur.

Residential properties and local businesses close to the proposed schemes may be subject to synergistic interrelationship effects during construction, principally arising from the following:

- Visual impacts from construction activities;
- Disturbances from construction noise and dust impacts;
- Impacts from increases in construction related traffic across the islands.

Table 14-4 below summarises the interrelationship effect on residential receptors and local businesses surrounding each of the proposed schemes as an accumulation of environmental effects assessed individually for these receptors elsewhere in the ES.

Table 14-4: Interrelationship impact during construction on specific receptors where environmental effects have been assessed individually elsewhere in the ES

Receptor	Impacts				Overall Significance Assessed
	Construction traffic	Dust emissions	Noise	Visual impact	
Residential receptors and visitors at Towyn Revetment	Not significant	Not significant	Temporary slight adverse	Neutral	Not significant
Residential receptors and visitors at Kinmel Bay West	Not significant	Not significant	Temporary slight adverse	Neutral	Not significant
Residential receptors and visitors at Kinmel Bay East	Not significant	Not significant	Temporary slight adverse	Neutral	Not significant

Interrelationship effects are also possible on some environmental receptors where mitigation is proposed on other environmental topics. For example, mitigation proposed in Chapter 13: Other Construction Related Effects could also have a positive impact upon receptors assessed in other ES chapters, including Chapter 4: Biodiversity and Nature Conservation.

14.6 Mitigation Measures

14.6.1 Cumulative effects with other committed developments

No significant cumulative impacts are anticipated to be caused by other committed developments. No mitigation is therefore proposed.

14.6.2 Interrelationship effects between topics

Mitigation of combined effects is best achieved through management and control measures to prevent the individual impacts in the first instance, or reduce the impacts themselves, and therefore reduce the likelihood of such interactions occurring. The mitigation measures set out in the preceding chapters are recommended to reduce any cumulative effects.

14.7 Residual Effects

14.7.1 Cumulative effects with other committed developments

No residual impacts regarding cumulative impacts with other developments are identified. However, it should be considered that these receptors will benefit from the installation of coastal defences in these areas.

14.7.2 Interrelationship effects between topics

Overall, it is not anticipated that any interrelationships between topics will make the impacts already described within Chapters 4-13 any more severe. Therefore, the residual effects identified in these preceding chapters remain.

15 Conclusions

15.1 EIA Outcomes

Table 15-1 provides a summary of the significant effects, mitigation measures and residual effects identified in each of the chapters in this ES. For the purpose of this summary table, some significance scores have been adapted to reflect the standardised approach to significance scoring as detailed in Table 3-2. Refer to the individual topic specific ES chapters for the topic specific guidelines significance terminology.

Table 15-1: Summary of significant effects, mitigation measures and residual effects

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
Ecology	Indirect damage through pollution event on Liverpool Bay SPA.	Significant negative effect	Pollution prevention measures following the latest CIRIA guidance will be implemented through the CEMP.	Not significant
	Removal of sand dune habitat on Kinmel Bay LNR	Significant negative effect	Habitat management will be carried out across the LNR, following construction, in order to improve the condition of habitats present.	No significant effect
	Pollution of coastal habitats (construction)	Significant negative effects	Pollution prevention measures following the latest CIRIA guidance will be implemented through the CEMP.	No significant effect
	Loss of intertidal habitat (priority habitat) during construction	Significant negative effects	Compensation through habitat improvement on the rock armour.	No significant effect
	Removal of amenity grassland	Temporary adverse effect.	New areas of coastal grassland will be created will be created using a suitable coastal grassland mix.	No significant effect
	Potential destruction of birds nest (construction)	Significant negative effects	Avoidance of main nesting bird season for vegetation clearance or pre-works nesting bird checks if required. All identified nests will be safeguarded until the chicks have fledged.	No significant effect
	Potential killing, injuring and disturbance of intertidal invertebrates	Slight adverse negative effects	A survey will be undertaken prior to works being undertaken in the littoral zone to ensure that Sabellaria is not present. Pollution prevention measures will be put in place to avoid impacts upon benthic invertebrate species. Haul roads within the intertidal areas will be agreed in advance and adhered to in order to avoid the compaction of a larger area of the foreshore.	No significant effects
	Potential killing, injuring and disturbance of fish	Slight adverse negative effects	The works will be carried out at low tide in the dry and therefore the proposals should not cause any noise or vibration impacts to the marine environment.	No significant effect
	Potential disturbance of marine mammals	Significant negative effect	All works will be undertaken in the dry and a 'soft start' to works should be carried out each day as this will move seals and cetaceans away from the area.	No significant effect
Landscape and Visual Impact	Impact on National Character Area (NLCA08: Colwyn and Northern Coastline)	Neutral	None proposed	Not significant
	Impact on National Marine Character Area (MCA02: Colwyn Bay and Rhyl Flats)	Neutral		
	Impact on LANDMAP aspects	No impact		

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
	Impact on Viewpoint 1	Neutral		
	Impact on Viewpoint 2	Slight beneficial		
	Impact on Viewpoint 3	Slight beneficial		
	Impact on visual receptors at the promenade along the seafront within proposed scheme	Neutral		
	Impact on visual receptors at Kinmel Bay and Beach	Neutral		
	Impact on visual receptors at Kinmel Dunes Local Nature Reserve	Beneficial		
	Impact on visual receptors at northern edge of the settlements of Kinmel Bay and Towyn	Neutral		
	Impact on viewpoint at Horton's Nose	Neutral		
	Impact on viewpoint at Kinmel Dunes	Beneficial		
Coastal Processes	Potential sediment dispersal within adjacent waterbody from excavation	Negligible	Potential coastal process impacts would be mitigated through the adoption of good construction practices. Work should be conducted under dry conditions during periods of low water. All work schedules should be assessed two weeks in advance to confirm compliance with the stated mitigation measures. Works should cease during storm events, where increased wave activity could mobilise sediments and present hazardous working conditions. Beach monitoring of the area is already undertaken on an annual basis. It is recommended that this continues, post-construction, at the same/similar time each year to identify changes in beach slope gradient and elevation.	Not Significant
	Sediment mobilisation during construction of rock revetment	Negligible		
	Storage of rock armour resulting in changes in beach profile	Negligible		
	Storm activity mobilising temporary stored material	Negligible		
	Rock revetment impacting beach profile	Negligible		
	Modification of beach morphology, local hydrodynamics and sediment regimes from movement of plant.	Negligible		
	Impacts to sediment dynamics during construction phase.	Negligible		
	Impact of the proposed scheme on natural beach morphology	Minor		
	Defence structure impacting sediment dynamics	Negligible		
	Defence structure interacting with longshore sediment processes	Negligible		
	Impact of defence structure on marine habitat	Negligible		
	Defence structure impacting the tidal or sediment regime	Not Significant		
Hydrology and Hydrogeology	Changes in flows, quality, blockage potential to on-site drainage systems.	Minor	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
	Changes in flows, quality from pollutants and contaminants during construction to Coastal North Wales.	Significant	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant
	Changes in flows, quality from pollutants and contaminants during construction to Ffynnon-y-ddol Channel, River Clwyd, Discharges, Ponds.	Negligible	None proposed	None
	Change in compaction and quality from contamination erosion and compaction to soils.	Moderate	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant
	Pollution sources from existing on-site contamination and pollutants generated through the construction phase. Changes in recharge to the Secondary A Superficial Aquifer.	Moderate	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant
	Pollution sources from existing on-site contamination and pollutants generated through the construction phase. Changes in recharge to the bedrock aquifer.	Substantial	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant
	Pollution sources from existing contamination and pollutants generated through the construction phase. Changes in recharge to the groundwater abstractions.	Negligible	None proposed	None
	Change in flows and quality from increase in the impermeable area and surface water run-off to the adjacent drains; flushing of silts and hydrocarbons from areas of hardstanding to on-site drainage.	Negligible	None proposed	Not Significant
	Change in flows and quality to Coastal North Wales from increasing pollutants and contaminants discharge with increasing run-off due to increase in impermeable area.	Moderate	None proposed	Not Significant
	Change in flows and quality to Ffynnon-y-ddol Channel, River Clwyd, Discharges, Ponds from increasing pollutants and contaminants discharge with increasing run-off due to increase in impermeable area.	Negligible	None proposed	None

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
	Change in compaction and quality from contamination erosion and compaction to soils.	Negligible	None proposed	None
	Contaminated surface runoff to reach the superficial Secondary A Superficial Aquifer.	Minor	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant
	Contaminated surface runoff to reach the bedrock aquifers.	Moderate	Design mitigation, specific construction mitigation and application of best practice would result in no significant effect.	Not Significant)
	Contaminated surface runoff to reach the groundwater abstractions.	Negligible	None proposed	None
Cultural Heritage	Impacts on the setting of designated heritage assets: Foryd Bridge, and Nos 72-75 West Parade.	Neutral	A toolbox talk (TBT) should be given as part of the works induction process and form part of the Construction Management Plan to help familiarise the project team with the cultural heritage of the area. The TBT should have an associated protocol for archaeological recording and reporting to the relevant authorities in the event of an unexpected discovery of archaeological deposits or artifacts.	None
	Impacts on the setting of designated heritage asset River Street Conservation Area			
	Impacts on the setting of designated heritage assets: Nos 72-75 West Parade.			
	Temporary impacts from construction to the setting of post-medieval brick building at Foryd Harbour.			
	Temporary impacts from construction to the setting of post-medieval brick building at Foryd timber yard wharf and quay.			
Contaminated Land	Human health from potential exposure to contamination associated with historical land use	Negligible (construction & operational phases)	None proposed.	Negligible
	Surface water and groundwater bodies and environmental receptor pollution from leaching and migration of contamination associated with historical land uses	Negligible (construction & operational phases)	None proposed.	Negligible
	Human health from Ground Gas Migration and Accumulation in Confined Spaces	Minor (construction phase) Negligible (operation phase)	Where required, temporary confined spaces/construction buildings would include void space below them to allow for passive ventilation.	Negligible
	Pollution of land and surface water/ groundwater/ecological receptor contamination during construction phase	Minor to Negligible (Kinmel Dunes LNR) Minor (River Clwyd & Secondary A aquifers)	Appropriate management of materials implemented through CEMP	Negligible

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
		Minor to Moderate (Coastal North Wales & deep bedrock aquifer)		
Socio-economic	Impact on local employment	Slight positive	This project and much of the subsequent procurement has been through the 'Sell 2 Wales Framework' . The Sell 2 Wales framework aims to help businesses win contracts with the public sector across Wales and to help businesses find contract opportunities in Wales.	None
	Impact on traffic and commuting from additional HGV traffic	Not significant	Contractors are part of the Considerate Contractors Scheme.	
	Impact of the proposed scheme on tourism	Neutral		
	Noise, nuisance and disruption	Slight negative		
	Impact of proposed scheme on education	No impact	None proposed	
	Impact of proposed scheme on Welsh Language	No impact	None proposed	
	Impact of proposed scheme on provision of healthcare	Slight positive	None proposed	
	Impact of proposed scheme on provision of Open Space	Slight negative	Impacts offset by the flood risk benefits provided by the scheme.	
	Potential diversion of the Wales Coast Path and National Cycle Network	Slight adverse	None proposed	
	Traffic and Transportation	Potential impact on severance	Not significant	None proposed
Impacts resulting in driver delay				
Impacts resulting in pedestrian delay				
Impacts to pedestrian amenity				
Impact to fear & intimidation to human receptors				
Increase in accidents resulting in a decrease in safety				
Noise and Vibration	Impact of noise on closest residents	Temporary slight adverse	During the construction works for the scheme, the predicted adverse effects are expected to be mitigated and minimised using Best Practicable Means (BPM). Acoustic screening of plant and isolate plant when not operating. Regular noise and vibration monitoring during the construction operations.	Not significant
	Impact of vibration on residents	Not significant	Not significant	Not significant

Environmental Topic	Potential Likely Significant Effect	Significance Score	Proposed Mitigation	Residual Effect Significance Score
	Impact of vibration on nearby buildings			
Other Construction Related Effects	Potential air quality impacts from dust generate from excavation at Towyn Revetment and Kinmel Bay east.	Temporary slight adverse	Appropriate mitigation methods in accordance with IQAM guidelines implemented through a CEMP. Measures include: Develop and implement a Dust Management (DMP) which may include measures to control other emissions, approved by the Local Authority. Ensure all vehicles switch off engines when stationary – no idling vehicles. Erect screens or barriers around dusty activities.	Negligible
	Potential trackout from access route to Towyn Revetment	Temporary slight adverse		
	Potential trackout from access route to Kinmel Bay west	Not significant		
	Potential trackout from access route to Kinmel Bay east	Not significant		
	Excavation of café frontage and length of wooden fencing	Not significant		
	Demolition of concrete wall, and concrete beach accesses	Temporary slight adverse		
	Impact of carbon emissions from proposed scheme	Not significant	Several mitigation measures outlined, include: In general, rock used for the scheme should be as locally sourced as possible - reducing the embodied carbon of the scheme involved in the transport of heavy materials. Utilising different, less-emissive plant fuel types where possible to reduce the carbon intensity of the construction works.	Negligible

15.2 Concluding remarks

The proposed scheme across the stretch of coastline at Kinmel Bay will protect properties, businesses, and infrastructure from a 1 in 200-year coastal flood event, reducing the risk of flood damages to 726 residential and non-residential properties currently at risk, and 2,289 properties by 2121.

This ES has assessed anticipated impacts from the scheme under the following specialist chapters – Ecology, Landscape and Visual, Coastal Processes, Hydrology and Hydrogeology, Cultural Heritage, Contaminated Land, Socio-economic, Traffic and Transportation, Noise and Vibration, Other Construction Related Effects, and Cumulative and in-combination effects. Where potential impacts have been identified (summarised in Table 12-1), mitigation has been suggested (where possible) in order to lessen these impacts.

15.3 Mitigation and monitoring

An Outline CEMP (Appendix H) has been produced to assist with the implementation of construction mitigation recommended within this ES. An ECoW would also be present on site, to aid the construction contractor for the duration of the construction period. The role of the ECoW on a construction project is to monitor compliance with the ecological policies described in the CEMP together with any planning conditions and legal environmental requirements.

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