Chapter 6:
Population & Human Health

ROUGHAN & O'DONOVAN

Chapter 6 Population and Human Health

6.1 Introduction

This chapter addresses the potential population and human health impacts relating to the construction and operational phases of the Trinity Wharf Development, referred to hereafter as the “proposed development”. The proposed development will form a new urban quarter in Wexford Town providing opportunities for residential, community/ cultural, business and employment opportunities, contributing to the growth and development of the area. Actual and perceived impacts of the proposed development on the population and human health may arise from various aspects of the proposed development. These impacts are dealt with throughout this Environmental Impact Assessment Report (EIAR). In particular, interactions will occur with effects described in the chapters listed in Table 6.1.

Table 6.1 Population and Human Health Interactions and Specialist Contributions

Relevant Aspects	Chapter & Specialists Contributor
Human Health: Traffic	Chapter 5: Traffic Analysis: Roughan & O’Donovan
Human Health: Contaminated Land	Chapter 8: Soils and Geology: Roughan & O’Donovan
Human Health: Noise and Vibration	Chapter 12: Noise and Vibration: Enfonic
Human Health: Air Quality and Climate	Chapter 13: Air Quality and Climate: AWN Consulting
Human Health: Water Quality and Flooding	Chapter 10: Hydrology: Roughan & O’Donovan
Human Health: Landscape and Visual	Chapter 11: Landscape and Visual Analysis: Cunnane Stratton Reynolds
Human Health: Material Assets	Chapter 16: Material Assets: Roughan & O’Donovan
Human Health: Major Accidents and Disasters	Chapter 17: Interrelationships, Major Accidents and Cumulative Effects: Roughan & O’Donovan

In accordance with the draft Environmental Protection Agency (EPA) Guidelines (2017), the relevant components of this chapter examine the attributes and characteristics associated with:

- Land use and social considerations, including effects on general amenity, journey characteristics, severance, amenity uses of the site or of other areas in the vicinity;
- Economic activity including tourism e.g. employment and population including associated land use; and
- Human health, considered with reference to, and interactions with, other environmental receptors contained in corresponding chapters such as air, noise, traffic and flooding, as appropriate.

This chapter sets out the methodology used for the population assessment and human health assessment (Section 6.2), then describes the receiving environment (Section 6.3) and sets out the predicted impacts of the proposed development on population and human health aspects (Section 6.4). The mitigation measures section (Section

6.5) sets down measures that are recommended to be incorporated into the design of the proposed development. Likely residual impacts are described in Section 6.6. This chapter also outlines any difficulties encountered in compiling information (Section 6.7). A conclusion and a summary of the assessment are provided in Section 6.8 and a list of reference material used to compile this chapter is contained in Section 6.8.

6.2 Methodology

This population and human health impact assessment has been undertaken in accordance with Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU and as transposed into Irish Law through Regulations in 2018 (S.I. No. 296 of 2018).

6.2.1 Relevant Guidelines

The following guidelines have influenced the preparation of this chapter:

- Draft Guidelines on information to be contained in the Environmental Impact Assessment Report, Environmental Protection Agency, August 2017;
- Draft Advice Notes for preparing Environmental Impact Statements Environmental Protection Agency. September, 2015;
- Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency. 2002;
- Advice notes on current practice in the preparation of Environmental Impact Statements, Environmental Protection Agency. 2003;
- Environmental Impact Assessment of National Road Schemes- A practical Guide, National Roads Authority/ Transport Infrastructure Ireland, Revision 1, November 2008;
- Guidelines on the Treatment of Tourism in an Environmental Impact Assessment, Fáilte Ireland. 2011;
- Additionality Guide, Homes and Communities Agency, United Kingdom. 2014;
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report. European Commission. 2017;
- Health Impact Assessment Resource and Tool Compilation, United States Environmental Protection Agency. 2016;
- Health Impact Assessment Guidance, Institute of Public Health Ireland. 2009; and
- Framework for Human Health Risk Assessment to Inform Decision Making developed by the United States Environmental Protection Agency (US EPA). 2014.

The description of the quality, significance, extent (magnitude), probability and duration of effects outlined within this assessment are based on the definitions set out within Section 3.7 of the 'Guidelines on information to be contained in Environmental Impact Assessment Reports' (EPA, Draft 2017).

6.2.2 Study Area

There is no national guidance available on an appropriate study area to focus the assessment of population and human health. The study area has been defined with reference to the potential for impact from the proposed development using professional judgement and based on availability of relevant information. The primary study area is defined by the Electoral Divisions (EDs) that are wholly and/or partially contained within 500m of the proposed development, as presented in Plate 6.1 and Figure 6.1 of Volume 3 of this EIAR. It is recognised that developments such as the one proposed can influence activities across a wider area. For this reason, a study area of 1km is also included. The human health study area is related to the potential impacts of any emissions as a result of the proposed development. Generally, the closer to the works, the greater the potential for impacts. The most significant environmental impacts are likely to be confined within 50-100m of the proposed development. Some impacts such as air quality and traffic may have a wider study area, and these are considered as part of the respective specialist assessments that have informed the assessment as part of this chapter.

Where population or human health information is not specifically available for these defined areas, information relating to the Wexford Town and/ or environs is relied upon. The study area also includes the marine environment of Wexford Harbour in terms of potential for economic impact relating to boating and tourism from the proposed development. The extent of the study area is shown in Plate 6.1.

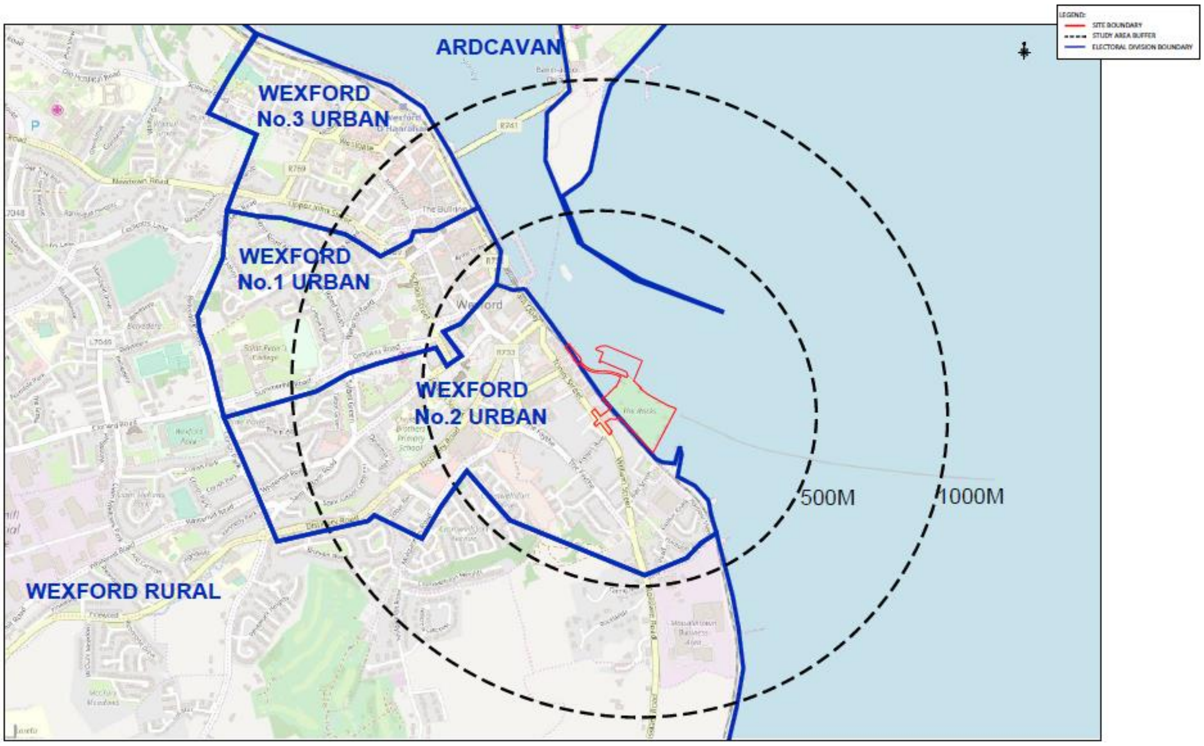

Plate 6.1 Study Area

6.2.3 Data Collection Methods

The data collection methods include primary and secondary data collection. Initially, a desk-based assessment determined the existing receiving environment (in terms of population and human health), including the existing population, economic activity in the area, employment, community infrastructure, tourism and recreation amenities. Topographical maps and Google maps have also been used to inform and validate the baseline description and local knowledge of the area. Analysis of existing demographic and health data to build up a community profile has also been completed.

6.2.4 Data Sources

The population and human health assessment requires an understanding of the community and characteristics of the area. Data sources consulted include:

- Population, demographic and health data from sources to include:
    - Census 2016 and 2011 from by the Central Statistics Office (CSO); GeoDirectory (Q1 2016 data), Map viewer of the Valuation Office of Ireland; Failte Ireland; Planning search of recently submitted and granted planning applications for development in the area; and
    - Pobal, the Institute of Public Health (IPH) and the Health Service Executive (HSE);
- Other relevant environmental data collated during the various environmental assessments, particularly traffic, noise, air and climate, water, land and soil and landscape and visual impacts;
- Ordnance Survey of Ireland aerial photography;
- Observation of local settlement and travel patterns and the location of community facilities and businesses during site visits; and
- Consideration of issues raised during public consultations.

A range of strategic planning guidance documents and technical reports were reviewed as part of the assessment process. The following presents a list of the key documents reviewed:

- Project Ireland 2040 – National Planning Framework (Government of Ireland 2017);
- Project Ireland 2040 National Development Plan 2018-2027;
- Regional Planning Guidelines for the South-East Region 2010-2018;
- South East Economic Development Strategy (SEEDS) 2013-2023;
- South East Action Plan for Jobs 2015-2017;
- Wexford County Development Plan 2013-2019;
- Wexford Town and Environs Development Plan 2009-2015 (as extended);
- Wexford Local Economic and Community Plan 2016-2021;
- Wexford Quay Economic Development and Spatial Implementation Plan; and
- Joint Housing Strategy 2013-2019.

6.2.5 Consultations

A public consultation event was held on Friday 5th September 2018 in the Talbot Hotel, Wexford Town. A total number of Feedback relevant to population and human health assessment was considered as part of this assessment.

A total of 34 submissions were received from the general public during this period, the majority of which were positive. However, some submissions also included concerns. They key issues are summarised in Section 1.6 of this EIAR.

In some cases, the consultation process has resulted in design changes and/ or agreement of appropriate mitigation measures as part of the design of the development. Where relevant, this mitigation has been integrated into this assessment.

6.2.6 Population Impact Assessment Categories

6.2.6.1 Overview

The purpose of the population assessment is to identify the likely significant impacts as they might affect users of the proposed development and the local community. It usually follows that impacts of a population and human health nature are a function of:

- The location and character of the local environment;
- The sensitivity of the local population and its capacity to absorb change;
- The nature of the environmental effect;
- The scale or extent of the effect in terms of area or population affected;
- The duration and frequency of an effect; and,
- The probability of an impact's occurrence and possibility of effectively reducing the effects through mitigation.

Impacts result from direct, indirect, secondary and cumulative effects on existing environmental conditions. Effects can be *positive, neutral* or *negative*. The significance of an effect depends on, among other considerations, the nature of the environmental effect, the timing and duration of an effect and the probability of the occurrence of an effect. The significance of an effect is described as *imperceptible, slight, moderate, significant*, *very significant* or *profound*. The impacts may be short-term, medium-term or long-term. The duration of an effect may be *momentary, brief, temporary, short-term, medium-term, long-term, permanent or reversible* in accordance with the timescales detailed in Table 6.2. The frequency of that effect can also influence significance i.e. if the effect will occur once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually. For example, disruption to road for a few hours could be described as having an *imperceptible, negative, brief* impact versus the complete closure of a road for a number of months which could be described as a *very significant, negative*, *temporary* impact.

The population and human health assessment addresses impacts at a community level rather than for individuals or identifiable properties, although impacts for individual properties are discussed where these are significant or located within close proximity to the proposed development, as appropriate.

This EIAR is focused on providing a clear documentary trail of analysis used to arrive at conclusions. The criteria used to describe the predicted effects across land use and social considerations including journey characteristics, journey amenity, general amenity and economic impacts is outlined in Table 6.2 (taken from the EPA Guidelines, 2017).

Table 6.2 Criteria Used to Describe Population Effects (adapted from the EPA, 2017)

Quality of Effects	
Positive	A change which improves the quality of the environment.
Neutral	No effects, or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative	A change which reduces the quality of the environment.
Describing Significance of Effects	
Imperceptible	An effect capable of measurement but without significant consequences on population.

Not Significant	An effect which causes noticeable (*Note 1*) changes in the character of the population environment without affecting its sensitivities.
Slight effects	A small effect which causes noticeable changes in the population and character of the environment without affecting its sensitivities.
Moderate effects	An effect that alters the character of the population environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the population environment.
Very significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the population environment.
Profound Effects	An effect which obliterates sensitive characteristics.
Describing the Extent and Context of Effects	
Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of the Effects	
Likely Effects	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
Unlikely Effects	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measure are properly implemented.
Describing the Duration and Frequency of Effects	
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects last less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years
Reversible effects	Effects that can be undone, for example through remediation or restoration.
Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hour, daily, weekly, monthly, annually).

Note 1: for the purposes of planning consent procedures

The relevant components of the population aspect of this chapter examines the attributes and characteristics associated with social considerations of the community. These components include land use change, journey characteristics and general amenity, severance, and economic activity including tourism e.g. employment including associated land use change as a result of the proposed development.

6.2.6.2 Land Use Change

Land use changes can affect populations in different ways. Planning policy plays an important role in guiding and facilitating approximate changes in land use which can influence settlement as well as transportation patterns. Planning policy ensures these changes are managed sensitively and are appropriate to the unique existing and emerging social, economic and environmental conditions. The primary consideration relating to land use change is to assess whether the proposed development conforms with land use policy and to identify if the proposed development is likely to change the intensity of patterns, types of activities and land uses. Therefore, a review of planning policy was carried out as part of this assessment as well as an assessment of the existing and emerging baseline and its capacity to absorb predicted changes.

6.2.6.3 Journey Characteristics

Journey length refers to the distance associated with a journey, whilst duration is the time taken to make the journey. Average walking speed for pedestrians is taken to be 5 km/h. Average cycling speed is assumed at 20 km/h. Impacts on journey amenity and community severance are described in Section 6.2.6.4. There are obvious interactions between these categories and with economic impacts and therefore the assessment is combined with positive impacts resulting from a decrease in journey length/ time and negative impacts resulting from an increase in journey length/time. In addition, new transport facilities can improve accessibility or connectivity through the combined effect of reduced journey time and reduced severance.

6.2.6.4 Journey Amenity and General Amenity

The assessment of journey amenity relies on the significance categories given in Table 6.2 and is supported by cross-reference where necessary with the relevant chapters. The level of traffic on a road, the proximity and separation of footpaths and cycle-paths, the nature of any crossings/junctions to be negotiated, the legibility of a journey (including signage), visual intrusion (including sightlines) and safety for equestrians, are amongst the factors relevant to the assessment of amenity, as are the number and types of people affected. The principal concern is with pedestrians and cyclists, but journey amenity impacts also apply to drivers; for example, due to safety and anxiety associated with the crossings of major roads. There are interactions, too, with the assessment of journey characteristics and community severance.

6.2.6.5 Severance

The definition of severance is not precise. Severance is an impact of transport infrastructure development such as roads or bridges. Its effect is to discourage community interaction and it occurs where access to community facilities or between neighbourhoods is impeded by a lengthening of journey time or by the physical barrier. For example, construction of a road can result in a physical barrier but can also create further severance affecting communities due to high traffic volumes or perimeter fencing.

The type of severance depends on the location of community facilities, the level of use of facilities, the time of day or duration when traffic conditions are experienced, the sensitivity of the population affected and the geographical spread of the community. Children, the elderly, the mobility impaired and people without access to a private car would be amongst those most affected by community or social severance and any corresponding loss of neighbourhood interaction or safety concerns caused by barriers such as roads and bridges. On the other hand, relief from existing severance may be provided by a new road or bridge where traffic volumes or speed are moderated, by the inclusion of crossing facilities in the design or through the presence of overbridges or underpasses. New severance is a negative impact that occurs when a barrier is created between people and community facilities.

Sensitive groups are identified specifically where they comprise a higher proportion of pedestrian journeys or where specific amenities are associated with these groups. Sensitive groups can include young and older population cohorts, the mobility impaired and people at risk of social isolation. Relevant facilities include schools, surgeries, hospitals, churches, post offices and shops.

Table 6.3 Criteria Used in the Assessment of Severance

Impact Level	Significance Criteria
Imperceptible	No noticeable consequences for journey patterns
Not significant	Some minor effects on connectivity but present journey patterns are maintained.
Slight	Slight effects on connectivity but journey patterns are maintained with some hinderance to movement.
Moderate	Moderate effects on connectivity. Some moderate hinderance to movement is likely to be experienced by some populations but journey patterns maintained.
Significant	Significant effects on connectivity i.e. changes could dissuade/ promote populations from making particular journeys or result in requirement for alternative route to origin and destination.
Very Significant	Very significant effects on connectivity i.e. dramatic changes could dissuade/ promote populations from making particular journeys or result in requirement for alternative route to/from origin and destination.
Profound	Profound changes to connectivity. Populations are likely to be required to completely alter journey patterns.

Relief from severance is a positive impact which can be defined in relation to existing severance. Relief from severance could follow from a transference of traffic from improvements to road design or sightlines, or from the introduction of crossing facilities, underpasses or bridges. Table 6.3 provides a guide to criteria used in the assessment of relief from severance. Where the assessment varies from these definitions due to the context in which the relief occurs, the reasons for the assessment are discussed in the text. Where there are implications for real and perceived safety, there are also potential interactions with journey amenity.

6.2.6.6 Economic Activity

Economic and employment impacts occur at both the regional and local scale and can be either positive or negative. Transport infrastructure is normally proposed with the intention of improving national competitiveness and economic/social linkages; for instance, in relation to improving access to areas, reducing journey time and improving journey time reliability for commercial goods, or for travel and commuting of tourists and the workforce. However, there can also be negative impacts in relation to loss of passing trade to businesses, car parks and those who rely on vehicular access which may be affected by transport infrastructure.

Economic impacts are assessed at a community level however development may affect identifiable local business. In this case, impacts on individual companies are discussed where relevant. Other economic impacts could affect the wider community, for example where a number of businesses are affected, tourism, or where the retail or business environment of a city or town is impacted.

6.2.7 Human Health Impact Assessment Categories

This section describes the methodology relating to the assessment of human health effects. Health, as defined by the World Health Organization (WHO), is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The United States Environmental Protection Agency (USEPA) Human Health Risk Assessment is a useful framework for considering potential human health impacts. It includes four basic steps to inform decision making detailed in Table 6.4

Table 6.4 Framework for Considering Potential Human Health Risk / Impacts, (Informed by USEPA)

Step 1 – Hazard Identification	Examines whether a stressor has the potential to cause harm to humans and/or ecological systems, and if so, under what circumstances. For example, in the case of transport infrastructure project one might consider an emission such as noise or air pollutants and examine its potential for harm.
Step 2 – Dose Response Assessment	Examines the numerical relationship (emission standards) between exposure and likely human health response/effects. For example, typically when the dose/emission increases the response/health effect increases. Some individuals may have a different dose response/ health effect than others e.g. vulnerable groups such as the old, very young or sick.
Step 3 – Exposure Assessment	Examines what is known about the frequency, timing, and levels of contact with a stressor (e.g. emission). For example, estimating human exposure to an emission/agent in the environment or estimating future exposure of an agent that has not yet been released/present in the future environment.
Step 4 – Risk Characterisation	Examines how well the data support conclusions about the nature and extent of the risk from exposure to environmental stressors. A risk characterisation conveys the risk assessor's judgement as to the nature and presence or absence of risks, along with information about how the risk was assessed, and where assumptions and uncertainties still exist. (This includes cross-referencing with the other environmental chapters of this EIAR).
Note: Informed by USEPA	

6.2.7.1 Significance of Health Effects

The assessment of significance relates to the identification and assessment of potential human health effects on the community. It does not assess effects on an individual basis. It is recognised that some individuals may have a different response to effects than others, this might include potential vulnerable groups, such as the elderly, very young or the sick.

The EPA Revised Draft Guidelines on the information to be contained in Environmental Impact Statement (August 2017) states, *"The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment."*

The significance criteria to assess human health effects is defined in Table 6.2 (as per EPA revised Guidelines). The quality of impact (*positive, negative or neutral*), the probability, duration and timing of effects that are used to qualify the type of human health impact are defined in Table 6.5.

Table 6.5 Criteria Used in the Assessment of Human Health Impacts (adapted from the EPA)

Impact Level	Significance Criteria
Imperceptible	An effect capable of measurement but without significant human health consequences.
Not significant	An effect which causes noticeable changes in the character of the environment without affecting the community human health sensitivities.
Slight	A slight/ small effect which causes noticeable changes in the reported symptoms of the population without affecting the community human health sensitivities (morbidity or mortality).
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging community's human health baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment affecting human health (morbidity or mortality).
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters **most o**f a sensitive aspect of the environment affecting the community's human health (morbidity or mortality).
Profound	An effect which changes a sensitive characteristic of the environment that profoundly affects the human health status of the community.

6.2.7.2 Health Based Standards

Health based standards are set by bodies such as the WHO and the European Union (EU). The standards are environmental health thresholds set for a range of environmental parameters to ensure no adverse health effects on the most vulnerable in society. For example, air quality and noise levels are set at levels to protect the vulnerable, not the robust (see Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate of this EIAR for the relevant standards). These standards are set to ensure scientific analysis (i.e. modelling) is undertaken on the baseline environment which includes an analysis of the likely changes in the receiving/baseline environment as a result of the proposed development to predict potential human health effects. This results in a level of certainty in relation to the potential effects (positive or negative) before a project is developed. This scientific analysis provides decision makers with a clear methodology outlining what information was used, data gaps and any assumptions that were made in order to provide a comprehensive assessment of impacts on human health.

Regardless of the methodology, psychological effects or well-being effects are difficult to measure as these effects are more subjective in nature. It must also be recognised that there are uncertainties in relation to assessing impacts on individuals due to availability of health data about individuals and the difficulty in predicting effects on individuals, which could be based on a variety of assumptions. Subsequently, the existing receiving environment and relevant health-based standards assessment are relied upon to arrive at conclusions relating to likely human health effects.

6.2.7.3 Identification of Vulnerable Groups

The population baseline characteristics or the community profile is required to inform the assessment of proposed development on human health and this informs the identification of potential vulnerable groups in the environment. Children and adolescents constitute a vulnerable group as they lack the experience and judgement displayed by adults. Studies also show that they may be more sensitive than adults to noise and air pollution and other environmental impacts.

Older people also constitute a vulnerable group, but this can vary depending on a number of factors including level of income, education, deprivation and individual preferences or genetics. However, an assumption can be made that older populations move slower than their younger counterparts, particularly when moving around in traffic and public places. Older persons are also more vulnerable to health conditions than their younger counterparts. Ease of access to medical and community facilities become very important in maintaining health and quality of life outcomes for all cohorts. Vulnerable groups in general have greater sensitivity to air pollution and potential effects on the respiratory system and cardiovascular system. There are many reasons for this, including the possible presence of other medical conditions such as respiratory or cardiovascular disease. Some subtle changes in the environment have the potential to have an adverse effect that would not be experienced by a younger more resilient person. Other vulnerable groups also include the mobility impaired or psychologically ill.

6.2.7.4 Hazard Identification

Human health impacts related to new developments can arise as a result of a variety of factors and interactions across environmental receptors e.g. incompatible land use changes, traffic accidents or safety issues, air and noise pollution, impacts on water quality, flooding, etc. which have the potential to cause a threat to the human health of populations and the wider environment. Therefore, all aspects of the environment influence human health to some degree or another.

A literature review was performed by Barton, H. and Grant, M. which identified recognised determinants of health and well-being in our neighbourhoods. The determinants of health and wellbeing are recognised as being complex and can be determined by a variety of social, environmental and economic factors, illustrated in Plate 6.2.

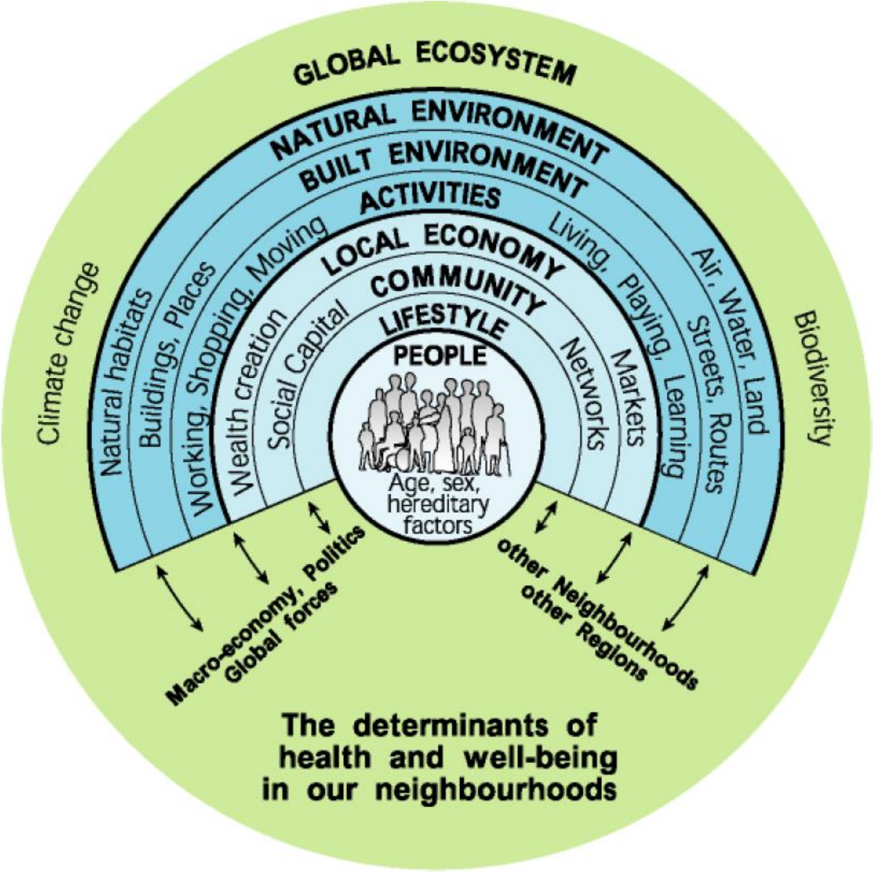

Plate 6.2 **The determinants of Health and well-being in our neighbourhoods (Barton, H. and Grant, M. 2006)**

Plate 6.2 illustrates the various potential influencers on health and well-being of neighbourhoods from a local to global level. It shows the individual or person at the centre whereby health can be influenced by age, sex, hereditary factors. The first three spheres are based around lifestyle factors such as; diet, exercise, social cohesion or community connectedness, availability or access to social services, and the local economy i.e. availability of money, employment etc. that can influence the support and maintenance of health. The next three spheres indicate that health determinants can be influenced by the built and natural environment which includes development process. The planning and design of the natural and built environment can influence how and where patterns of activity occur i.e. where/ how people live, work and recreate, etc. The next sphere is the influence that the global environment can have on our health such as the influence of climate change (flooding, extreme weather events affecting biodiversity or availability of food, etc), the impact of global political instability or war that can also impact on health outcomes.

A review from similar projects elsewhere identifies that there are four main hazards to human health that can be classified under physical, psychosocial, chemical and biological hazards and are summarised in Table 6.6.

Table 6.6 Four Main Hazards to Human Health

Physical Hazards	Psychosocial Hazards	Chemical Hazards	Biological Hazards
The main physical hazards identified are: • Noise (including nuisance/ disturbance, noise induced hearing impairment, interference with speech communication, sleep disturbance, hypertension and cardiovascular disease), • Vibration (including nuisance) • Air quality (including construction dust, carbon monoxide, fine particles, etc.), • Water quality (including effects due to contaminated land); • Soils (contamination of land); • Traffic – including collisions, injuries or worst-case fatalities); • Other physical hazards e.g. radon	The main hazards identified include: • Nuisance • Anti-social behaviour • Suicide	The main hazards identified include: • Heavy metals, • Contaminants.	The main biological hazards identified are: • Surface water and ground water (including water contamination) • Aspergillus (A fungi with potential for human health impacts) • Rodent-borne diseases e.g. Leptospirosis

6.2.7.5 *Impact of Emissions to Air*

Air quality is generally classified as good in Ireland. However, traffic is a key pressure on air quality and is the main cause of air quality problems in our larger towns and cities (EPA, 2016). Vehicles emit a range of air pollutants including nitrogen oxides (NOx), particulate matter (PM10 and PM2.5), black carbon and volatile organic compounds (VOCs) particularly present in urban areas and areas with high congestion levels. There are significant human health impacts from particulate matter (PM) and nitrogen oxides (NOx) emissions, which include cardiovascular disease, lung disease and heart attacks (EPA, 2015).

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU. In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Chapter 13, Table 13.1 and Appendix 13.1 Ambient Air Quality Standards of this EIAR). The Institute of Air Quality Management (IAQM) guidelines (IAQM 2014) for assessing the impact of dust emissions from construction and demolition activities based on the scale and nature of the works and the sensitivity of the area to dust impacts have been used in this assessment.

Asbestos

The term "asbestos" designates a group of naturally occurring fibrous serpentine amphibole minerals with current or historical commercial usefulness due to their extraordinary tensile strength, poor heat conduction and relative resistance to chemical attack. The principal varieties of asbestos are chrysotile, a serpentine material, and crocidolite, amosite, anthophyllite, tremolite and actinolite, which are amphiboles. According to the WHO "exposure to asbestos, including chrysotile, causes cancer of the lung, larynx and ovary, mesothelioma (a cancer of the pleural and peritoneal linings) and asbestosis (fibrosis of the lungs)" (WHO, 2014).

"Exposure to asbestos occurs through inhalation of fibres in air in the working environment, ambient air in the vicinity of point sources such as factories handling asbestos, or indoor air in housing and buildings containing friable (crumbly) asbestos materials (WHO, 2014)". The WHO go on to state that "*Exposure to asbestos, including chrysotile, causes cancer of the lung, larynx and ovary, mesothelioma (a cancer of the pleural and peritoneal linings) and asbestosis (fibrosis of the lungs).*"

The Health and Safety Authority (HSA, 2013) states that there are a number of determining factors to individuals developing an asbestos related disease, these include:

- **Asbestos type** (blue, brown or white);
- **Age** at first exposure (likelihood increases if exposure start young). The younger people are when they inhale asbestos, the more likely they are to develop mesothelioma;
- **Dose** (or number of fibres inhaled) **and duration of each exposure**, i.e. the more you are exposed to asbestos and the more fibres that enter your body, the more likely you are to develop asbestos related problems. While there is no "safe level" of asbestos exposure, people who are exposed more frequently over a long period of time are more at risk; and
- **Smoking** The Health and Safety Authority state, *"a smoker who inhales asbestos is fifty times more likely to develop lung cancer than a non-smoker who has not been exposed to asbestos."*

Bernstein et al (2013) report that studies have shown that *"low exposures to chrysotile do not present a detectable risk to health. Since total dose over time decides the likelihood of disease occurrence and progression, they also suggest that the risk of an adverse outcome may be low with even high exposures experienced over a short duration."*

6.2.7.6 Impact of Noise and Vibration Emissions

Noise

Noise is measured using the standard decibel scale (dB). An increase in 3dB means a doubling of the sound intensity in energy terms. However, the human ear does not normally perceive this degree of increase in volume. Normally, a 10dB increase in noise levels equates to a subjective doubling in audible sound.

According to the WHO, noise is the second greatest environmental cause of health problems, after air quality. Excessive noise can seriously harm human health, affect mental health and people's daily activities including in sensitive receptors such as residential properties, schools, workplace and during amenity or leisure time. EPA, 2016 states that "*noise can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour".*

EPA, 2016 also states that "*a study commissioned by the European Commission on the health implications of road, railway and aircraft noise in the European Union (RIVM, 2014) found that exposure to noise in Europe contributes to:*

- *about 910,000 additional prevalent cases of hypertension;*
- *43,000 hospital admissions per year;*

- *at least 10,000 premature deaths per year related to coronary heart disease and stroke*."

The assessment and management of noise from the infrastructural transport sources (roads, rail, and airports) are governed by the Environmental Noise Directive and associated 2006 Environmental Noise Regulations (S.I. 140 of 2006). A detailed methodology relating to the assessment of noise and vibration impacts is set out in Chapter 12 Noise and Vibration of this EIAR. There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project.

In lieu of statutory guidance, an assessment of significance has been undertaken as per Transport Infrastructure Ireland (TII), *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* – 2014 and British Standard *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise.*

The approach adopted calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 6.7 is replicated from Chapter 12 Noise and Vibration of this EIAR and sets out the values which, when exceeded, signify a significant effect at the façades of residential receptors.

Table 6.7 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period	**Threshold value, in decibels (dB) ($L_{Aeq, T}$)**		
	Category A^A	**Category B^B**	**Category C^C**
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends ^{D}	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

During the assessment period (i.e. daytime in this instance) the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur.

Table 6.8 presents the Design Manual Roads Bridges (2011) likely impacts associated with change in traffic noise level. The corresponding significance of impact presented in the '*EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR)' Draft, August 2017 is presented alongside this for consistency in wording and terminology for the assessment of impact significance.

Table 6.8 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant

The criteria in Table 6.8 above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

What determines the noise level significance is the amount of the exceedance. The other factor that needs to be considered is the baseline. If the change from the current baseline is 3dB or less, even if the absolute levels are above 55dB the change is likely to be imperceptible.

It is assumed that average noise levels in a building with windows open will be at least an estimated 15dB less than outside. Average sound inside a building with the windows closed can be greater than 35dB, depending on the building fabric. Accordingly, the attenuation can vary depending on the size of windows, building type and other factors. The potential health impacts due to noise include:

- Noise-induced hearing impairment;
- Interference with speech communication;
- Disturbance at schools;
- Sleep disturbance; and
- Hypertension and cardiovascular disease.

In terms of the health effects of environmental noise, there is some limited evidence of effects on blood pressure, cardiovascular risk, school performance and in relation to sleep disturbance. Any effects demonstrated are more likely at higher noise levels. Many effects are only demonstrated with ambient noise in excess of 70dB. Whilst noise levels are often quoted with respect to potential effects on health and they are used in the significance assessment, it should be noted that the differences in significance between the different levels are relative rather than absolute.

Vibration

People can generally perceive vibration at levels which are substantially lower than those required to cause building damage. The human body is most sensitive to vibration in the vertical direction. The effect of vibration on humans is guided *by BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings.* This standard does not give guidance on the limit of perceptibility, but it is generally accepted that vibration becomes perceptible at levels of approximately 0.15 to 0.3 mms^{-1}.

Vibration has the potential to have health effects when perceptible. These could include, for example, sleep disturbance. Another issue which is sometimes described is infrasound. The latter is sound but at a frequency so low that it is not audible to the human ear. If at high levels it may be perceived as vibration. These effects, in relation to vibration and infrasound, however, only occur when the levels are high and perceptible to human beings for example an underground train.

6.2.7.7 Impact of Emissions to Hydrology and Hydrogeology

Emissions standards and pathways that affect human health relating to hydrology and hydrogeology include water quality and flood risk. From a human health perspective these pathways are discussed below.

Water quality

Construction and operational (fuel spillages, etc) activities pose a risk to watercourses, particularly contaminated surface water runoff from construction activities entering the watercourse. Impacts to sources of drinking water are also sensitive and should be considered as part a human health issue in this context.

Flood Risk

Hydraulic structures such as bridges, culverts, channel diversions and outfalls can, if not appropriately designed, impact negatively on upstream water levels and downstream flows.

6.2.7.8 Psychosocial Impacts

Consideration of likely negative psychosocial hazards relating to new developments include nuisance, anti-social behaviour and suicide. On the contrary, there could also be positive psychosocial impacts on the community due to improved connectivity, particularly for pedestrians and cyclists and as a result of regeneration associated with land use changes and increased economic prosperity.

Demolition and property acquisition can also have impact on both the occupants themselves but also at community level due to impact on community ties and amenity of residents, local economy, etc.

6.3 Description of Receiving Environment

6.3.1 Introduction

The proposed development comprises a mixed-use development that will provide office, hotel, residential, car parking, cultural centre and small-scale retail uses in Wexford Town. The development will comprise a number of buildings, with an internal shared access route for cars, pedestrians and cyclists. A footbridge / cycleway will connect the northern corner of the site to Paul Quay, providing pedestrian and cycleway access to Wexford Town. A new marina, located to the north of Trinity Wharf, will provide space for approximately 64 berths.

The development is proposed to be undertaken in a number of phases as outlined in Chapter 4 Description of the Proposed Development of this EIAR and will be constructed over the course of approximately 80 months. An accurate assessment of the receiving environment is necessary to predict the likely significance of the impacts of the proposed development. The following paragraphs present an overview of the context, character, significance and identifies the types of population and human health receptors that could be sensitive to the proposed development within the study area.

Context

The proposed development is located on lands known as Trinity Wharf in Wexford Town, adjoining Wexford Harbour. The brownfield site is situated at the southern end of Wexford's Quays and comprises 3.6 ha. Wexford Town is identified as a 'key town' in the Draft South East Regional Spatial and Economic Plans (Draft SE RSES (2018)). The strategic location of Wexford Town in relation to Rosslare Europort has been identified as one part of the Wexford - Rosslare Europort change location, where the development of Rosslare and access routes to the port will be of national strategic importance for the state, particularly post Brexit.

Character

Wexford Town itself has a rich, historical and maritime past with an attractive coastal influence. The site of the proposed development and wider area was historically used for a mix of commercial uses, factories and as a fishing harbour interspersed with a network of residential streets which were home to local workers. It was a colourful and vibrant area where people lived and worked. When these traditional industries closed (including the harbour and factory on the proposed subject site), service related businesses gravitated towards more central areas and larger commercial developments towards greenfield sites and outer business parks. The relative vibrancy of the area was diminished, and the beginnings of dereliction and vacancy became apparent.

At the same time there was a movement of young families to the newly developed suburbs facilitated by increased car ownership. Residential vacancy has become an issue in the area 95 of the 549 housing units in the five Small Areas (SA) in and adjoining the site are vacant. The area also suffers from disadvantage. The haase-pratschke (HP) Deprivation Index for the SA within which the site is located is -10 (compared to the State 0.06). The SA adjoining the site SA to the south has a score of -26. The site itself, since its dereliction, has been subject to a level of anti-social activity and environmental degradation.

Significance

Wexford is the principal town in County Wexford and is identified as a 'key town' in the Draft South East RSES in the South East region. In the 2016 Census, Wexford Town had a population of 20,188 which represented a very small increase (116 persons) since the 2011 census period. It is a regional centre of focus for education, retail, health and public services. Wexford is an important base for tourists and is located in 'Ireland's Ancient East'. The town has a vibrant arts and cultural sector with the National Opera House and Wexford Arts Centre located in the town. It also hosts various annual festivals. It has many attractive and extensive beaches and unparalleled coastal landscapes.

The National Spatial Strategy designated Wexford town and Kilkenny town as 'hub' towns to support Waterford City 'Gateway', forming a national 'growth triangle' in the

South East region. The continued development of Wexford Town will, in turn, seek to energise smaller towns and rural areas within its influence and is of strategic importance to the development of the South East region. This site of the proposed development is recognised as a strategic opportunity site in Wexford Town Development Plan 2013-2019. Therefore, the site is deemed to be a significant and important site in the development and regeneration of the town.

Sensitivity

The proposed development is located on a brownfield site in an existing urban environment with a long history of industrial and manufacturing development. The surrounding land uses are mainly retail warehousing deemed to have a low sensitivity to land use change. There are also low-density residential properties located on Trinity Street. Furthermore, these properties are influenced by traffic, air and noise emissions due to their urban location. Therefore, they are deemed to have a moderate sensitivity to change and would be capable of absorbing changes due to their urban location. The neighbouring residential and economic operators are likely to be the most sensitive receptors in the area together with Wexford Harbour's marine environment which is a sensitive ecological and amenity area. It is considered that due to the location of the site, previous land uses and current urban forces acting on the area i.e. traffic consistent with an urban environment the site has a low sensitivity to change.

6.3.2 Land Use and Social Considerations

The proposed development is comprised of two distinct land use areas:

- Wexford Harbour marine environment, which is a navigational channel and source of recreational, ecological, amenity and economic value; and
- 3.6 ha of a brownfield site known as Trinity Wharf.

The 3.6 ha reclaimed land site was the location of a range of industrial/ manufacturing related land uses dating back from the 1800s. It has been disused since 2001 following the closure of a manufacturing business and is now a vacant site, partly overgrown with most of the former structures demolished.

The land uses adjoining the site include Wexford Harbour marine environment along the west, north and eastern boundaries. The northern and eastern boundary of the site is Wexford Harbour marina environment which is primarily used as a navigational channel. Goodtide Harbour is located approximately 50m south of the site and is an area where small leisure craft can moor haphazardly along the coast. Wexford Harbour itself is located approximately north west of the site.

The southwestern boundary is bounded by the Dublin to Rosslare railway line running in a north-south direction along the site's south-western boundary. Retail warehousing adjoins the site and a number of residential dwellings which line Trinity Street also run in a north-south direction.

There is currently no permissible pedestrian access into the site and no public rights of way. However, there have been reports of anti-social behaviour occurring within the site of the proposed development. The site is currently fenced off from all access.

The need for the development is in order to revitalise Wexford Town, support the growing need for high-quality mixed-use development, particularly in the growing office, commercial, residential and tourism sectors and provide a stimulus to the existing and future economic development in Wexford Town.

There is an existing wayleave between Trinity Street and the Trinity Wharf site at the existing level crossing.

6.3.3 Planning Policy Overview

The policy review in Chapter 2 of this EIAR has shown that the proposed development aligns with national, regional and local planning policy. This section provides an overview of the key planning and land use considerations and how planning policy is likely to influence existing and future land use and social considerations in the area.

At a strategic level national planning policy is directed by the National Planning Framework which was published in 2018. The National Planning Framework aims to regenerate existing cities and towns and encourage sustainable development and job creation across the regions. The Draft South Eastern RSES identifies Wexford Town as a "key town" in the hierarchy of settlements and recognises that it has a wide zone of influence. It also states that "key infrastructure requirements" include "investment to support development of Trinity Wharf as a Strategic Employment Location."

The development land use zoning map is included in Figure 2.1 in Volume 3 of this EIAR. The site is included within a large area zoned for 'town centre' uses of which the proposed land uses are consistent. The area is also adjoining an ecological designated and sensitive area; the Wexford Harbour and Slobs Special Protection Area (SPA) and Slaney River Valley Special Area of Conservation (SAC).

6.3.4 Population

The CSO census 2016 reported that the total population of County Wexford has increased by 3% from 145,320 in 2011 to 149,722 in 2016. In 2016, Wexford Town had 20,188 persons representing only an increase of 113 persons since the 2011 census. The total population in the ED of Wexford No. 2 Urban, the location of the proposed development was 4,087, of which males numbered 2,025 and females were 2,062.

The Draft SE RSES (2018) population projections for County Wexford indicate that the county will increase from 149,000 persons in 2016 to between 169,000-172,500 persons to 2031, a projected increase of between 20,000-31,000 persons over a 15 year period in 2031. Wexford Town is identified as a key settlement that has substantial existing supporting infrastructure and as such is well placed to attract additional population in a sustainable manner. The proposed development is aimed at making Wexford Town and this area of Wexford Town more attractive to investors and as a place to live, work and visit.

Wexford Town urban area is made up of three EDs, namely; Wexford No. 1 Urban; Wexford No. 2 Urban and Wexford No. 3 Urban (Refer to Figure 6.1 Volume 3 of this EIAR). The proposed development is located in Wexford No.2 Urban, census 2016 report that this area had a population of 4,126 persons in 2016 and a deprivation score of -11.3. This was the highest deprivation rate of the three Wexford Town EDs in 2016.

Table 6.9 Population Change in the Study Area (Census, 2016, 2011)

Electoral Division in Study Area	Population 2016	Population 2011	% change 2011-2016
EDs within 500m			
Wexford No.2 Urban	4,079	4,126	-0.01%
Wexford No.1 Urban	1,613	1,581	0.04%

Electoral Division in Study Area	Population 2016	Population 2011	% change 2011-2016
Wexford Rural (pt.)	12,505	12,085	0.04%
Wexford No.3 Urban	1,243	1,321	0.01%
EDs within 1km			
Ardcavan	2,841	2,758	0.06%
County			
Wexford Town	20,188	20,072	0.06%
Wexford County	149,722	145,320	3%

Table 6.9 above demonstrates that significant population increases have primarily been experienced in the rural ED outside of Wexford Town's urban areas. Wexford No.2 Urban (site of the proposed development) declined by -0.01% with Wexford No.1 Urban only increasing by 0.04%. Consistent and significant population increases have occurred in areas outside Wexford Town such as in Ardcavan ED. This a trend that is representative of the national situation, with declining populations in existing urban areas. It also emphasises the need to support the regeneration of existing urban environments in order to capitalise on existing infrastructure costs and create attractive environments for people to live and work.

6.3.4.1 Age Profile and Dependency Ratio

Wexford Town has a relatively equal age distribution across the age bands from the ages 0 to 65 years of age. 13% of the population is between the age of 0-9, 12% is between 10 to 19 years of age, 20% is between 20-34 years of age, 22% are aged between 35-39 years of age and 18% are aged between 50 and 64. 15% are aged 65 to 84 years, with only 2% aged 85 or over. This illustrates that 65% of the population (19 – 65 years of age) are of working age according to census 2016.

The average age in Wexford was 38.1 in 2016 which is up from 36.5 in 2011. The average age of the population of the State in 2016 was 37.4 which is up from 36.1 in 2011. This is a rise of 1.3 years. People in Ireland and western society in general are living longer lives.

The age dependency ratio is the age population ratio of those typically not in the labour force (0-14 and 65+) and those typically in the labour force (15-64). It indicates the pressure on the productive population to support services for younger and older age cohorts. Wexford County Council's demographic profile, based on census 2016 and AIRO data, reports that the youth dependency ratio is 28.9 lower than the national average of 32.3. The old dependency ratio is 25.1 significantly higher than the state average of 20.4. This indicates that there is a significant proportion of the population dependant of all ages (young and old).

Pobal data from census 2016 indicates that the age dependency ratio for the Wexford Urban No.2 is high at 33.41 (for all ages) in 2016. This is an increase from the 2011 census figure of 32.84. This indicates that there is currently pressure, and a higher potential for pressure to occur, on the productive population to support the younger and older age groups both now and in the future. It also suggests that there will be increased need for, and pressure on, a range of services including medical, educational and amenity services that will be required to serve the needs of the population.

6.3.5 Households and Household Formation, Vacancy

Census 2016 revealed that the national average number of persons per household recorded an increase for the first time since 1966 with an average of 2.75 persons per household in 2016. This is an increase from the average 2.73 persons per households in 2011.

In 2016, the total number of housing stock was 8,030 private households, of which vacant households (excluding holiday homes) was 990 (CSO, 2016b) in Wexford Town. Of this, 1,757 houses are in Wexford No. 2 Urban of which vacant households (excluding holiday homes) numbered 346 (CSO, 2016a).

The majority of the housing stock in Wexford Town are houses/ bungalows (7,002 units). The next largest type are flat/ apartments (917 units) according to CSO, 2016b. Most of the housing stock ranges between 4 rooms and 6 room properties (total of 4,922 households), indicating that there is likely to be a need to accommodate the smaller households' sizes (2.75) such as what is proposed in the proposed development (1, 2 and 3 bed apartments). There were 167 unoccupied holiday homes in Wexford Town on census night 2016. Holiday homes make up 9.7% (6,629) of the total housing stock in County Wexford.

The number of households built in the years 2001 to 2010 in Wexford Town was 1,810. Over the same period, 17,414 units were built across County Wexford which represents 32.2% of the total households. This rate is higher than the State (25.4%), the Southern RA (25.7%) and South-East SPA (28.6%) averages according to AIRO, 2018. A significant portion of the housing stock in Wexford Town was built between 1980 and 2010 (3,999 units), with only 91 housing units built between 2011 or later (Census, 2016). This signifies that there is likely to be a demand for modern housing stock that caters to the needs of the changing populations needs i.e. smaller household sizes.

However, in contrast there is a high vacancy rate in Wexford Town with 35% of the stock in long-term vacancy in 2016. 37.3% of these were detached houses (AIRO, 2018). County Wexford had a vacancy rate of 8.7% which is marginally below the State average of 9.1% (Census 2016).

Wexford Town has 2,806 households with no mortgage, 1,104 households are private rented local authority housing. Approximately 36% of the households (2,929) are rented accommodation, either rented from a private landlord and local authority or voluntary body (Census, 2016b).

The Wexford County Development Plan 2013-209 states there is a requirement of 6,609 households during the lifetime of the County Development Plan 2013-2019. The Draft RSES indicated that there will be continued population increases in the South East region up to 2031 and developments such as the one proposed are aimed at regenerating existing settlements and ensuring Wexford Town receives investment and the appropriate employment opportunities that would attract people to live and work in existing urban centres such as Wexford Town.

6.3.6 Education

Wexford Town has 14,106 persons aged 15 years and over whose education has ceased. The majority of this cohort have attained primary and secondary education, 880 persons in Wexford Town have attained postgraduate Diploma or Degree with a further 69 persons attaining a Doctorate (Ph.D) or higher form of education (CSO, 2016b). There were 1,381 persons aged 15 years and over still at school or college and 916 persons in some other form of education in Wexford Town (CSO, 2016b). Within the Wexford Urban No. 2 ED, 2,992 of the population aged 15 years education has ceased. 287 people (aged 15 years and over) are still in school or college and 210 persons are in some other form of education. The most common level of education is that of lower secondary level (23%), whilst a further 20% have attained upper secondary level of education. 5% of Wexford Urban No. 2 ED have attained an ordinary bachelor's degree or national diploma whilst 6% have attained an honours bachelor degree (CSO, 2016a).

6.3.7 Community Infrastructure

Community infrastructure can include a range of physical, social and economic infrastructure. It can comprise of places where people can relax and enjoy public spaces such as parks or walking paths. There are a wide range of community and social services available in Wexford Town and its environs. These include educational and religious facilities as well other community facilities such as medical centres, youth clubs and sport centres.

Within close proximity to the site includes: Abacus Montessori School which is located approximately 300m west of the site. St. John of God School, Curran medical centre and South End Family Resource Centre are located approximately 200m west of the site. There are also a range of hotels, B&Bs and guesthouses located in the area. Wexford Garda Station is located approximately 500m west. Wexford Opera House, Wexford Harbour and Paul Quay car park are also located north west within 500m of the site and are deemed to be significant community infrastructure. Other notable land uses in the area include Tesco and Aldi retail services and various carparks in the area including Paul Quay car park. Significant social and community facilities are illustrated in Plate 6.3 below and Figure 6.2 of Volume 3 of this EIAR.

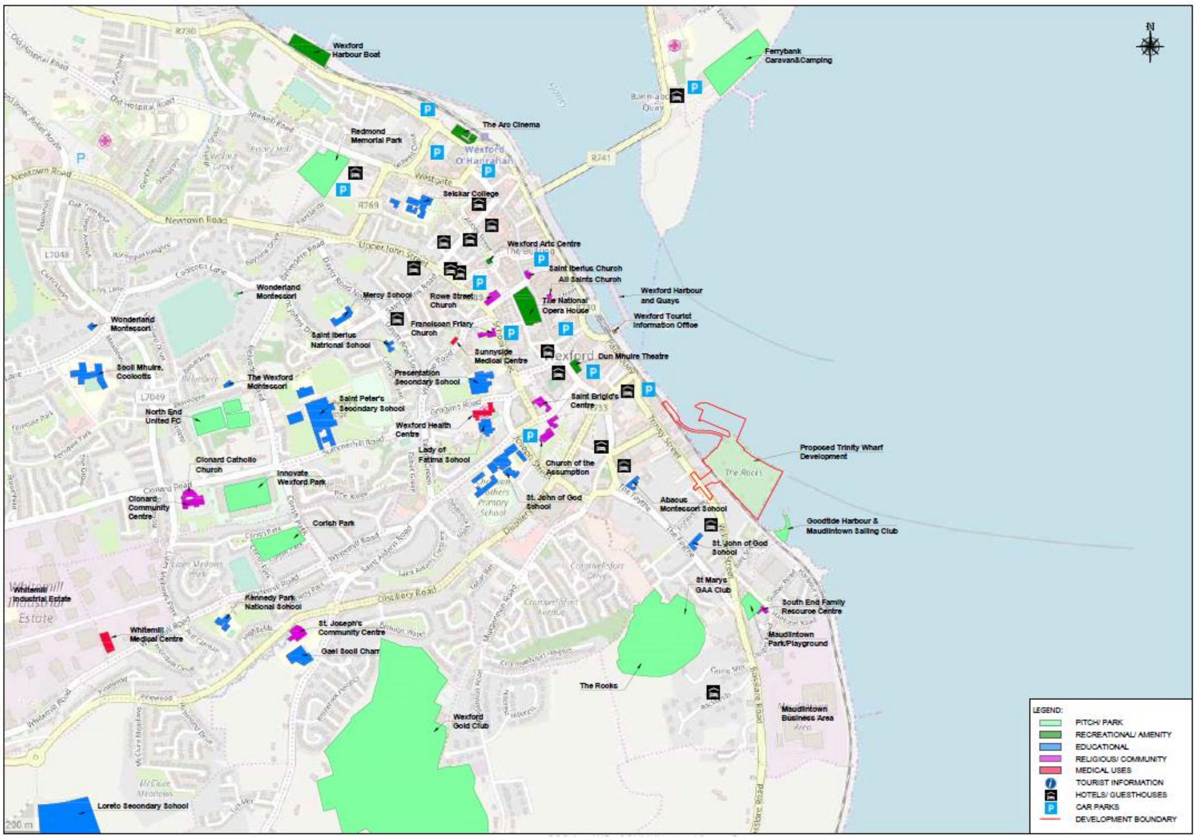

Plate 6.3 Social and Community Facilities within Study Area

Educational Facilities

A significant part of the local community infrastructure is educational facilities. These vary in Wexford Town from early education to third level education i.e. IT Carlow's Wexford Campus is located approximately 1.6km away from the proposed development. The following educational facilities exist within 500m of the proposed development:

- St John of God School; and
- Abacus Montessori School.

The following education facilities exist within the wider study area:

- St Brigid's Community Playgroup (500m);
- Naionra Irish Pre School (1km);
- Lady of Fatima School (700m);
- CBS Primary School (770m);
- Wexford CBS Secondary School (500m); and
- Presentation Secondary School (790m).

Outside of the study area:

- County Wexford School of Music (1.2km)
- Wexford Campus IT Carlow (1.2km)
- Mercy school (1.2km)
- Saint Peter's College Secondary School (1.3km)
- Kennedy Park National School (1.7km) Loreto Secondary School (2km)
- Educate together (2km)

Transport Infrastructure

Transport facilities are also considered important community infrastructure. The Fisher's Row bus stop is located 55m south of the proposed access on Trinity Street and is served by the WX1 bus route, servicing Clonard Village to Drinagh Business Park. The Trinity Street bus stop is located 270m north of the proposed site access and is served by a number of bus routes locally and regionally detailed in Chapter 5 Traffic Analysis of this EIAR. Within 1.5km or an 18 minute walk is Wexford (O'Hanrahan) Train Station and Wexford bus station which services Rosslare Europort and Dublin among other routes. Although there are cycle lanes provided on both sides of the Rosslare Road for 2.5km, there are no dedicated cycle facilities along Trinity Street (refer to Chapter 5 of this EIAR). There are two existing marinas to the north of Wexford in Arklow and Greystones and two existing marinas to the west of Wexford in Kilmore Quay and New Ross. Wexford Harbour is also considered to be a significant transport infrastructure and is used on a commercial basis by local fishing vessels. It is also considered to be a key public amenity for residents and visitors to Wexford Town.

There is a wide variety and availability of existing transport infrastructure and services located within close proximity to the proposed development (walking, cycling, bus and rail services) as described in this section and Chapter 5 of this EIAR. The availability and choice of transport modes supports the principles of sustainable land use and travel patterns. The proposed development will also facilitate improvements in transport infrastructure, particularly for walking, cycling and mariners as a result of the integrated nature of the site layout, construction of a new boardwalk structure and the marina development and connectivity to wider infrastructure across the area.

6.3.8 Economic Activity

According to Census 2016, County Wexford is home to 3.1% of the population of the State but 4.5% of those are on the Live Register. Census 2016 shows that Wexford had the fifth highest rate of unemployment in the country. The South East Economic Monitor (Waterford Institute of Technology (WIT) July 2018) states that Wexford receives less than its fair share of Industrial Development Agency (IDA) jobs. "*From 2011-16 the IDA created 51,793 net jobs. Wexford accounted for a mere 0.47% of these net additional jobs despite being home to 3.14% of the Irish population and Wexford currently accounts for a mere 1.31% of IDA jobs*." It goes on to state that "*there is also evidence of low job quality as the returns for taxes on work (PAYE, USC, and self-employed taxes) in Wexford are 41% of what one would expect based on population share"* (WIT, 2018)

Census 2016 indicates that the distribution of socio-economic groups in Wexford Town is dominated by Managerial and Technical (4,605 persons) and "non-manual workers" (4091 persons). There is also nearly equal level of skilled manual workers and semi-skilled workers in the study area at; 2,833 and 2,760 respectively.

6.3.8.1 Employment

The labour force consists of those who are able to work i.e. those aged 15 and over and out of full-time education and performing duties that prevent them from working (e.g. carers). According to 2016 Census results, Wexford Town had a 58.5% labour force participation rate or 9,602 persons (AIRO,2018). 2016 Census reports the unemployment rate in County Wexford was 16.6% (11,478 persons out of a labour force of 69,237). The national average unemployment rate was 12.9%. In 2016, County Wexford had the fifth highest rate of unemployment in the country with 4.5% of those being on the Live Register.

Census figures for 2016 are provided in Table 6.10 below which provides a breakdown of the population employed in Wexford Urban No. 2 by social class. The majority of the workforce are engaged in 'Non-manual' work (24%), followed closely by those engaged in work under 'gainfully occupied and unknown' (20%).

Table 6.10 Persons in Private Households by Socio-economic Group of Reference Person

Socio-economic Group of Reference Person	Households	Persons	Percentage
A Employers and Managers	154	365	9%
B Higher Professional	48	98	2%
C Lower Professional	129	281	7%
D Non-manual	410	930	24%
E Manual skilled	167	409	10%
F Semi-skilled	237	575	15%
G Unskilled	153	339	9%
H Own account workers	63	133	3%
I Farmers	5	14	0.3%
J Agricultural Workers	5	13	0.3%

Z All others gainfully occupied and unknown	386	799	20%
Total	**1757**	**3956**	

Table 6.11 indicates that the majority of the workforce of Wexford Urban No. 2 are engaged in 'Other' industries (27%). The second largest industry is the 'Commerce and Trade' sector which engages 25% of the population, followed by 'Professional services' which accounts for 22% of the population. Only 4% are employed within the 'Building and construction' industry and it is likely that this number could increase during the construction stages of the proposed development.

According to Census 2016, the majority of Wexford Town's total persons employed was in the 'Commerce and Trade' industry at 25.7%, 'Professional Services' followed at 23.4%, 'Manufacturing Industries' was 10.7%, 'Public Administration' was 6.1%, 'Transport and Communications' was 5%, 'Building and Construction' was 5% with only 1% employed in 'Agriculture, Forestry and Fishing Industry' (AIRO, 2018). In contrast County Wexford has a higher than average dependency on the traditional industrial sectors when compared with the State average, i.e. the 'Agriculture, Forestry and Fishing' industry 7.5%, 'Building and Construction' (6.9%) and 'Manufacturing Industries' (12%) are all higher than the equivalent State average (AIRO,2018). Consequently, these figures would suggest that the population employed in these industries in the study area most likely reside in other settlements or in the town's rural hinterland.

Table 6.11 Persons at Work by Industry and Sex (Wexford Urban No. 2, Census 2016)

Industry	Male	Female	Total	Percentage
Agriculture, forestry and fishing	15	0	15	1%
Building and construction	58	5	63	4%
Manufacturing industries	126	30	156	10%
Commerce and trade	164	205	369	25%
Transport and communications	63	23	86	6%
Public administration	37	43	80	5%
Professional services	105	224	329	22%
Other	201	195	396	27%
Total	**769**	**725**	**1494**	**100%**

6.3.8.2 Unemployment

In 2016, at Social Welfare Office (SWO) level, Wexford Town (3,534) had the highest number of Live Register recipients in the County. Of the recipients aged under 25, Enniscorthy has the highest rate at 13.9% and Wexford had the lowest rate at 10.8%. The State average rate was 12.6%. (AIRO, 2018).

Analysis of Census data indicates that all three of the Wexford Urban EDs have high rates of unemployment. However, the location of the proposed development (Wexford No.2) had the highest levels of unemployment of the three EDs with a rate of 26.75. This figure has decreased significantly since the 2011 Census figure of 39.39% (Pobal, 2016).

6.3.8.3 Retail Activity

In terms of retail activity there are a number of mainly large-scale retail warehousing properties located close to the site on Trinity Street, these include McMahon Building

Suppliers, Trinity Motors (Land Rover and Range Rover motor sales), Meylers Tyres, Maxol Service Station (that sells fuel only by automated pumps) and Aldi. These properties are all located west of the site, within 20m -150m of the proposed development. There are a limited number of other commercial or retail units on Trinity Street with the area mainly characterised by residential uses or vacant properties.

Tesco Extra is located approximately 300m west of the site and the Talbot hotel is located approximately 300m from the site of the proposed development.

Wexford Town centre is located within 300m to 1km of the proposed development. The town centre itself has an attractive townscape of winding streets and a range of quality shops and retail offer with pedestrianised streets.

6.3.8.4 Tourism

Wexford is the geographic cornerstone of Fáilte Ireland's 'Ireland's Ancient East' and tourism is a significant contributor to Wexford's local economy. Failte Ireland (2016) report that Wexford experienced a 27% increase in tourism numbers and a 20% growth in revenue earned from tourism since 2013. Their report relates to 2015 figures and within that year 221,000 overseas tourists visited Wexford leaving an economic impact of €65 million. Additionally, there was a total of 679,000 domestic tourists visiting Wexford which had an economic impact of €140 million for the county.

The South East region attracted a total of 2,194,000 visitors in 2015, with Wexford accounting for 41% of this total number. Total revenue for the South East region in 2015 was €506 million, with Wexford earning 40% of this at €205 million. This highlighted just how important tourism is to the area.

Within Wexford Town, tourist attractions include Selskar Abbey, the National Opera House and Wexford Harbour. There are a number of supporting services within the area including hotels as discussed below, as well as award winning restaurants, a tourism office and public toilets.

There are a number of tourist attractions located further away from the town centre across the county. However, Wexford Town still reaps in the benefits of such attractions, due to the hotels on offer here in a central location facilitating ease of access to the rest of the county. The Talbot Hotel, Clayton White's Hotel and a number of Bed & Breakfasts accommodate tourists who visit elsewhere such as The Hook Lighthouse and Tintern Abbey as well as the numerous beaches such as Curracloe beach. It is likely that tourism will increase with the proposed development including a new hotel, a new marina and arts/ cultural space.

6.3.9 Human Health Profile

In census 2016, the majority of Wexford Town's population reported that they had very good or good health, 55% and 29% respectively. 2% stated that they had bad and/ or very bad health. Census 2016 indicates that there was a total of 3,658 persons with a disability and 796 carers in Wexford Town.

The Lenus profile 2015 for County Wexford was consulted in order to inform a human health profile for the area. The key facts for the area include:

- There was a high birth rate to females aged 20 and under. Rate per 1,000 of the population in Wexford was 16.7 versus nationally 12.3 between 2007-2012;
- Incidence rates for all cancers are lower or close to the national rate, except for female malignant melanoma which is highest nationally;
- Death rates for all causes and all ages are above the national average.

- Suicide rate of 15.9 is higher than the national rate of 11.3 (2007-2013); and
- Immunisation uptake at 24 months and measles mumps rubella (MMR) are higher than the national rates at 97%.

It also confirms that the county is marginally below affluence.

The highest rate of deaths per 100,000 for the four principal causes of death over the period 2007-2012 for all ages compared to Ireland are illustrated in Plate 6.4 below. From this it is clear to see that the highest rate of death is attributed to heart disease and stroke, followed by cancer and respiratory disease, injury and poisoning.

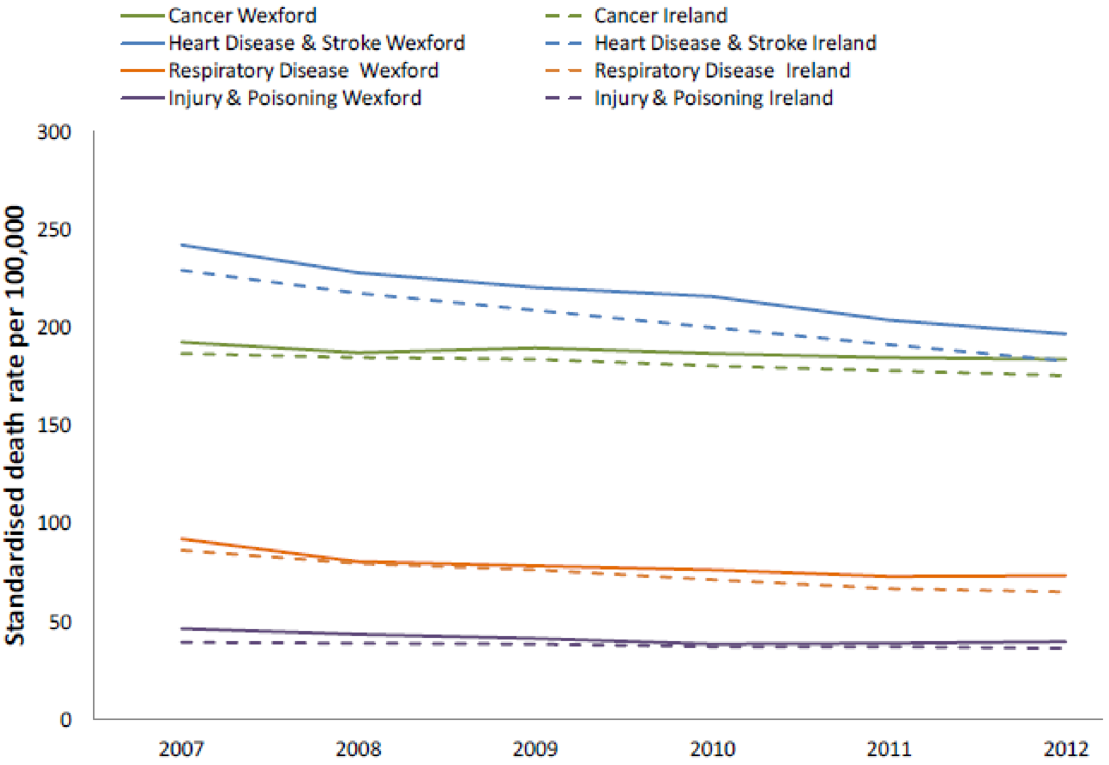

Plate 6.4 **The highest rate of deaths per 100,000 for the four principal causes of death over the period 2007-2012 for all ages compared to Ireland (Lenus, 2015)**

6.3.9.1 Levels of Deprivation

The HP deprivation index looks at geographical areas in order to measure the relative affluence or disadvantage of a particular geographical area. These are compiled from various census under 10 key indicators including the proportion of skilled professionals, education levels, employment levels, and single-parent households found in an area. This data is particularly useful in assessing predicted health outcomes. Overall, the South East region of Ireland is the second most disadvantaged region in the country.

Wexford Town is classified as predominantly 'marginally below average' with 'marginally above average affluence' areas located predominantly outside Wexford Town administrative boundary. As already stated, Wexford Urban No. 2 has a HP deprivation score of -11.29 significantly higher than the average deprivation score for the County which is -4.81. Wexford Urban No. 2 is classified as 'disadvantaged'. Wexford Urban No. 1 has a score of -7.19 and Wexford Urban No. 3 is -5.40.

6.3.9.2 Travel to Work, School or College

The 2016 CSO census Small Area Population Statistics (SAPS) was analysed for the settlement of Wexford to ascertain the modes of travel used when travelling to work. The Census data is detailed in Chapter 5 (*Plate 5.12: Travel Modes Chart – Settlement of Wexford).* This data shows a high dependency of single occupant vehicles as a mode of transport with 63% of people in Wexford Town driving to work by car or van while 5% travel as a passenger. The data shows 17% walk to work, 2% cycle and 2% use public transport. Further analysis of this data shows that journey times for the majority of the population is under 15 minutes. This data could correspond with national trends in high rates of private car use which could also be attributed to increasing sedentary lifestyles which can be attributed to health outcomes such as rising obesity levels nationally. The Road Safety Authority reports on collisions across Ireland. There has been a total of 3 collisions on Trinity Street and William Street Lower between 2005 and 2014, all of which were minor injury rear end collisions.

6.3.9.3 Noise Environment

Day time and evening time noise surveys were undertaken in two locations to inform this assessment and are detailed in Chapter 12 of this EIAR.

The Mean Value of the L_{Aeq} parameter is considered representative of the Ambient noise level under the measurement conditions. Details of the results and modelling are presented in Chapter 12 of this EIAR.

Mean day time ambient noise level (L_{Aeq}) from survey results ranged from between 50dB and to 53.5 L_{Aeq}.

The Value of the LAF90[1] parameter is considered representative of the background noise level under the measurement conditions. Mean LAF90 values ranged from 42.2 and 45.7 LAF90.

The noise level of a passing train event was measured as $L_{Aeq,\ 32sec}$ = 60.6dB.

According to the current Irish Rail schedule, there are 8 trains (arrivals and departures) from Monday to Friday during the day period and one during the night which departs from Rosslare at 05:35. There are 6 trains on Saturdays and Sundays during the day-period.

6.3.9.4 Air Quality

Air quality in the area of the proposed development is considered to be good. Air quality monitoring programmes have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality ("Air Quality Monitoring Annual Report 2016", EPA 2017) details the range and scope of monitoring undertaken throughout Ireland. Long term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions such as natural sources, industry and home heating etc. Chapter 13 of this EIAR details the results from this monitoring.

Contaminated Land

A Preliminary Asbestos Walkover Survey was undertaken by RSK Ireland Limited in October 2018 (refer to Appendix 8.1 of this EIAR). The assessment confirms the

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[1] This is the A-weighted sound level that is exceeded for 90% of the sample period. Referred to the "background" noise level in some standards.

presence of Asbestos Containing Materials (ACMs) on the surface and near surface of the site. Seven samples representative of suspected ACMs were taken and five were confirmed by laboratory analysis as containing asbestos. Three of the positive samples were confirmed as asbestos cement (AC) and two were confirmed as asbestos floor tiles including bitumen adhesive, consistent with floor tiles, corrugated profile sheeting and rainwater materials that would have been used in the former buildings on site.

The bulk sample results confirm the presence of chrysotile in tile, bitumen and cement. The Health and Safety Authority state that "if ACMs are in good condition and left undisturbed it is unlikely that airborne asbestos will be released into the air and therefore the risk to health is extremely low. However, if the asbestos or ACM has deteriorated, been disturbed, or if asbestos-contaminated dust is present, the likelihood that airborne asbestos fibres will be released into the air is increased. If left alone and not disturbed, it will not generally pose a human health risk (HSA, 2013).

6.4 Description of Predicted Impacts

In accordance with the EPA Guidelines and the above methodology, the following sections provide an overview of the predicted impacts on:

- Land use and social considerations, including effects on general amenity, journey characteristics, journey amenity, severance;
- Economic activity including tourism e.g. employment and population including associated land use; and
- Human health, considered with reference to and interactions with other environmental receptors contained in corresponding chapters such as air, noise and traffic.

Likely or predicted significant impacts are split based on construction and operational phases under the headings above.

Do-Nothing Scenario

If the proposed development is not developed the site would become overgrown and result in underutilisation of a strategic town centre site. Residential and commercial properties may be adversely impacted due to poor visual impacts and potential for increased anti-social behaviour occurring on the site. Also, the presence of asbestos and remnants of former land uses would result in a continuation of a public health risk.

6.4.1 Construction Phase Impacts

Details of the construction methodology is included as part of Chapter 4 of this EIAR which has been relied on for this impact assessment and is not repeated here.

6.4.1.1 Land Use and Social Considerations

The proposed development has been designed to act as a stimulus to regenerate Wexford Town. The proposed development of the Trinity Wharf lands is consistent with national, regional and local planning policy, with the Wexford County Development Plan 2013-2019 and the Wexford Town and Environs Development Plan 2009-2015 (as extended), to harness the economic potential of the hub of Wexford Town, and in particular the Trinity Wharf site which has been identified as a Key Opportunity Site.

It will also serve to address a number of social issues such as high unemployment levels, and high levels of social deprivation within Wexford Town and particularly, and indirectly, antisocial behaviour through the direct provision of quality employment, by opening up the area as a new modern quarter and through tailoring a use mix which will make it a more attractive and vibrant place for people to live, work and visit. Such vibrancy and new life will encourage take up of vacant premises in the wider area.

There are a number of residential and economic operators' properties located within close proximity (Trinity Street) to the proposed development. Construction activities may cause nuisance and disruption to these areas for the duration of the construction programme i.e. traffic, noise. While construction activities are likely to be confined to the Trinity Wharf site itself, the duration of the construction phase is an extensive period. To manage these changes and the 80-month construction phase a Stakeholder Management and Communication Plan will be developed by the successful works contractors to communicate planned activities/program and minimise disruption to stakeholders that may be affected by the construction activities.

Land Use

The site of the proposed development will be a substantial construction site for approximately 80 months. Construction activities are detailed in Chapter 4 (Table 4.3 of Chapter 4 includes the envisaged construction program). The large-scale visible land use changes will begin once the construction of the buildings commences. This will be undertaken as part of phases 2 and 3 of the programme. The public realm works and hard and soft landscaping will advance as each phase progress, ensuring an attractive environment and sense of place is created from the outset.

In the marine environment, land use change will include the construction of a 64 berth marina, a boardwalk structure, installation of marina breakwaters and mooring units, construction of a seawall including a sheet piled wall and rock armour revetment along the south east boundary and the north west boundary. The seawall and revetment construction is likely to take place from Trinity Wharf with barges required to deliver some material and other construction elements will require work to be carried out from barge. The design has been developed to maximise the use of a workshop and remote working. As such, the bridge superstructure and the primary components associated with the marine will be fabricated remotely and transported to site. Consultation with the Wexford Harbour Master confirms that the navigation channel in the region of the proposed marina is very wide and can easily accommodate the construction phase barges and marine related traffic associated with the construction of the marine based elements of the project. Therefore, marine traffic and general journey characteristics are not likely to be impacted during the construction stage.

The construction phase is not expected to significantly impact land uses in the area. All transport routes and economic operators in the area will remain open throughout the construction stage. Residential amenity is likely to be impacted during the construction phase particularly along Trinity Street and along haulage routes due to traffic disruption, noise, air and potential visual impacts. It is likely that there will be *slight negative, medium-term* impacts due to the protracted nature of the programme on land uses during the construction stage.

Journey Characteristics, Journey Amenity and Severance

Construction activities have the potential to impact access and journey times during specific periods for road users, rail users and along the navigational channel as part of construction works and installation of the bridge sections. The impacts are likely to be *moderate negative, medium-term* impacts and are discussed below.

Road

Construction traffic will result in an increase in vehicles and HGV movements transporting construction materials/ plant or machinery, including cranes and other general construction traffic on roads and by water. Chapter 5 Traffic Analysis of this EIAR has assessed construction traffic relating to the proposed development and has found that the dominant construction activities include the haulage of plant and materials, and the estimated peak traffic generated during the construction phase of the development.

The peak traffic generated by the development during the construction phase will result in a 2.5% increase in total traffic movements and an increase of 28% in HGV movements over course of a working day. This is considered a worst-case scenario which will be confined to the 6-month period for earthwork activities. While the increase in total traffic movements is not considered environmentally significant, the increase in HGV movements is high and is considered a *temporary moderate negative* impact.

All other construction activities, including the concrete pours, will generate less than 30 HGV movements per working day which is not considered environmentally significant. The traffic assessment in Chapter 5 found that this will result in a *moderate negative* impact from a traffic perspective. Therefore, the construction stage is likely to create a *slight to moderative negative medium-term impact* on journey characteristics and journey amenity during the different phases of the development, particularly close to the construction site, on haulage routes along the R730 and on the N25.

Rail

The principal permanent railway level crossing infrastructure will likely be installed at an early stage of the construction works. During the initial construction of the site infrastructure, the level railway crossing is expected to be operated either under flag man control. CCTV control of the level crossing is likely to be fully implemented towards the latter stages of the site infrastructure construction. At this stage the access road on the approaches to the railway is expected to be completed. The exact arrangements of the crossing will be agreed with Iarnród Éireann at detailed design stage as part of the technical approvals process and the Construction Traffic Management Plan. The level crossing is likely to be operated in its final configuration for construction of the latter phases of the project. Safe access across the railway will be under the control of the Contractor and Iarnód Éireann and the safety of railway traffic will be ensured at all times. The construction of the level crossing is likely to have *imperceptible, negative, brief* – temporary effects on passenger services on the railway with likely daytime work under possession and weekend possession of the railway over a limited period that will be agreed with Iarnód Éireann.

There are no likely significant impacts predicted to rail-based journey times, however journey characteristics may be impacted due to presence of machinery and hoarding associated with the construction site. Traffic movements across the level crossing will be managed as part of the Construction Traffic Management Plan to be developed and agreed with Iarnód Éireann. The presence of a construction site close to the rail line may result in an *imperceptible, negative, medium-term* impact on journey characteristics and journey amenities due to visual presence of the construction compounds during the construction stages.

Marine

Construction plant and machinery will mobilise in the harbour and will include a pile driving rig as described in Chapter 4 of this EIAR. These construction activities may have an impact on marine traffic and journey characteristics as boats may be required to manoeuvre around these areas when the rig and barges are present. This disruption is not likely to be significant as there is sufficient space for boats and leisure craft to manoeuvre around the harbour.

Barges will be required in the navigational channel during the construction period and are likely to change journey characteristics and amenity during the construction period. Noise emissions generated during the construction phase may cause nuisance to marina users. Access will be maintained on the navigational channel throughout the construction phase. All boat users, including search and rescue organisations vessels, will continue to have access as required. Therefore, no significant impact on journey times are likely.

Severance

Up until recently the Trinity Wharf site was accessed, without authorisation, by members of the public for walking, dog walking and anecdotally as a meeting point for typically anti-social behaviour. However, Wexford County Council reinforced the existing perimeter fencing in October 2018 to prevent further unauthorised entry.

During the boardwalk construction phase, a portion of Paul Quay car park will be a construction site and access will not be permitted to this area of the site for health and safety reasons. During the marina construction (approximately 2 months) and the boardwalk construction (approximately 4 months), temporary severance to existing routes is likely to result in *imperceptible, negative, temporary* impacts.

Wexford Harbour has a wide navigational channel in this area and it is not expected that the construction works will create severance on marine activities during the construction phase.

Access will be maintained to all residential and commercial properties in the vicinity of the proposed development throughout the construction phase. Based on above no additional severance is predicted.

6.4.1.2 Economic Activity

Increased direct and indirect employment opportunities will occur as a result of the proposed development over an estimated 80 month construction period. There will be approximately 50 persons employed during each construction phase. Additional indirect employment and economic activity is likely due to provision of goods and services during the construction stages. *Moderate, positive, medium-term* impacts are expected as a result of employment opportunities.

Economic operators within the immediate vicinity of the construction site may be impacted as people may avoid the area due to traffic disruption, noise, air or visual impacts. This assessment has found that there may be *slight negative, medium term* impacts on economic operators as a result of construction activities. This assessment has considered that much of the construction work will take place off the main street, however there will be an increase in HGVs and construction workers' traffic during distinct phases of the development. There is potential for traffic congestion to occur during distinct phases of the construction period, i.e. during the noise intensive works and/ or disruption caused during the construction of the signalised junction on Trinity Street. The Traffic Analysis chapter of this EIAR has predicted that all construction activities will generate less than 30 HGV movements per working day which is not considered significant in traffic terms (see Chapter 5 of this EIAR). With the implementation of the CEMP and the associated Traffic Management Plan (TMP), the nearby retail warehousing operators are not likely to be significantly impacted as works will be completed on site with limited construction activities impacting on the R730 for the duration of the works.

Hotels, B&Bs and guesthouses within close proximity to the site may be impacted during daytime hours due to disruption i.e. noise, air or visual impacts however these are not considered to be significant. Construction activities may cause nuisance and disruption to tourists' general amenity close to the construction site however these are not expected to be significant.

6.4.1.3 Human Health Impacts

As already stated, environmental health standards are set to protect the vulnerable and not the robust, who are generally more resilient to changes in their environment. In accordance with the methodology outlined in Section 6.2, a summary of likely significant human health impacts/hazards relating to the proposed development have been identified to include:

- Impacts of emissions to air;
- Impacts of noise and vibration emissions;
- Impacts of emissions to hydrology;
- Impacts of collisions/ risks of accidents; and
- Psychosocial impacts.

6.4.1.4 Impacts of Emissions to Air

The greatest potential impact on air quality during the construction phase is from construction dust emissions, the potential for nuisance dust and the release of fibres from asbestos containing materials in the atmosphere.

The proposed development is major in scale (approximately 5.47 ha) and therefore there is potential for significant airborne dust emissions as described in Chapter 13 Air Quality and Climate of this EIAR. Sensitive receptors, such as residential and commercial properties in close proximity to the site, may be impacted by dust generated from construction. The air quality assessment presented in Chapter 13 of this EIAR states that while construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. The assessment found that, provided the dust minimisation measures outlined in the EIAR (see Appendix 13.3) are adhered to, the air quality impacts during the construction phase will not be significant

A primary source of air quality impacts from the proposed development relates to dust emissions / particulate matter ($PM_{10}/PM_{2.5}$) from construction works and emissions from vehicles. A CEMP will be put in place by the contractor to minimise such impacts, including shutting off construction vehicles when not in use, dust suppression and wheel washes to be provided if necessary, in order to prevent mud and dust being brought onto public roads. These mitigation measures will ensure that any impacts comply with all EU ambient air quality legislation and therefore, the impact of air emissions to human health are likely to be imperceptible with respect to human health. A Dust Management Plan is included as mitigation measure as part of Chapter 13 Air Quality and Climate of this EIAR.

Asbestos

An asbestos survey was undertaken in 2018 by RSK (detailed in Appendix 8.1 of this EIAR) and found that asbestos is present on the site. Of seven representative samples taken of suspected ACMs, five were confirmed by laboratory analysis as containing asbestos. Three of the positive samples were confirmed as asbestos cement and two confirmed as asbestos floor tiles. Asbestos cement was identified in numerous locations across the surface of the site whilst asbestos floor tiles were identified in large pieces or in small badly damaged fragments across the majority of the site, including in stockpiles. As reported in the literature review (Section 6.2.7 of this chapter), asbestos is known to cause lung disease and fibrosis of the lungs. In order to avoid risks to human health, a number of recommendations and mitigation measures have been provided during the site clearance and will be implemented prior to the site being redeveloped. These are detailed in Chapter 4 and Chapter 8 of this EIAR. Chapter 4 details the asbestos management strategy for the site (Section 4.4.4) which includes the requirements to undertake site specific surveys and the development of a Remedial Strategy that is taking place at the time of writing this EIAR. Measures for working with asbestos and mitigation measures to protect workers and the general public from exposure to asbestos fibres is detailed in Section 4.4.4.2 of this chapter. These measures include appropriate asbestos training, Personal Protective Equipment (PPE) and site management during the construction stage. As part of this strategy a Remediation Verification Report will also be undertaken to ensure that all mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.

These detailed measures will be informed by further survey and investigation work to inform the site development and will prevent potential release of asbestos fibres during the construction works and potential for human health effects to occur on workers or nearby residents or the general public. Therefore, this assessment has found that once the full and proper implementation of all mitigation measures detailed in Chapter 4 and Chapter 8 of this EIAR is carried out, impacts to human health are likely to be *imperceptible, temporary* human health effects. No additional mitigation is recommended as part of this assessment.

6.4.1.5 Noise and Vibration Impacts

Noise Assessment

Construction noise is temporary in nature and will be experienced over a short to medium-term period, depending on the programme and nature of activities taking place. This characteristic requires it to be considered differently to other longer-term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated. Chapter 12 (Noise and Vibration) of this EIAR details the results of the noise and vibration assessment. The impact assessment was undertaken for the daytime period. It was also based on a likely construction phasing and likely equipment that would be required to be on site under a range of assumptions detailed in Chapter 12 of this EIAR. Increased noise levels may result from demolition and site preparation works which will include breakers, excavators, piling operations, dump trucks, compressors and generators as well as general concreting plant, road surfacing and levelling equipment. The assessment found that the predicted noise levels were less than the TII maximum recommended limit and the lowest Category A limit of the BS 5228.

Lower limits of 65dB (TII guidance) / 55dB (BS5228 guidance) apply for weekend works. The sum of the predicted and ambient levels above would therefore be exceeded under such circumstances. The predicted levels above are based on all plant (detailed in Table 12.6 of Chapter 12 of this EIAR) operating simultaneously, which is unlikely. However, care should be taken that this does not occur during weekends so as not to exceed these reduced limits.

Where predicted noise levels are in excess of adopted criteria, or to control any risks associated with the uncertainty of the results, mitigation measures are proposed in Chapter 12 (Section 12.6) of this EIAR. With the full application of these mitigation measures no further mitigation is proposed as part of this assessment.

The results of the noise assessment in Chapter 12 of this EIAR indicate that construction activities can operate within the adopted noise limits for daytime periods at the nearest properties to the works. Restricted hours of operation along with the appropriate implementation of noise control measures will ensure that the impact of noise emissions is limited and not significant to human health.

Vibration Assessment

The most likely potential vibration effects are associated with the construction phase activities of the development. The vibration assessment in Chapter 12 of this EIAR has been referred to as part of this assessment. The site is located in a urban environment along its western boundary, with Irish Rail (Dublin to Rosslare) rail line located along its western boundary, with a number of commercial and residential properties. commercial and residential are located further west from the site of the proposed development. Vibration is generally only a concern at properties that are located close to the construction site. Therefore, a vibration monitoring programme will be required to be adopted at a select number of the nearest buildings during the most critical phase(s) of construction e.g. pile driving, etc.

6.4.1.6 Impacts of Emissions to Hydrology

Water Quality

Construction activities within and alongside surface waters can contribute to the deterioration of water quality and can physically alter the stream/river bed and bank morphology with the potential to alter erosion and deposition rates locally and downstream. Activities within or close to the watercourse channels can lead to increased turbidity through re-suspension of bed sediments and release of new sediments from earthworks. There are no recorded public groundwater supplies or group water schemes on the Geological Survey of Ireland (GSI) database within the zone of influence. There are abstraction points on the River Slaney, upstream of the development site, that are used for drinking water purposes that are outside of zone of influence. Chapter 10 of this EIAR has been cross-referenced to inform this aspect of the human health assessment. No significant impacts are likely to occur to drinking water supplies as a result of the proposed development. Chapters 9 and 10 of this EIAR include a range of mitigation measures related to hydrology to address potential human health impacts.

Flooding

Chapter 10 of this EIAR also provides an assessment of potential impacts relating to flooding. The assessment found that the proposed construction works will include for the construction of a new sea wall consisting of steel sheet piles to be installed around the perimeter of the site, with a reinforced concrete capping beam to be constructed on top of the sheet piles which will support a handrail. The proposed boardwalk will also consist of driven pile foundations. The volumes of water displaced by the proposed sheet pile wall and boardwalk foundations during the construction phase is extremely small relative to the volumes of the receiving waterbody and will result in an imperceptible impact.

6.4.1.7 *Impacts of Collisions/ Risk of accidents*

Construction activities may increase the risk of collisions due to an increase in the number of movements of HGVs entering and exiting from the construction compound and haulage routes located in a trafficked urban environment. It is also likely to increase potential risks to vulnerable populations. Construction workers may be at risk of potential accidents from working at heights or close to the sea.

The CEMP will be required to address these risks and detail measures to address health and safety risks for construction workers, neighbouring properties and the general public as appropriate. Overall, the impact is predicted to be *not significant, negative and medium-term* during the construction stage.

Road Safety Audit

A Stage 1 Road Safety Audit has been carried out in accordance with TII's publication 'GE-STY-01024 – Road Safety Audit' and included in Appendix 5.8 Road Safety Audit Report of this EIAR. All issues raised in the Road Safety Audit have been addressed so the proposed development will be satisfactory in terms of traffic operations and safety.

Subject to planning approval, a Stage 2 Road Safety Audit will be carried out on the detailed design and a Stage 3 Road Safety Audit will be carried out on the constructed scheme.

An Accessibility Implementation Plan will be prepared by the organisers if an event held at the cultural performance building coincides with office working hours. The objective of the Accessibility Implementation Plan is to ease transport and parking pressures on the site and on the surrounding network. More details are included as part of Chapter 5 of this EIAR.

6.4.1.8 *Psychosocial Impacts on Human Health*

Consideration of likely psychosocial hazards relating to the proposed development include nuisance, anti-social behaviour and suicide. During the construction phase, the proposed development has the potential to create nuisance, particularly due to emissions from noise, air and dust that can impact on psychological health. A CEMP will be developed by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the Construction Erosion and Sediment Control Plan (CESCP), Environmental Operating Plan (EOP) and the Construction & Demolition Waste Management Plan (C&D WMP). The construction activities are limited to specific locations and daytime periods for use of certain plant and machinery in order to reduce impacts to sensitive receptors. The production of the CEMP will also detail areas of concern with regard to health and safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.

6.4.1.9 *Other Physical Effects*

The construction stage is not likely to result in changes or to impact significantly on physical activity during the construction stage.

6.4.2 Operational Phase

6.4.2.1 Land Use and Social Considerations

Land Use

The proposed development supports existing national, regional and local land use and planning policy and will have the opportunity to positively influence and change the nature and intensity of surrounding land uses and Wexford Town as a whole in the long-term. A review of local planning policy identifies that the land use proposed on the site is 'permissible' and/ or 'open for consideration' as part of the Wexford Town Development Plan Zoning matrix, as can be seen in Figure 2.1 in Volume 3 of this EIAR. It is also consistent with the Wexford County Development Plan 2013-2019. The Masterplan developed by Waterford City and County Council (WCC), and subsequently the Wexford Quay Economic Development & Spatial Implementation Plan, have identified the marina as a potential use for this area. The proposed development is also consistent with the Wexford Local Economic and Community Plan (LECP), 2016-2021 with the project seeking to make Wexford an attractive destination for business whilst facilitating the provision of the necessary infrastructure and property solutions in supporting industry and employment within the town.

The proposed development will facilitate urban regeneration of the area. The proposed development will transform a strategically located brownfield site into a new high quality, attractive, commercial, residential and office development along with residential and recreational facilities in Wexford Town. The marina and pedestrian and cycle boardwalk structure across Wexford Harbour will physically integrate with the existing amenities of Wexford's quay front and contribute to a new attractive, connected town centre amenity.

It is hoped that this project will have a transformative effect on the character of the local area and on Wexford Town and will also provide high quality employment and residential and social facilities as well as high quality public realm and amenities.

The construction of the boardwalk will change land use in this area and result in the loss of approximately 21 car parking spaces at the southern end of Paul Quay car park. The removal of car parking spaces will facilitate the link via a boardwalk structure, providing improved connectivity and a safer access for pedestrians and cyclists between Paul Quay and the Trinity Wharf Development. The boardwalk structure is also likely to create a new destination area and will be beneficial from a human health and well-being perspective. The traffic assessment in Chapter 5 of this EIAR found that the loss of these spaces is not considered critical as the nearby Sinnott Place multi-storey long-term car park has adequate capacity to absorb the demand for long-term parking. This is discussed further in Section 5.4.7 Parking Provisions of Chapter 5 of this EIAR.

The boardwalk structure is also expected to improve the amenity value for residents and visitors as well as marina users accessing Wexford Town. The overall development will have a *moderate, positive, long-term effect* on land uses in the area.

The proposed development will result in the loss of 16 parking spaces on Trinity Street. The traffic assessment (Chapter 5 of this EIAR) has found that the loss of on-street parking will have a moderate impact on residents and business in the immediate vicinity of the proposed access junction. A mitigating factor is that 10 of the spaces lost do not directly front houses or business, including 8 spaces which front a vacant plot and 2 spaces which front a grass area. The traffic assessment also found that the network can adjust and absorb the demand for parking at this location.

Journey Characteristics, Journey Amenity and Severance

Road

The internal road network will be connected to Trinity Street via a new road to be constructed perpendicular to Trinity Street that will cross the railway line by means of a level crossing. This will be the main vehicular access to the site and will also facilitate pedestrian access. The internal road network of the development site is discussed in more detail in Chapters 4 and 5 of this EIAR.

The 180m boardwalk will provide the main link between the current Wexford Harbour promenade and the cycleway facilities provided on the internal road network of Trinity Wharf. This will be the primary pedestrian and bicycle access from Paul Quay car park/ Wexford Town centre over Wexford Harbour. The development of this structure will result in a new transport route for pedestrians and cyclists and is likely to have a *significant*, *positive, long term* effect on journey characteristic, amenity and reduce journey times and severance for pedestrian and cyclists accessing the Trinity Wharf area from the Town Centre in this area. It also provides dedicated shared walking and cycling infrastructure that will connect to existing and future Smarter Travel routes.

Rail

A new level crossing will be developed in conjunction with Iarnród Éireann which will consist of signalised automatic controlled boom barriers. Analysis of the traffic impacts associated with the requirement for the new barriers has been carried out and presented in Chapter 5. It found that it is unlikely that inbound vehicles queueing at the level crossing will stack back onto the Trinity Street access junction as the train services operate outside the AM peak hour traffic.

This is anticipated to result in a queue of 2 inbound vehicles and 10 outbound vehicles based on a predicted traffic flow of 35 vehicles per hour and 187 vehicles per hour arriving and departing the site between 17:00 and 18:00. These outbound vehicles will stack back into the site and will have no external impact for traffic on Trinity Street. Brief traffic queuing resulting from the signalised level crossing is anticipated to dissipate quickly once the barriers are lifted.

Any congestion resulting from the signalised level crossing is anticipated to dissipate quickly once the barriers are lifted, ie. after 3 minutes. Chapter 5 of this EIAR found that no significant traffic impacts are likely to result. There is likely to be an *imperceptible, negative, momentary* impact on journey characteristics for road users including pedestrians and cyclists.

Marine

Wexford Harbour is a large shallow estuary which, up until this development, has lacked proper marine leisure facilities for the numerous vessels within the harbour. As such, the provision of a marina will help alleviate the tidal restrictions for vessel access. It is expected that the marina will consolidate berth activity in the area providing a year-round safe location for vessels to berth. It is expected that the majority of the new 64 berth marina will be occupied by vessels already within the harbour and will not significantly increase the volume of boats or boating activity.

Consultation with the Harbour Master of Wexford Harbour has confirmed that the navigation channel in the region of the proposed marina is very wide and can easily accommodate such development without impinging on the safety of navigation in the area.

The construction of the brownfield development is expected to improve journey characteristics and amenity value from the perspective of marine based travellers. It is expected that the area around the Goodtide Harbour will also become more visually attractive.

Severance

No new severance is predicted during the operational phase. The proposed boardwalk will provide relief from severance for pedestrians and cyclists accessing the site from Paul Quay.

Social Considerations

The proposed development is a high quality, multi-use scheme and has been designed with an emphasis on place-making and 'liveability'. The development will be physically integrated with the existing amenities of Wexford's award-winning quay front and attractive town centre through the provision of a waterfront pedestrian and cycle route. The proximity of Trinity Wharf to the many existing employers, services and amenities in the town centre supports the high-density development in an existing urban environment while also offering an attractive strong character, public places and spaces and maintaining human scale.

The marina, culture and arts building, hotel and the new public realm areas will create a new destination for the area and will improve the amenity of residents, workers and visitors to the town centre. Trinity Wharf will also stimulate the redevelopment of other underutilised sites and vacant premises in the vicinity, consolidating the pattern of development in the area to help achieve a compact and sustainable urban form.

This mix of business, commercial, cultural, recreational and residential development will position the Trinity Wharf Development to disperse day and night time footfall and vibrancy associated with the proposed uses. The development will seek to encourage the regeneration of the area and stimulate regeneration of vacant dwellings/properties and other under-utilised sites in the surrounding residential streets and commercial areas and beyond to south Main Street.

Community Facilities

The development will regenerate a brownfield site into a social active area during both day and night, due to the mix of uses (commercial, residential, cultural) benefiting existing and future communities in Wexford Town and the region. Access to social and community facilities will not be affected but will be enhanced as a result of the proposed development. An extensive landscape design strategy (Refer to Appendix 4.7 of this EIAR) has been developed. The strategy is aimed at guiding the spatial design of the landscape and public spaces into a coherent design. These spaces include the coastal path, arrival space, central civic area, internal access roads, residential communal spaces, central paths and car park and rail line planting. The coastal path around the site, public park, plaza, play areas and performance spaces together with a comprehensive landscape design will further contribute to the development of both day and night time social facilities/ activities for residents and visitors as well as providing a significant public amenity and community facilities to existing communities. The design of the development ensures that the general amenity and recreational resources in the area are enhanced and accessible to all.

Furthermore, the marina will provide a purpose-built facility for local and visiting mariners and will provide greater opportunities for community events and activities to take place in the town that are associated with marine uses. The boardwalk structure will contribute to improving access and integration between existing and proposed marina facilities as well as sustainable modes of transport (walking and cycling route), a source of recreational and general amenity and community resource.

The proposed development has been designed to address the issues of urban decline, deprivation and stimulate economic activity in Wexford Town. The development will provide high quality employment opportunities and a variety of social and cultural spaces through the development of a new modern mixed-use urban quarter, together with an attractive environment and vibrant urban place for people to live, work and visit. The regeneration of this key site has the potential to have a significant positive spin-off effect and stimulate wider vibrancy, new opportunities for development and encourage increased take up of vacant or other brownfield premises in the local area.

Marine Environment

The proposed marina at Trinity Wharf is located alongside the buoyed navigation channel in the River Slaney which is maintained by Wexford County Council. There is an active group of water sports enthusiasts in Wexford Harbour and the provision of a marina will facilitate greater participation in boating activities within the harbour among the local community. The proposed marina is located within close proximity to the existing marina and, as such, will offer marina users ease of access and provide greater opportunities for recreational, community and economic development.

Wexford County Council's consultation with local stakeholder groups indicates that the proposed marina is broadly supported. It is considered that the proposed development will provide an improvement to the public realm in the Trinity Wharf area, and will lead to greater use and therefore, opportunities for new business, community and recreational activities in the vicinity.

6.4.2.2 Economic Impact

The proposed development is seen as a project that will enhance Wexford Town's attractiveness for international companies seeking to locate in the county or for existing companies looking to expand. Trinity Wharf represents a significant opportunity to expand the economic profile and performance of Wexford Town.

The development has the potential to create approximately 1,200 jobs, many of these are likely to high quality skilled jobs. This is likely to lead to *significant, positive, long-term* impacts to the local economy and associated socio-economic profile of the area. The proposed development supports this regional objective for Trinity Wharf to become a "strategic employment location" as detailed in the Draft SE RSES (2018) . It also states that the site will require key infrastructure requirements and investment to support development of the site which this development supports.

Tourism Activity

The marina, hotel, cultural/arts building, and high-quality public realm will also complement the office development, add vibrancy and diversify use. The marina and hotel will further enrich the high-quality tourism and cultural offering in Wexford and will add to the town's high-end offerings, such as the renowned International Opera Festival. The development is supported by a residential element which will provide much needed modern housing units in the area, rejuvenate this community, reverse trends towards population decline and will ensure that the area is active during the day and evenings, supporting vibrancy and vitality of the area.

Wexford Harbour has a strong maritime and sea faring tradition. The proposed development, and in particular the hotel and marina, will support the development of Fáilte Ireland's value proposition for 'Ireland's Ancient East'. The proposed marina, hotel and cultural space, as well as amenity walks, and public realm improvements will contribute to scaling up the tourism asset base of Wexford Town.

Wexford Harbour is ideally located between a number of existing marinas along the coast (Arklow and Greystone to the north, and Kilmore Quay and New Ross to the west), providing an ideal 'stopping off' location for visiting boats and also attracting new berth holders into the area. The proposed development will offer a step on / step off facility from the marina and as such will be attractive to existing and visiting mariners.

The proposed marina is located in a deep-water section of the channel and will be accessible from the Irish Sea between mid-tide and mid tide. The proposed marina in Wexford Harbour is protected from the Irish Sea by the headlands of Rosslare Point and Raven Point. Wave protection is provided by the training walls in the vicinity of the proposed Trinity Wharf marina and the proposed development. It incorporates floating breakwaters around the proposed marina to provide additional wave protection for the boats in the berths.

6.4.2.3 Human Health Impacts

Urban regeneration has the potential to positively influence population and human health outcomes particularly in areas that are deprived, such as Wexford Town. Furthermore, the high-quality pedestrian and cycle link will be provided from Paul Quay to the north west corner of the site and will provide a direct and safe link to the Town Centre, thereby creating a safer access to and from the site to the town centre for pedestrians, cyclists and mariners.

6.4.2.4 Impacts of Emissions to Air Quality

Chapter 13 Air Quality and Climate of this EIAR includes an assessment which found that there is the potential for increased exposure to emissions during the operational phase of the development, in particular to traffic related air emissions which may generate air pollutants such as NO_2, CO, benzene and PM_{10}. Sensitive receptors close to the proposed development have been assessed in air modelling assessments which found that the impact of the development due to PM_{10}, $PM_{2.5}$, CO, NO_2 and benzene emissions is *negligible, long-term, negative and imperceptible*.

Air dispersion modelling of operational traffic emissions was undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated by the modelling results, emissions as a result of the proposed development are compliant with all national and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health.

Remedial measures will be undertaken during the construction phase of the proposed development, as detailed in Chapter 4 and Chapter 8 of this EIAR, to remove ACMs and therefore there is no impact to human health predicted for the operational phase.

Chapter 13 of this EIAR states that the "likely overall magnitude of the changes on air quality in the operational stage is *imperceptible, long-term and not significant*."

6.4.2.5 Impacts of Noise and Vibration Emissions

Noise levels from operations associated with the development have been estimated and their impact has been assessed in Chapter 12 of this EIAR. Sources of operational noise from the proposed development include traffic (road, rail and boating activities), Arts & Cultural Centre operations and items of industrial plant associated with the hotel and office buildings. Chapter 12 of this EIAR found that almost all locations will experience an increase in noise level as a result of the proposed development. The operations of the marina and on-site café/restaurant are likely to have no significant impact on any existing residence. Therefore, no human health impacts are likely as a result of the proposed development.

Chapter 12 of this EIAR found that this development falls within the Lowest Observed Adverse Effect Level (LOAEL) i.e. that some impact is likely to be detectable but is not considered significant. This is supported by the results of the BS4142 assessment. Chapter 12 recommends a vibration monitoring programme should be adopted at the nearest residential properties during the most critical phase(s) of construction e.g. rock-breaking, pile driving (if applicable) etc.

6.4.2.6 *Impacts of Collisions/ Risk of Accidents*

Boardwalk

Currently people access the Trinity Wharf site (without authorisation) from Paul Quay, walking alongside a live railway track to access the area from the north-west and south-west corners of the site. A requirement of the regeneration of the site is to provide a safer link between Paul Quay and the site. The proposed development creates a direct link via a shared pedestrian and cycleway boardwalk across Wexford Harbour. This new structure is expected to enhance journey characteristics, amenity and reduce journey times while also providing a safer access into the site. This is a *significant positive long-term* impact.

Marina

The marina has been designed and developed to ensure safety is integrated into the design of the proposed development. This includes service pedestal, lifesaving stations, emergency ladder, service areas and floating breakwater units. The access stairway will ensure access is suitably controlled and risk of accidents reduced. No significant impacts are predicted.

Traffic

The cultural and performance centre will generate a concentrated traffic demand on the Trinity Street junction when events are being held. Traffic analysis in Chapter 5 of this EIAR indicates that the peak traffic generated by the cultural and performance centre is estimated to be 200 vehicles per hour based on a venue capacity of 400 people, and these events are likely to be held during evening times. This peak traffic demand of 200 vehicles is significantly less than the number of trips generated by the development during regular daily peak hour traffic and therefore does not prove to be a significant problem in terms of a potential increase in risk of accidents.

Building Development

All buildings are designed to comply with Building Regulations TGD Part B – Fire Safety (2006). Buildings have been considered in terms of vertical and horizontal compartmentation, internal travel distances, stair core locations, etc. Consideration has also been given to B4: 'External Fire Spread' in terms of building separation distances and materials.

Residential buildings are designed to comply with BS5588 Part 1. Office buildings are required to comply with BS5588 Part II. and the cultural/performance centre is designed to comply with BS5588 Part 6.

Buildings can be provided with either wet or dry risers. However, hydrants are to be located around the site and building heights are limited with top floor levels under 20m above ground level. Therefore, no significant human health impacts are likely as a result of the proposed development.

6.4.2.7 *Psychosocial Impacts on Human Health*

Consideration of the negative psychosocial hazards relating to the proposed development include potential for nuisance and anti-social behaviour. The proposed development is located in a town centre marine environment, close to a heavily trafficked urban environment which is active during both the day and night. As a result of the design of buildings, spaces and integration with existing and proposed transportation modes, together with the exposed nature and opportunities for constant overlooking, it is unlikely that the proposed development will promote negative psychosocial hazards. On the contrary, this development will transform the existing area from a location prone to anti-social behaviour into a lively mixed-use development.

Wexford Town, and particularly Wexford Urban No.2, has a high deprivation rate. It is likely that the regeneration of Trinity Wharf site will provide new social and economic opportunities for the people in this area and in the region through the provision of a mixture of high quality and also service industry jobs once the development is completed. The development will therefore provide a source of direct and indirect employment. It will improve the general amenity areas available to the town's population, including new playgrounds and walking trails and increasing opportunities for social connections

Furthermore, the development of the boardwalk structure will improve connectivity, particularly along the harbour for communities travelling north and south along the coast. Positive community outcomes are likely as a result of the urban regeneration of the area. Positive land use changes are expected which have the potential to increase social and economic activity and promote physical activity that can contribute to positively influencing psychosocial factors of a population.

Overall, the regeneration of the site has the potential to impact positively on the wider local and regional economy over time which could in turn result in reducing social inequality and the high deprivation rates in the town, which in turn have been found to positively influence health outcomes of populations.

No acquisition of private property is required as a result of the proposed development. Therefore, no psychosocial impacts are likely in this regard.

6.4.2.8 *Other Physical Effects*

It is widely recognised that land use planning and transport patterns can influence physical activity and/ or inactivity of populations which in turn can influence lifestyle factors and human health outcomes. The benefits of physical activity are widely reported and include benefits such as improved fitness, mood and can improve the potential for social interaction and social cohesion. From a human health perspective, this can translate into improved cardiovascular 'fitness', help reduce chronic disease and even premature death which are the leading causes of death for Wexford's population.

Census 2016 statistics reveal Wexford Town is similar to the national trends with a high reliance on the private car. The majority of those traveling to work, school or college travel by car with the majority of trips less than 15 minutes. Transport patterns that promote walking, cycling and sustainable modes of travel can reduce sedentary lifestyle, thereby increasing activity and improving health outcomes and reducing car use. Obesity in Ireland is a significant health issue and can be linked to travel mode as well as lifestyle factors. The operational phase of the proposed development has the potential to positively impact transport mode choices or general physical activity by providing improved walking and cycling infrastructure, providing real alternatives to using the private car and supporting wider investment in the sustainable transport network and links with public transport infrastructure in Wexford over the long-term. Smarter travel and compact sustainable developments have the potential to have positive lifestyle, health and environmental benefits i.e. reduction in noise, air and Greenhouse House Gas (GHG) emissions over the long-term operational phase. The proposed mixed-use development has the opportunity to result in *significant, positive, long-term* physical health effects.

6.5 Mitigation and Monitoring Measures

This assessment has allowed for the inclusion of a number of mitigation measures as part of the design of the proposed development to address the likely significant predicted population and human health impacts.

6.5.1 Construction Stage Mitigation Measures

- All mitigation measures detailed in Chapter 4 Description of the Proposed Development of this EIAR will be required to be implemented. A CEMP and an associated Construction Traffic Management Plan will be developed and implemented by the contractor to address all modes of transport and will be agreed with Wexford County Council prior to the construction stage.
    - The Construction Traffic Management Plan will be required to maximise the safety of the workforce and the public and to minimise traffic delays, disruption and maintain access to properties;
    - The Construction Traffic Management Plan will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points;
    - The Construction Traffic Management Plan will be developed and agreed with Irish Rail;
    - The contractor will provide an appropriate information campaign for the duration of the construction works; and
    - The Construction Traffic Management Plan will be required to minimise disruption to economic amenities, marine users and residential amenities. The Plan will be approved by Wexford County Council prior to construction and will ensure access is maintained along Trinity Street for vehicles, pedestrians, cyclists and economic operators at all times.
- Appropriate measures relating to working at heights and near water will be included as part of the EOP. Ringbuoys will be installed and maintained as part of construction design stage in consultation with search and rescue organisations in the area;
- The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the CESCP, EOP and the CDWMP;
- A Transportation Mobility Management Plan will be developed and will address all modes of transport required as part of the construction stages i.e. road and

Wexford Harbour. This will include details regarding haulage routes and construction compounds;

- The contractor will be required to develop and implement a Stakeholder Management and Communication Plan which will be agreed with Wexford County Council prior to the construction stage.
    - All stakeholders will be required to be agreed with Wexford County Council prior to construction commencing; and
    - Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed of the nature and duration of construction works;
- In order to minimise air quality impacts within the community, a Dust Management Plan will be implemented. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of this plan, as detailed in Chapter 13 Air Quality and Climate in this EIAR;
- Noise and vibration mitigation measures are discussed in detail in Chapter 12 Noise and Vibration of this EIAR. A comprehensive Construction Management Plan, which includes adopting appropriate mitigation measures, will manage the risk of noise impacting the local community. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities, including the application of binding noise limits and hours of operation. These measures will ensure that noise and vibration impacts will be reduced as far as possible; and
- The contractor will be required to implement a vibration monitoring programme at a select number of the nearest residential properties during the most critical phase(s) of construction e.g. pile driving.

All construction works will be short to medium term in nature and will be carried out in line with best practice guidelines, thereby minimising the likely significant impacts to the community and human health. The contractor will work within stringent construction limits and guidelines to protect surrounding populations and amenities.

With the application of the mitigation measures identified in this section, along with those specific mitigation measures related to Population and Human Health described in Chapter 4 Description of Development, 5 Traffic and Transport, Chapter 8 Soils and Geology, Chapter 11 Landscape and Visual Analysis, Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate, Chapter 16 Material Assets and Land of this EIAR, no likely significant impacts are predicted during construction stage. All mitigation measures are summarised in Chapter 18 of this EIAR.

6.5.2 Operational Stage Mitigation Measures

This assessment has found that operational stage of the proposed development will result in *significant positive, long-term* impacts to the population and human health of the area.

Mitigation measures required to address likely impacts relating to population and human health during the operational stage of the proposed development include:

- An Accessibility Implementation Plan (AIP) will be prepared by the organisers if an event is held at the cultural performance building which coincides with office working hours. The objective of the AIP is to ease transport and parking pressures on the site and on the surrounding network. The AIP will involve a Variable Message Sign (VMS) system which can provide real time information on the availability of parking within the site and provide details of alternative car parks elsewhere. The plan will be required to ensure adequate public transport is scheduled to service the event;

- A Transportation Mobility Management Plan will be developed in order to identify the measures that will be implemented to promote sustainable modes of transport and reduce the use of the private car in accordance with Smarter Travel Policy. This should include details of Workplace Travel Plans to encourage employers and employees to take steps to reduce dependency on the car and to take alternative transport options; and
- The recommended mitigation measures detailed in Chapter 10 Hydrology of this EIAR will be implemented to address the potential risk of flooding.

With the application of the mitigation measures identified in this section, along with those specific mitigation measures related to Population and Human Health described in Chapter 5 Traffic Analysis, Chapter 11 Landscape and Visual Analysis, Chapter 12 Noise and Vibration, Chapter 13 Air Quality and Climate and Chapter 16 Material Assets of this EIAR, no likely significant impacts are predicted during operational stage. All mitigation measures are summarised in Chapter 18 of this EIAR.

6.6 Residual Impacts

During the construction phase of the proposed development, residual impacts include disruption to traffic, noise and air quality which have been discussed above and in the relevant chapters of this EIAR.

Urban regeneration projects of this nature and scale have the potential to act as a stimulus and create wider investment opportunities resulting in *significant, positive, long-term* residual effects for the local and regional community and economy. It may also encourage continued investment in high quality urban regeneration projects elsewhere in Wexford, resulting in higher tenancy rates in the town and improvements in the general amenity of Wexford Town.

Positive social and health outcomes are likely as a result of the urban regeneration of the site through indirect positive land use changes, increased social and economic activity in the area and expansion of walking and cycling facilities with the wider area over time.

6.7 Difficulties Encountered

No particular difficulties were encountered in preparing the population assessment. In terms of the human health assessment, there are uncertainties in relation to assessing impacts on individuals or communities due to the lack of available health data and the difficulty in predicting effects, which could be based on a variety of assumptions.

6.8 Conclusion

The construction phase is temporary in nature and impacts on population and human health were found to be mainly *slight to moderate, negative, medium-term* impacts, primarily due to construction activities and construction traffic. A summary of the key construction impacts found as part of this assessment include:

- Land use changes due to temporary construction activities and construction works in both the terrestrial and marine environment that may impact on the environment, businesses and residential amenity within proximity to the construction site. The assessment found that these impacts are not expected to be significant as most construction work will take place within the Trinity Wharf site itself;

- It is likely there will be *moderate, negative, medium-term* impacts due to construction traffic which may impact on journey characteristics, general amenity, residential amenity and economic operators close to the site (Trinity Street) and along haulage routes (R730 and N25);
- During the boardwalk construction phase, a portion of Paul Quay car park will be a construction site and access will not be permitted to this area of the site for health and safety reasons. Temporary severance to existing routes in this area is likely during this period which will result in an *imperceptible, negative, temporary* impact;
- Increased direct and indirect employment opportunities will occur as a result of the proposed development over an estimated 80-month construction period. There will be approximately 50 persons employed during each construction phase. This is likely to result in *moderate, positive, medium term* impact to the local economy through direct and indirect employment and through local expenditure by construction workers, purchases of local materials and services, etc.;
- With the full and proper implementation of asbestos mitigation measures (asbestos surveys, development of a Remedial Strategy and verification report by a suitably qualified, experienced and licenced asbestos contractor, as detailed in Chapter 4 and Chapter 8 of this EIAR) it was found that there are no likely significant impacts to human health as a result of ACMs present on the site.

Overall the operation of the proposed development is expected to have a *moderate, positive, long-term* impact on the population and human health of the Wexford Town and the south east region.

- The proposed development facilitates urban regeneration of a brownfield site and will facilitate the consolidation of existing land uses in the Town. The development is expected to improve the general amenity, journey characteristics and local economy for residents, visitors as well as marina users that will result in a *moderate, positive, long-term* impact on land uses, social considerations and economic activity in the area;
- The construction of the brownfield development that includes public paths, a boardwalk structure and a 64 berth marina is expected to improve journey characteristics and reduce severance of the site that will result in *positive long-term* impacts;
- Due to the development of the various elements of the proposed development, there are likely to be an additional 1,200 jobs leading to *significant, positive long-term* impacts to the local economy and the associated socio-economic profile of the area;
- The proposed marina, hotel and cultural/ performance space, as well as amenity walks, and public realm improvements, will contribute to scaling up the tourism asset base of Wexford Town and providing recreational amenities to local populations of the area;
- The development will facilitate improvements in sustainable transport infrastructure through the provision of safe, affordable sustainable travel modes (walking and cycling facilities), leading to the promotion of physical activity which can positively influence human health determinants; and

- Sustainable modes of travel (walking, cycling and integration with public transport (rail and bus services) have the potential to reduce emissions to the air and noise environment and provide associated benefits to the environment and human health.

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Chapter 7:
Biodiversity

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Chapter 7 Biodiversity

7.1 Introduction

This chapter examines the ecology of the receiving environment within and surrounding the proposed development at Trinity Wharf, Wexford ("the proposed development") and assesses the potential impacts of the proposed development on Biodiversity. The methods employed to establish the ecological baseline within and around the proposed development are described, together with the process followed to determine the nature conservation importance of the ecological features present. The ways in which habitats, species and ecosystems are likely to be affected by the proposed development are explained and the magnitude of the likely effects predicted, taking into account the conservation condition of the habitats and species under consideration. Mitigation and enhancement measures are also proposed, and any residual effects are assessed, taking into account the mitigation and enhancement measures proposed.

7.1.1 Conservation Legislation and Planning

The European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended) ("the Habitats Regulations") transpose into Irish law Directive 2009/147/EC (the Birds Directive) and Council Directive 92/43/EEC (the Habitats Directive), which list priority habitats and species of international (European Union) conservation importance and that require protection. This protection is afforded in part through the designation of areas that represent significant populations of listed species within a European context, i.e. Natura 2000 sites. An area designated for bird species is classed as a Special Protection Area (SPA), and an area designated for other protected species and habitats is classed as a Special Area of Conservation (SAC). Wild bird species in SPAs and habitats and species listed on Annexes I and II, respectively, of the Habitats Directive in SACs in which they are designated features have full European protection. Species listed on Annex IV of the Habitats Directive are strictly protected wherever they occur, whether inside or outside the Natura 2000 network. This protection is afforded to animal and plant species by Sections 51 and 52, respectively, of the Habitats Regulations. Annex I habitats outside of SACs are still considered of national and international importance and, under Section 27(4)(b) of the Habitats Regulations, public authorities have a duty to strive to avoid the pollution or deterioration of Annex I habitats and habitats integral to the functioning of SPAs.

The Wildlife Act, 2000 (as amended) ("the Wildlife Acts") is the principle legislative mechanism for the protection of wildlife in Ireland. A network of nationally protected Nature Reserves was set up under the Wildlife Acts which public bodies have a duty to protect. Sites of national importance for nature conservation are afforded protection under planning policy and the Wildlife Acts. Natural Heritage Areas (NHAs) are sites that are designated under the Wildlife Acts for the protection of flora, fauna, habitats and geological interest. Proposed Natural Heritage Areas (pNHAs) are published sites identified as of similar conservation interest but have not been statutorily proposed or designated but are protected through planning policies and objectives. The Wildlife Acts also protect species of conservation value from injury, disturbance and damage to them or to their breeding and resting places. All species listed in the Wildlife Acts must, therefore, be a material consideration in the planning process. An important piece of national legislation for the protection of wild flora, i.e. vascular plants, mosses, liverworts, lichens and stoneworts, is the Flora (Protection) Order, 2015, which makes it illegal to cut, uproot or damage listed species in any way or to alter, damage or interfere in any way with their habitats.

Ireland's national biodiversity action plan *Actions for Biodiversity 2017-2021* (DAHG, 2011), in accordance with the Convention on Biological Diversity, is a framework for the conservation and protection of Ireland's biodiversity, with an overall objective to secure the conservation, including, where possible, the enhancement and sustainable use of biological diversity in Ireland and to contribute to collective efforts for conservation of biodiversity globally. Action 1.1.3 of the National Biodiversity Strategy states that "all Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting and/or investment in Blue-Green infrastructure". This is particularly relevant to developments. The plan is implemented through legislation and statutory instruments concerned with nature conservation.

The *County Wexford Biodiversity Action Plan 2013-2018 (WCC,2013)* lists actions to effectively manage wildlife in the County. This includes raising awareness of biodiversity as well as more specific actions such as promoting Swift breeding colonies in urban environments (Action 1.14).

The *All-Ireland Pollinator Plan 2015-2021* (NBDC, 2015) seeks to halt the decline in pollinators through a range of objectives. This plan is supplemented by the guidance document *Councils: actions to help pollinators* (NBDC, 2016).

7.1.2 Approach and Objectives

A habitat is the environment in which an animal or plant lives and is generally defined in terms of vegetation and physical structures. Habitats and species of ecological significance occurring or likely to occur within the defined **Zone of Influence** and **study area** of the Proposed development were classified as **Key Ecological Receptors**.

In accordance with Transport Infrastructure Ireland (TII) *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (2009), an impact assessment has been undertaken of Key Ecological Receptors within the Zone of Influence of the proposed development. According to these guidelines, the Zone of Influence is the "effect area" over which change resulting from the proposed development is likely to occur and the Key Ecological Receptors are defined as features of sufficient value as to be material in the decision-making process for which potential impacts are likely.

In the context of the proposed development, a Key Ecological Receptor is defined as any feature valued as follows:

- International Importance
- National Importance
- County Importance
- Local Importance (Higher Value)

Features of local importance (Lower Value) and features of no ecological value are not considered to be Key Ecological Receptors. The assessment does not consider any other type of environmental impact other than Biodiversity (Flora and Fauna).

This chapter quantifies the potential impacts on identified Key Ecological Receptors and prescribes mitigation measures required to avoid and reduce any negative impacts.

Determining the ecological issues to be addressed for the assessment was informed by early engagement with relevant stakeholders. During this scoping process, selected consultees were provided the opportunity to provide comments and observations on the proposed development. Further details of the consultation process, including a list of the statutory and non-statutory consultees, can be found in Section 7.2.5.

On completion of scoping, a desk study was undertaken to review all available published data describing ecological conditions within the greater area of the proposed development. The desk study cross-referenced this published data with publicly available maps and aerial orthophotography from Ordnance Survey Ireland (OSi), National Parks & Wildlife Service (NPWS) and Environmental Protection Agency (EPA) to identify Key Ecological Receptors. During this assessment, the statutory conservation agency, the NPWS, provided data on nature conservation designations, habitats and species of conservation interest. The baseline information obtained from the desk study was the first stage in defining the Zone of Influence of the proposed development.

The results of the invasive species and habitat survey undertaken in June 2018 are presented in thematic maps for ease of geospatial reference and interpretation (refer to Figures 7.1 and 7.2 in Volume 3). The multidisciplinary walkover surveys also included a bat roost suitability assessment, an otter survey and all plant and bird species were noted.

Where detrimental impacts were identified, detailed and specific mitigation measures have been proposed in accordance with the hierarchy of options suggested in the research for the European Commission publication; '*Assessment of plans and projects significantly affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC'*. Preference was given to avoiding impacts at their source. Where this was not possible, the following approaches were adopted, in order of decreasing preference: reduce impacts at source, abate on site, and finally abate at receptor. These measures have been incorporated into the design of the proposed development.

The information provided in this chapter accurately and comprehensively describes the baseline ecological environment, provides an accurate prediction of the potential ecological impacts of the proposed development, prescribes specific mitigation as necessary and describes the likely residual ecological effects.

7.1.3 Terminology

The valuation of Key Ecological Receptors and the terminology used to determine ecological value adheres to aforementioned guidance (TII, 2009). The definitions of impacts (e.g. description of effects) used to predict impacts and consider mitigation measures follows the definitions in the EPA's Draft *Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA, 2017).

7.2 Methodology

This section describes the methodologies that were followed in collecting information, in describing the baseline ecological conditions and in assessing the likely impacts of the proposed development.

7.2.1 Guidelines on Environmental Impact Assessment

The process of identifying, quantifying and evaluating potential impacts of the proposed development on habitats, species and ecosystems was undertaken in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) best practice guidance (CIEEM, 2018).

In addition, reference to recognised guidance on the Environmental Impact Assessment of National Road Schemes provided for an appropriately defined scope and evaluation process:

- Draft Guidelines on information to be contained in the Environmental Impact Assessment Report, Environmental Protection Agency, August 2017;
- Draft Advice Notes for preparing Environmental Impact Statements Environmental Protection Agency. September, 2015;
- Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency. 2002;
- Advice notes on current practice in the preparation of Environmental Impact Statements, Environmental Protection Agency. 2003;
- TII (2006a) *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*. Transport Infrastructure Ireland.
- TII, (2006b) *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2006c) *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2008a) *Environmental Impact Assessment of National Road Schemes – A Practical Guide. Revision 1*. Transport Infrastructure Ireland.
- TII (2008b) *Guidelines for Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2008c) *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2008d) *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2009) *Guidelines for Assessment of Ecological Impacts of National Road Schemes.* Transport Infrastructure Ireland.
- TII (2010) *Guidelines on management of noxious weeds and non-native invasive plant species on national roads.* Transport Infrastructure Ireland.

7.2.2 Establishing the Zone of Influence

The key variables determining whether Key Ecological Receptors will be subject to impacts through development are: the physical distance of the proposed development to the Key Ecological Receptors; the sensitivities of the Key Ecological Receptors within the receiving natural environment; and, the potential for in-combination impacts. The Zone of Influence was defined as the entire area within 550m of the proposed development (a precautionary flushing distance for waterbirds) and the Lower Slaney Estuary transitional water body (as far upstream as Ferrycarrig Bridge) together with the Wexford Harbour coastal water body. The Zone of Influence is presented in Figure 7.3 in Volume 3.

7.2.3 Establishing the Study Area

The extent of the study area is defined by the ecological features likely to occur within an effects distance from the proposed development. This is informed by the findings of the desk study (presence/absence of protected habitats, flora or fauna within the Zone of Influence) and best practice methodology referenced above for assessing impacts on those ecological features. The study area in this case included the entire Trinity Wharf site and an appropriate buffer (c. 150m on land and as far as visible with binoculars over the estuary).

7.2.4 Desk Study

The desk study undertaken for this assessment included a thorough review of the available baseline data within the study area. The following resources were used:

- Aquatic Services Unit, University College Cork (2018). Trinity Wharf Marina Development. Marine Benthic Assessment.
- Colhoun & Cummins, (2013). Birds of Conservation Concern (BoCCI) in Ireland 2014-2019.
- Envirico (2017) Invasive Alien Species Management Plan, Trinity Wharf, Wexford. Report for Wexford County Council.
- Environmental Protection Agency (EPA) Unified GIS Application provided data in relation to the Water Framework Directive Risk/Status of waterbodies and watercourses in the Zone of Influence.
- Gittings, Tom (2016) Carcur Park Development: Waterbird Report. Report for William Neville and Sons.
- Irish Wetland Bird Survey Site Inventory (I-WeBS).
- Mayes, Elanor (2015) Wexford to Rosslare Strand Active Travel Route: Waterbird Data. Report for Wexford County Council.
- National Parks & Wildlife Service (NPWS) map viewer was reviewed to determine the location of national (e.g. Natural Heritage Areas) and European (e.g. Natura 2000 sites) designated sites within the Zone of Influence of the proposed development.
- National Biodiversity Data Centre (NBDC) map viewer provided protected species data.
- Natura Environmental Consultants (2016) Trinity Wharf Wexford Harbour Bird Surveys 2015/16.
- Tom Philips and Associates (2007) Environmental Impact Statement: A Proposed Marina and Marina Facilities Building Amending a Previously Permitted Hotel Scheme Reg. Ref. 6042 at Trinity Wharf, Townparks (off Trinity Street), and an Adjoining Foreshore Area at Wexford Harbour, Wexford.
- RPS (2018) Trinity Wharf Marina Feasibility Study.
- RPS (2018b) Trinity Wharf Marina. Additional Modelling Services.
- Scott Cawley Ecological Consultants (2018) Natura Impact Statement: Wexford to Curracloe Greenway. Prepared for Wexford County Council.

As with all desk studies, the data considered were only as good as the data supplied by the recorders and recording schemes. The recording schemes provide disclaimers in relation to the quality and quantity of the data they provide, and these were considered when examining outputs of the desk study.

7.2.5 Consultation

The statutory and non-statutory consultees listed in Table 7.1 were contacted during the desk study and invited to submit any observations in relation to the proposed development. Consultees were also provided with a drawing showing the proposed development.

The purpose of the consultations was to:

- Identify any relevant information that consultees held, including the presence of data on protected species or species of conservation concern;
- Identify any concerns that consultees may have about the proposed development; and,
- Identify any issues that the consultees would like to see addressed during the ecological impact assessment process.

Organisations or individuals consulted in relation to ecology and nature conservation, together with a summary of responses, are listed in Table 7.1. In each case, only the responses relevant to this chapter have been included. All issues raised by the consultees have been addressed as in depth as possible in this chapter.

Table 7.1 Consultation Responses

Consultee	Date Correspondence Received	Summary of Response
Statutory Consultees		
National Parks & Wildlife Service (NPWS)	26th November 2018	Protected species of particular concern to the NPWS were birds, marine mammals, badgers and bats. The NPWS highlighted the need to address invasive species in the assessment and outlined the potential impacts of pile driving to marine mammals and artificial lighting to bats. The NPWS requested that adequate ecological surveys be carried out to confirm/deny presence of protected species and detailed European designated sites in proximity to the proposed development. Rare and Protected Species records were provided on the 7th September 2018.
Inland Fisheries Ireland (IFI)	3rd December 2018	IFI provided description of species groups present in estuarine environments and examples of potential impacts that require mitigation such as uncured concrete, silt laden run-off and oils/fuels. IFI also noted that access to slip ways must be maintained and any impacts on shore angling are addressed.

Consultee	Date Correspondence Received	Summary of Response
Non-statutory Consultees		
Wexford Harbour Harbour Master	4th December	The Harbour Master was consulted in relation to existing boat traffic and any impacts associated with the new marina. The new marina will mainly facilitate leisure craft already in the harbour where tidal restrictions currently limit vessel access to moorings further upstream. Jet-skiing and similar activities require the permission of the Harbour Master to take place, in accordance with the Wexford County Council Harbour and Piers Bye-laws. The Harbour Master has received one request for jet-ski access since 2014. A decline in wildfowling was also noted.
BirdWatch Ireland (BWI)	12th September 2018	BWI provided counts from i-WeBS sites in proximity to the proposed development. BWI do not provide pre-planning consultations.
Coastwatch Europe	N/A	No response

An EIA Scoping Document was also sent to a list of statutory and non-statutory consultees as part of the EIA process.

7.2.6 Ecological Survey Methodology

Following the desk study, field surveys were conducted over the full area of the proposed development adhering to the following guidelines:

- Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (TII, 2008b);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (TII, 2009); and
- Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011).

The multidisciplinary walkover survey classified habitats according to *A Guide to Habitats in Ireland* (Fossitt, 2000) and identified any habitats corresponding to Annex I of the Habitats Directive using the *Interpretation Manual of European Union Habitats* (European Commission, 2013).

7.2.7 Multidisciplinary Walkover Survey

The multi-disciplinary walkover survey was undertaken in June 2018 and included a habitat survey and aimed to detect the presence, or likely presence, of protected and invasive species. The survey provided baseline information regarding the existing ecology of the study area and informed the need for further specialist species-specific survey work. The walkover survey was undertaken by ROD Ecologist Owen O'Keefe ACIEEM. Owen holds a BSc. (Hons) in Ecology from University College Cork and has over three years' experience in ecological surveying and impact assessment.

The desk study and walkover survey identified Key Ecological Receptors in the Zone of Influence. The following sections outline methodologies followed during the ecological surveys.

7.2.8 Habitat Survey

The habitat survey was conducted to define the habitats present in the study area. The site was systematically walked, and habitats were assessed, classified and sketched on to field maps of the site in accordance with Smith et al. (2011). Habitats were identified in accordance with the Heritage Council's *A Guide to Habitats in Ireland* (Fossitt, 2000).

7.2.9 Survey of Aquatic Habtiats

The proposed development is within and adjacent to the River Slaney Estuary and Wexford Harbour.

A marine benthic assessment of the subtidal and intertidal communities within the area of proposed development was undertaken by Aquatic Services Unit (UCC) in November 2018 (Appendix 7.1).

7.2.10 Otter

The purpose of the otter survey was to identify any sensitive features within the study area used by otter for breeding, resting, foraging and to establish presence or absence of otter activity in the vicinity of the proposed development. The otter survey was conducted adhering to best practice guidance (TII, 2008c) and involved a systematic search of the Trinity Wharf site and the shoreline within 150 m of the site for physical evidence of otters, e.g. spraints, prints, slides, trails, couches and holts.

7.2.11 Bats

Bat Suitability Assessment

A bat suitability assessment was undertaken in June 2018 as part of the walkover survey following to best practice guidance (TII, 2006a; 2006b, Collins (ed.), 2016)

The purpose of the bat suitability assessment was to categorise any suitable features on trees and man-made structures capable of supporting a bat roost.

Bat Activity Survey

A bat activity survey was conducted on the 24th September 2018. The survey involved walking the entire site including taking in the 50-100m of surface water (the approximate limit of the bat detector) adjacent to the site to observe and record bat activity in the survey area. This survey was used to identify the species and numbers of bats using the survey area and to allocate a value to these features. The bat activity survey was undertaken between sunset and 2 hours after sunset. Health and Safety policy dictated that surveyors operated in pairs. During the survey, the site was walked slowly using an Anabat Walkabout bat detector to record bat echolocations. The bat detector allows visual validation of echolocation recordings (species/species group identification) in real time.

7.2.12 Badger

The badger survey was conducted in order to determine the presence or absence of badger within the survey area. The Badger survey was conducted adhering to best practice guidance (TII, 2006c; 2009) and involved a systematic search for physical evidence of badger e.g. setts, latrines, badger paths of the full extent of the study area of the proposed development in June 2018. The Trinity Wharf Site itself is made up entirely of built land and therefore the likelihood of badger setts being present was considered low.

7.2.13 Other Mammals, Reptiles and Amphibians

During the multi-disciplinary ecological walkover survey the potential for the study area to support additional protected mammals, reptiles and amphibians listed in the Wildlife Acts was assessed. Given that the study area is on built land and no evidence of these species was recorded, no that additional species-specific surveys were undertaken.

7.2.14 Breeding Birds

All birds seen or heard during the walkover survey were recorded. The character of the site limited the availability of nesting habitat and existing disturbance meant that no specific breeding bird survey was undertaken for the proposed development. Breeding bird surveys undertaken for a greenway development on the north side of Wexford Harbour between the Raven and Ferrybank (Scott Cawley, 2018) provided information on the breeding birds present in Wexford Harbour.

7.2.15 Wintering Birds

A wintering bird survey (Natura, 2016) was undertaken for the proposed development in 2015/2016 (Appendix 7.2). Two wintering bird survey reports (Gittings, 2016; Mayes, 2015) for projects in the vicinity of the proposed development were also reviewed.

7.2.16 Fisheries and Aquatic Fauna

The water bodies potentially affected by the proposed development were assessed with regard to their potential to support aquatic habitats and species, including but not limited to Annex I estuaries and mudflats and protected lampreys, salmonids and shads. Data relating to protected fish species had been collected during the desk study, so detailed fish stock surveys were not necessary. All water bodies potentially impacted by the proposed development are either transitional/brackish/estuarine or coastal/marine, therefore surveys for Freshwater Pearl Mussel and White-clawed Crayfish, both of which occur exclusively in freshwater, were not necessary.

7.2.17 Invasive Species

During the multi-disciplinary walkover survey, the presence of invasive species was recorded. In particular, the invasive species survey focussed on species subject to restrictions under Regulation 49 of the Habitats Regulations, including Japanese Knotweed (*Fallopia japonica*), which is known to occur in the area.

7.2.18 Ecological Evaluation and Impact Assessment Methodology

The ecological evaluation and Impact assessment within this chapter follows the methodology that is set out in Chapter 03 of the '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*' (TII, 2009).

7.2.19 Evaluation of Ecological Resources

The criteria used for the ecological evaluation follows those set out in Section 3.3 of TII (2009). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scale:

- International
- National
- County

- Local Importance (Higher Value)
- Local Importance (Lower Value)

This guidance clearly sets out the criteria by which each geographic level of importance can be assigned. For example, Locally Important (Lower Value) receptors contain habitats and species that are widespread and of low ecological significance and only of importance in the local area. Conversely, Internationally Important receptors are either designated for conservation as part of the Natura 2000 network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected fauna.

All habitats and species within the Zone of Influence and study area were assigned a level of significance on the above basis and Key Ecological Receptors were established and classified on this basis.

7.2.20 Impact Assessment Methodology

The impact assessment uses the EPA (2002 & 2003) guidelines, but also has regard to the EPA (2015 & 2017) draft revised guidelines, for characterising the impact that the proposed development would have on the receiving environment. The parameters used to characterise impacts were:

- Magnitude - relates to the quantum of impact, for example the number of individuals affected by an activity;
- Extent - relates to the area over which the impact occurs;
- Duration - intended to refer to the length of time for which the impact is predicted to continue, until recovery or re-instatement;
- Reversibility - whether an impact is ecologically reversible, either spontaneously or through specific action; and,
- Timing/frequency of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated impacts) would take place can be an important determinant of the impact on receptors.

It is necessary to ensure that any assessment of impact takes account of construction and operational phases; direct, indirect and cumulative impacts; and, those that are temporary, reversible and irreversible. The most relevant criteria for assessment of effect include quality and significance and these criteria are defined in

Table **7.2** and Table **7.3**. The following terms are defined when quantifying duration (EPA, 2017):

Temporary	– up to 1 year
Short-term	– 1 to 7 years
Medium-term	– 7 to 15 years
Long-term	– 15 to 60 years
Permanent	– over 60 years

Table 7.2 Criteria for Assessing Impact Significance based on EPA (2017)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

Table 7.3 Criteria for Assessing Impact Quality based on EPA (2017)

Impact Type	Criteria
Positive	A change which improves the quality of the environment e.g. increasing species diversity, improving reproductive capacity of an ecosystem or removing nuisances
Neutral	A change which does not affect the quality of the environment
Negative	A change which reduces the quality of the environment e.g. lessening species diversity or reducing the reproductive capacity of an ecosystem

Once the potential impacts are characterised, the significance of any such impacts on each of the Key Ecological Receptors is evaluated.

7.2.21 Process of Asessing Significance

The significance of impacts was determined following guidance set out in Section 7.2.20 of TII (2009), whereby impacts are assigned significance based on their characterisation, irrespective of the value of the receptor. Significance is determined by effects on conservation status or integrity, regardless of geographical level at which these would be relevant.

7.2.22 Mitigation

The proposed development has been designed to specifically avoid, reduce and minimise impacts on all Key Ecological Receptors. Where potential impacts on Key Ecological Receptors are predicted, mitigation has been prescribed to ameliorate such impacts. Ecological Enhancements have been built into the proposed development to increase the overall biodiversity value of the site in the long term.

Proposed best practice design and mitigation measures are specifically set out in this chapter and are realistic in terms of cost and practicality. Provided measures follow the prescribed methodologies and best practice where available, they have a high probability of success in terms of addressing the impacts on the identified Key Ecological Receptors.

The potential impacts of the proposed development were considered and assessed to ensure that all impacts on Key Ecological Receptors are adequately addressed and no significant residual impacts remain following mitigation.

7.2.23 Survey Limitations

Standard survey methods were followed, however, any biases or limitations associated with these methods could potentially affect the results collected. Whilst every effort was made to provide a full assessment and comprehensive description of the study area, population fluctuations may not be fully reflected due to the instantaneous nature of the field surveys. However, the field surveys together with the background knowledge provided by the desk study, provides a robust representation of the baseline for the habitats and species within the Zone of Influence.

7.3 Desk Study Results

7.3.1 General Description and Context

The proposed development comprises a new urban quarter created on derelict lands reclaimed from the sea in Wexford Town. The existing Trinity Wharf site comprises a 3.6 ha brownfield site southeast of Wexford Town Centre. The development will also include a marina, boardwalk, access road and roadworks on Trinity Street resulting in a total area for development reaching 5.47 ha. The development will prioritise job creation and economic development through the provision of key areas for advanced office and technology buildings. The mixed-use site will also accommodate a mix of office, leisure and residential development and will include a 64-berth marina. The new marina will mainly facilitate leisure craft already in the harbour where tidal restrictions currently limit vessel access to moorings further upstream. The construction of the proposed development is expected to take place over a period of 80 months. Piling works and the construction of the rock revetments take place over seven months.

New road infrastructure is required for the internal road network and to create a vehicular and pedestrian access from Trinity Street, crossing the Dublin-Rosslare railway line, while a pedestrian access to Paul Quay will link the development to the existing Quay-front.

The proposed development is close to the mouth of the River Slaney, and although this habitat is highly modified through quay walls, training walls, dredging, intensive mussel farming and visual and noise disturbance associated with an urban area, it is still of high biodiversity value. The biodiversity value of the site is evident in the number of designated sites in the River Slaney/Wexford Harbour which includes SACs, SPAs, Nature Reserves and Ramsar Sites. The river also supports species listed on Annex II and IV of the Habitats Directive and functions as a link between the sea and freshwater habtiats.

7.3.2 Designated Sites

The NPWS map viewer was reviewed for the location of designated sites within the Zone of Influence. The proposed development lies within the Wexford Harbour and Slobs SPA, the Slaney River Valley SAC and the Wexford Harbour and Slobs pNHA. Designated sites within the Zone of Influence are presented in Table 7.4. European Sites and other designated sites are illustrated in Figures 7.3 and 7.4 of Volume 3 respectively.

Table 7.4 Designated sites within the Zone of Influence

Designated Site	Distance from proposed development
European Designated Sites	
Wexford Harbour and Slobs SPA [004076]	Within proposed development Area
The Raven SPA [004019]	4.7 km
Raven Point Nature Reserve SAC [000710]	4.6 km
Slaney River Valley SAC [000781]	Within proposed development Area
Nationally and other Designated Sites	
Wexford Slobs and Harbour pNHA [000712]	Within proposed development Area
Slaney River Valley pNHA [000781]	5km
The Raven (Nature Reserve & Ramsar Site)	4.6 km

Designated Site	Distance from proposed development
Wexford Wildfowl Reserve (Nature Reserve & Ramsar Site)	3 km

Wexford Harbour and Slobs (SPA and pNHA)

Wexford Harbour is the lowermost part of the estuary of the River Slaney, a major river which drains much of the south-east region. The site is divided between the natural estuarine habitats of Wexford Harbour, the reclaimed polders known as the North and South "Slobs", and the tidal section of the River Slaney. The seaward boundary extends from the Rosslare peninsula in the south to the area just west of The Raven Point in the north. Shallow marine water is a principal habitat, but at low tide extensive areas of intertidal flats are exposed. Wexford Harbour and Slobs is one of the top three sites in the country for numbers and diversity of wintering birds. The combination of estuarine habitats, including shallow waters for grebes, diving ducks and sea ducks, and the farmland of the polders, which include freshwater drainage channels, provides optimum feeding and roost areas for a wide range of species. The habitats within the land take surrounding Trinity Wharf will be impacted directly by the proposed development and therefore 'Mudflats and Benthic Habitats' has been included as a Key Ecological Receptor. Impacts on water quality are addressed under the Key Ecological Receptor 'River Slaney and Wexford Harbour waterbodies'.

Slaney River Valley SAC

The Slaney River Valley encompasses the entire watercourse from its headwater in the Wicklow Mountains to Wexford Harbour. It is designated for freshwater and saltwater aquatic habitats, terrestrial habitats as well as mammals, invertebrates and fish. The lower reaches of the SAC also provide important habitat for wintering birds. Features of this site have the potential to be impacted by the proposed development, therefore, the 'River Slaney and Wexford Harbour waterbodies', 'Mudflats and Benthic Habitats', 'Migratory Fish', 'Otter' and 'Marine Mammals' have all been included as Key Ecological Receptors.

The Raven (SPA, SAC, Nature Reserve and Ramsar Site)

The Raven forms part of the Wexford Harbour complex and consists of a diverse dynamic dune system. Areas of the dunes have been planted with conifers. The site is the primary roost for internationally important numbers of Greenland White-fronted Goose. The gravel banks that form part of the site also host breeding Little Terns and Ringed Plover. Six species listed on Annex I of the Birds Directive regularly occur here, namely Red-throated Diver, Great Northern Diver, Greenland White-fronted Goose, Golden Plover and Bar-tailed Godwit. The site contains an introduced population of Natterjack Toad. Impacts on water quality are addressed under the Key Ecological Receptor 'River Slaney and Wexford Harbour waterbodies'.

Wexford Wildfowl Reserve (Nature Reserve and Ramsar Site)

The Wexford Wildfowl Reserve covers 194 hectares on the North Slob of Wexford Harbour. The site provides an important site for migrating birds. Waders and wildfowl in particular, are attracted to the area where the flat landscape is accentuated by a number of complementary characteristics that create a safe place to feed, loaf, roost and breed. These features are dominated by the wide shallow harbour with its sandbars and mud-banks. Over 260 bird species have been recorded to date of which 69 are considered common in winter, with a further 37 being categorised as scarce. This is a wintering ground of international importance for a number of migratory waterfowl including in particular Greenland White-fronted Goose and Brent Goose, as well as Bewick's Swans and Wigeon. The reserve has recorded 29 species of duck and 42 species of wader. Hares are fully protected on the Reserve and on the surrounding townlands of the North Slob. Impacts on water quality are addressed under the Key Ecological Receptor 'River Slaney and Wexford Harbour waterbodies'.

7.3.3 Habitats, Flora and fauna

The desk study also identified which important habitats and species have been recorded and are, therefore, likely to occur within the Zone of Influence and study area. The following sections give an overview of the results of the desk study.

National Parks & Wildlife Service Data

Table 7.5 lists rare and protected species records within the Zone of Influence obtained from NPWS in September 2018.

Table 7.5 Records for Rare and Protected Species, NPWS

Common Name	Scientific Name	Status
Mammals		
Irish Hare	*Lepus timidus hibernicus*	Annex V HD, WA
European Hedgehog	*Erinaceus europaeus*	WA
Otter	*Lutra lutra*	Annexes II, IV HD, WA
Badger	*Meles meles*	WA
Stoat	*Mustela erminea hibernica*	WA
Hedgehog	*Erinaceus europaeus*	WA
Grey Seal	*Halichoerus grypus*	Annex II, V HD, WA
Harbour Seal	*Phoca vitulina*	Annex II, V HD, WA
Eurasian Pygmy Shrew	*Sorex minutus*	WA
Reptiles & Amphibians		
Common Lizard	*Zootoca vivipara*	WA
Natterjack Toad	*Bufo calamita*	Annex IV HD, WA
Common Frog	*Rana temporaria*	Annex V HD, WA
Fish		
Twaite Shad	*Alosa fallax*	Annexes II HD, WA
Plants/ Lichens/ Mosses		
Borrer's Saltmarsh-grass	*Puccinellia fasciculata*	FPO, NT
Betony	*Betonica officinalis*	FPO, NT
Lesser Centaury	*Centaurium pulchellum*	FPO; NT
Cladonia ciliata var. *tenuis*	*Cladonia ciliata* var. *tenuis*	Annex V HD
Reindeer Moss	*Cladonia portentosa*	Annex V HD
Moore's Horsetail	*Equisetum hyemale x ramosissimum = E. x moorei*	FPO; NT
Small Cudweed	*Logfia minima*	FPO; NT
Henbane	*Hyoscyamus niger*	NT
Hairy Bird's-foot-trefoil	*Lotus subbiflorus*	FPO, NT
Yellow Bird's-nest	*Hypopitys monotropa*	NT
Wintergreen	*Pyrola rotundifolia subsp. maritima*	FPO, VU

Status (listing conferring protection or describing conservation status) abbreviations: Annex II/IV/V (non-avian species) = Habitats Directive (HD); WA = Wildlife Acts 1976 (as amended); FPO = Flora (Protection) Order. IRL Red List: R: NT: Near Threatened. VU: Vulnerable.

National Biodiversity Data Centre

Table 7.6 lists the rare and protected species recorded by the National Biodiversity Data Centre (NBDC) within the Zone of Influence. To avoid replication, all records of species represented in the NPWS dataset have been removed from the displayed NBDC data. Table 7.7 lists the Invasive Species recorded within the Zone of Influence.

Table 7.6 NBDC Records from within the Zone of Influence

Common Name	Scientific Name	Status
Marine Mammals & Amphibians		
Harbour Porpoise	*Phocoena*	WA; Annex II, IV HD
Common Dolphin	*Delphinus delphis*	WA; Annex IV HD
Bottle-nosed Dolphin	*Tursiops truncates*	WA; Annex II, IV HD
Smooth Newt	*Lissotriton vulgaris*	WA
Birds		
Bar-tailed Godwit	*Limosa lapponica*	Annex I BD, Amber BOCCI
Black-headed Gull	*Larus ridibundus*	Red List BOCCI
Black-necked Grebe	*Podiceps nigricollis*	Red List BOCCI
Common Guillemot	*Uria aalge*	Amber BOCCI
Cormorant	*Phalacrocorax carbo*	Amber BOCCI
Dunlin	*Calidris alpina*	Annex I BD, Red List BOCCI
Goldeneye	*Bucephala clangula*	Red List BOCCI
Great Black-backed Gull	*Larus marinus*	Amber BOCCI
Great Crested Grebe	*Podiceps cristatus*	Amber BOCCI
Great Northern Diver	*Gavia immer*	Annex I BD, Amber BOCCI
Greenshank	*Tringa nebularia*	Annex II BD
Herring Gull	*Larus argentatus*	Red List BOCCI
Little Grebe	*Tachybaptus ruficollis*	Amber BOCCI
Little Tern	*Sternula albifrons*	Annex I BD, Amber BOCCI
Lesser Black-backed Gull	*Larus fuscus*	Amber BOCCI
Long-tailed Duck	*Clangula hyemalis*	Red BOCCI
Oystercatcher	*Haematopus ostralegus*	Amber BOCCI
Redshank	*Tringa totanus*	Red List BOCCI
Shelduck	*Tadorna*	Amber BOCCI
Slavonian Grebe	*Podiceps auritus*	Annex I BD, Amber BOCCI
Swift	*Apus apus*	Amber BOCCI

Status (listing conferring protection or describing conservation status) abbreviations: Annex II/IV/V (non-avian species) = Habitats Directive (HD); Birds Directive (BD); and, Red/Amber = Birds of Conservation Concern in Ireland, 2014 to 2019 (BOCCI). All bird species in Ireland are protected under the Wildlife Acts 1976 to 2012.

Table 7.7 Invasive Species Recorded within the Zone of Influence

Common Name	Scientific Name
Japanese Knotweed	*Fallopia japonica*
Common Cord-grass	*Spartina anglica*

Invasive Species

An invasive species survey was carried out by Envireco in November 2017 and is presented in Appendix 7.4 to this Chapter. This survey was undertaken outside the optimum survey season for vegetation and was subsequently verified and updated in June 2018. The results of the June 2018 survey are described in Section 7.4.4. Two invasive species, Japanese knotweed and three-cornered leek were recorded within the Trinity Wharf site. The construction and operation of the proposed development has the potential to spread invasive species, therefore 'invasive species' has been included as a Key Ecological Receptor.

Wintering Birds

To inform this EIAR, BirdWatch Ireland provided Irish Wetland Bird Survey (I-WeBS) data for the two subsites closest to the proposed development (O0496 and O0490). Subsite O0496 extends from Trinity Wharf and includes the south slob and a significant portion of the southern side of Wexford Harbour. Subsite O0490 encompasses the north side of Wexford Harbour from the Wexford Bridge to the Raven Point. The I-WeBS data show that these subsites are used by large numbers of wintering birds, including nationally important number of 13 species and internationally important numbers of two species, golden plover and bar-tailed godwit.

A wintering bird survey was carried out during the winter of 2015/2016 by Natura Environmental Consultants (Natura, 2016) for the proposed development. The study area included the entire area within 1km of the proposed development. The surveys recorded 23 species of bird, 15 of which are qualifying interests of the Wexford Harbour and Slobs SPA. The report concluded that: *"The most abundant species here were Black-headed Gull, Oystercatcher and Lapwing. The most important habitats are the training walls on either side of the river mouth. The bird numbers present in this area* [within 1km of Trinity Wharf] *represent a small proportion of the total numbers in the Wexford Harbour and Slobs SPA. Very few individuals occurred within the immediate vicinity (200m) of the Wharf because there is limited suitable habitat here*". As there is limited suitable habitat and low numbers of wintering birds using the area within 200m of the proposed development, the impacts of visual and noise disturbance, considering the ambient visual and noise disturbance levels in the area, will be limited to very few individuals.

The sensitivity of birds to disturbance varies by species and whether the source of the disturbance is visual, or noise based (IECS, 2009). Additionally, the current level of habituation will also determine a bird's response to disturbance (IECS, 2013). The noise levels from impact hammers and vibratory hammers are less than 100 Db(A). Put into practice, this will mean that if an impact hammer generates 100 Db(A) at 1.0m from the source, this sound will be 70 Db(A) at 34m away. The 'acceptable dose' for waterbirds is 70 Db(A) at receptor (IECS, 2013). Regular noise above this level is likely to illicit a response, although this depends on species and the level of habituation (which in the case of Trinity Wharf is high).

There are a number of mitigation measures included for other receptors, namely people, marine mammals and migratory fish, which will reduce the noise and visual impacts on the small numbers of birds within 200m of the proposed development. These include the erection of 3m-4m high hoarding along the southern and northern site boundaries of the site once the sea wall is constructed and the implementation of a 30 minute soft start/ ramp up procedure for piling associated with the marina and boardwalk. During the operation phase, the breakwaters will provide a roosting site for waterbirds.

Mayes (2015) provided data from winter 2014/ 2015 from two areas relevant to the proposed development, the south training wall and the area between Goodtide Harbour and the Wexford Creamery outfall. Eight species were recorded on the south training wall, with Lapwing (peak 109) and Oystercatcher (peak 71) occurring in the highest numbers. The creamery outfall, 1km from the proposed development, is used as a hightide roost, with black-headed gulls (peak 271) and cormorant (peak 44) occurring in the highest numbers. These numbers are relatively low and are not significant in the context of Wexford Harbour.

During the operation of the proposed development, birds in the vicinity of Trinity Wharf, which are already habituated to the ambient levels of disturbance will habituate to the increased levels in noise and visual impacts. Gittings (2016) provided data on disturbance responses to walkers, walkers with dogs and bait diggers in the vicinity of the Carcur Park development (1.3km upstream of Wexford Bridge) from the winter 2015/ 2016. Across all species recorded during the surveys, the modal distance at which birds were disturbed was 100-150m with some species feeding within 25-50m of the disturbance source.

In considering the potential impacts on wintering birds including the direct and indirect habitat loss; the fact that bird use is low within 200m of Trinity Wharf as described by Natura (2016), the location of the proposed development within an existing urban environment, and the conclusion that feeding, roosting areas and flight paths of wintering birds will be unaffected, wintering birds have not been included as a Key Ecological Receptor.

Breeding Birds

Scott Cawley (2018) was the main source of information on breeding birds in Wexford Harbour. The survey was undertaken on three separate days in May and June 2018 and covered the area between the Raven and Ferrybank. Fifty species were recorded, 26 of which were recorded as breeding. The species assemblage on the north side of Wexford Harbour should be considered representative of the species present in Wexford Harbour during the breeding season, however it should be noted that the area in the vicinity of the proposed development is urbanised and far less suitable for birds than the north side of the harbour. Certain groups of birds are susceptible to flying into glass facades and windows and therefore 'Birds' have been included as a Key Ecological Receptor. The potential impacts and proposed mitigation are described in table 7.15 and Section 7.8.2.

Marine Mammals

A marine mammal risk assessment (IWDGC, 2018) was undertaken for the proposed development and is provided in Appendix 7.3. To summarise, two cetacean species, harbour porpoise (*Phocoena phocoena*) and common dolphin (*Delphinus delphis*), have been recorded in Wexford Harbour, but are rare. The conservation status of grey and harbour seals in Ireland has been assessed as favourable. The main activities that could impact on marine mammals were identified as the installation of the steel sheet pile wall around the entire coastal boundary of the site, the addition of rock armour revetment along the south-east and north-west edges and piling for the construction of the marina and boardwalk. Marine mammals have therefore been included as a Key Ecological Receptor. The potential impacts and proposed mitigation are described in table 7.15 and Section 7.8.2.

Marine Benthic Surveys

The marine benthic assessment (ASU, 2018) assessed the subtidal and intertidal communities within the area of proposed marina development at Trinity Wharf, Wexford.

The benthic habitats in the vicinity of the proposed development consist of mixed sediments, dominated by shell and coarse gravels with scattered clusters of mussels interspersed with shell gravel on muddy sands / sandy muds. The soft sediment intertidal community is typified by low faunal densities and diversity at all intertidal sites. The proposed development will include the loss of intertidal and subtidal habitats, and therefore 'Mudflats and Benthic Habitats' have been included as a KER.

7.3.4 Fisheries and Aquatic Fauna

The River Slaney is internationally important for the presence of fish species including Atlantic Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax*), Sea Lamprey (*Petromyzon marinus)*, River Lamprey (*Lampetra fluviatilis)* and European Eel (*Anguilla anguilla*). The status and occurrence of these species within the study area are described below. Allis Shad (*Alosa alosa*) and Brown Trout (*Salmo trutta*) also occur in the River Slaney Estuary. Migratory fish could be impacted by the proposed development and have been included as a Key Ecological Receptor. Freshwater Pearl Mussel (*Margaritifera margaritifera*) and White-clawed Crayfish (*Austropotamobius pallipes)* both occur in the River Slaney; however, these species are strictly freshwater and therefore they will not be directly impacted by the proposed development. A reduction in salmonids in the River Slaney could potentially lead to reduced recruitment of Freshwater Pearl Mussel, however the proposed development will have no perceptible impact on salmonid abundance in the River Slaney and therefore impacts on Freshwater Pearl Mussel, or White-clawed Crayfish, are not considered further.

Twaite Shad

The River Slaney is known to have supported an important population of Twaite Shad (Doherty et al., 2004). As such, this species is a Qualifying Interest of the Slaney River Valley SAC. Twaite Shad spawns at the top of the tidal waters in May and June, and the juvenile fish spend 1-2 years in the estuary before migrating to sea (IFI, 2018). After spawning, most adults return to sea and may spawn again in subsequent years (King & Roche, 2008). The species is classed Vulnerable in the Irish Red List (King et al., 2011) and anecdotal reports indicate a substantial decline in the River Slaney (King & Linnane, 2004; King & Roche, 2008; King et al., 2011; NPWS, 2013). Given the proximity of Twaite Shad habitat (i.e. estuary) to the proposed development, this species could potentially be impacted by the proposed development and therefore Twaite Shad, as a migratory fish, has been identified as a Key Ecological Receptor.

Atlantic Salmon

Atlantic Salmon is a Qualifying Interest of the Slaney River Valley SAC. Salmonids require unimpeded passage through the estuary. While the River Slaney at the location of the proposed development and downstream does not provide suitable spawning gravels for Salmonid species (salmon and trout), Atlantic Salmon could be impacted by increased barriers to connectivity during in-stream works and reduced water quality as a result of accidental pollution. Therefore, Atlantic Salmon, as a migratory fish, has been included as a Key Ecological Receptor.

Lamprey Species

All three lamprey species found in Ireland are Qualifying Interests of the Slaney River Valley SAC. Areas of significance (optimum spawning or nursery habitat) for these species does not exist at the location of the proposed development. Sea Lamprey and River Lamprey require unimpeded passage from the sea to freshwater habitats in the River Slaney to spawn. Therefore, River and Sea Lamprey, as migratory fish, have been included as a Key Ecological Receptor.

European Eel

European Eel stocks have undergone a serious population decline, and recently introduced EU legislation (EC 1100/2007) specifies major conservation actions. Juvenile eels make their way to the upper estuary and river to mature. Given that European Eel require unimpeded passage from the sea to freshwater habitats in the River Slaney, Eel, as a migratory fish, has been included as a Key Ecological Receptor.

European Sea Bass

European Sea Bass is an important commercial and recreational fish. It has suffered declines across its range in recent years as a result of increased pressure from fishing and the slow rate at which the species reaches reproductive age. The species is migratory, spending the winter in the offshore where they spawn. Mature bass migrate to coastal feeding grounds. Estuaries and sheltered bays provide nursery habitat for juvenile bass, who spend 4-5 years in these habitats before returning to the open ocean to spawn. Wexford Harbour is likely to be the most important bass nursery in Ireland (IFI, pers. comm.). European Bass could be impacted by noise and a deterioration in water quality and have been included as a Key Ecological Receptor, under migratory fish.

7.3.5 Aquatic Environment

Water Quality

The WFD requires that each member state protects and improves water quality in all waters so that good ecological status is achieved. Additionally, proposed actions (within discrete River Basin Management Plans) are also required, to secure national natural water resources for the future. The EPA is the competent authority responsible for monitoring, protecting and improving the water environment in Ireland. In accordance with WFD guidelines, water quality 'Status' is assigned using a variety of available data on aquatic flora and fauna (including fish), the availability of nutrients, and aspects like salinity, temperature and pollution by chemical pollutants. Morphological features, such as quantity, water flow, water depths and the structure of the river beds, are also taken into account.

The online EPA Unified GIS Application provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries, and coastal waters) or to groundwater. Table 7.8 shows the information recorded regarding water quality status within the proposed development.

Table 7.8 EPA Water Quality Results

Waterbody	Transitional Waterbody WFD Status (2010-2012)	Coastal Water Quality (2010-2012)
Lower Slaney Estuary	Potentially Eutrophic	N/A
Wexford Harbour	N/A	Potentially Eutrophic

Environmental Testing

The sea bed in the vicinity of the Trinity Wharf development, corresponding to the location of the boardwalk, marina and the sea wall/revetments, was sampled and tested as a part of the Trinity Wharf Marina Feasibility Study by RPS Group (2018). A comprehensive sampling programme was undertaken in July 2016 by Hydrographic Surveys Ltd to inform the feasibility study, whilst the sediment quality analysis was undertaken by the RPS Laboratory Services. The samples returned values above the upper guidance threshold for polycyclic aromatic hydrocarbons (PAH) and organochlorine pesticides (OCP) levels that are substantially in excess of the lower guidance limit (Marine Institute's Guidelines for the Assessment of Dredge Material for Disposal in Irish Waters). Generally speaking, the area returned results showing mild levels of contamination in the sediments although in a couple of instances there were moderate levels of contamination. Further details on contaminated lands are presented in Chapter 08.

Hydrodynamic Modelling

As part of the Trinity Wharf Marina Feasibility Study, hydrodynamic modelling undertaken for the proposed development (RPS,2018b; Appendix 4.4) concluded that:

> "*neither the proposed landside development, nor the landside development in combination with a marina will result in any significant differences to either the tidal regime or the prevailing wave climate it can be concluded that neither development would result in any significant changes to the sediment transport regime*. *As such, it can be concluded that the nearby environmentally sensitive areas will be not be adversely impacted by any changes in the sediment transport as a result of either the landside development in isolation or the landside development in combination with the marina".*

7.4 Field Survey Results

7.4.1 Habitats

This section describes the habitats recorded during the field survey in June 2018. Nine habitats were recorded within the study area (Table 7.9). For the habitat map, refer to Figure 7.1 of Volume 3 of this EIAR.

Table 7.9 Habitats Recorded Within the Study Area

Habitat Name	Fossitt Code
Sea Walls, Piers, Jetties	CC1
Spoil and Bare Ground/ Scrub	ED2/WS1
Scrub	WS1
Dry Meadows and Grassy Verges	GS2
Recolonising Bare Ground	ED3
Mud shores	LS4
Estuaries	MW4
Buildings and artificial surfaces	BL3
Buildings and artificial surfaces/ Amenity Grassland	BL3/GA2

Sea Walls, Piers, Jetties (CC1)

This habitat includes the training walls, the rock armour and concrete walls around the site and the harbour wall at Goodtide Harbour to the south of the site. These structures are inundated by sea water at high tide and exposed to wave action. This habitat, has, in places, been colonised by salt tolerant plants such as Scurvygrass (*Cochleria officinalis*) and Sea Plantain (*Plantago maritima*).

Spoil and Bare Ground/ Scrub (ED2/WS1)

This habitat occurs in the site where rubble has been collected in heaps and where scrub is developing. The most common scrub species is Butterfly Bush (*Buddleja davidii*).

Scrub (WS1)

Scrub refers to habitats less than 5 m tall that are dominated by stunted trees, shrubs and brambles. It frequently develops as a precursor to woodland. Scrub is found in areas of the site that have been allowed to regenerate naturally. Almost all of the scrub within the site is Butterfly Bush (*Buddleja davidii*).

Dry Meadows and Grassy Verges (GS2)

This habitat is found in areas of the site where grasses and herbs dominate the flora. The exposure of the site to the sea has led to some salt tolerant species such as Rock Sea-spurrey (*Spergularia rupicola*) and Sea Plantain (*Plantago maritima*) colonising the areas closest to the sea. Other species include Red Clover (*Trifolium pratense*), Ox-eye daisy (*Leucanthemum vulgare),* Red Valerian (*Centranthus ruber)* and Pale Flax *(Linum bienne).*

Recolonising Bare Ground (ED3)

This habitat refers to land that is former built land which has been recolonised and where vegetation cover is greater than 50%. It is found as a transitional habitat between BL3 and GS2.

Mud Shores (LS4)

This habitat was recorded immediately north and south of proposed development along the shore. The substrate is predominantly mud and is covered by water at high tide. Goodtide Harbour is used for small fishing boats and pleasure craft. This habitat has links to the following Annex I habitats in Ireland:

- *Mudflats and Sandflats not covered by sea water at low tide* [1140]

The intertidal areas around the proposed development correspond to the Annex I habitat *Mudflats and Sandflats not covered by sea water at low tide* [1140]. EC (2013) describes this habitat as Sands and muds of the coasts of the oceans, their connected seas and associated lagoons, not covered by sea water at low tide, devoid of vascular plants, usually coated by blue algae and diatoms. The marine benthic study for the proposed development (ASU, 2018) describes "*The soft sediment intertidal community is typified by low faunal densities and diversity at all intertidal sites*".

Surveys by NPWS identified a single faunal community in the vicinity of the Trinity Wharf complex. This 'Estuarine muds dominated by polychaetes and crustaceans community complex' occurs on the large intertidal mudflat south-east of Wexford Town and as a narrow shoreline band on the north and south shores of the site (NPWS, 2011). Mudflats and Benthic Habitats have been included as a Key Ecological Receptor of the proposed development.

Estuaries (MW4)

The proposed development is immediately adjacent to and within the River Slaney estuary and Wexford Harbour. At this point the salinity is permanently variable because it is open to the sea, is influenced by the tide and also has the input of large amounts of freshwater from the River Slaney. The river is designated as the Slaney River Valley SAC at the location of the proposed development. This river has links to the following Annex I habitats in Ireland:

- *Estuaries* [1130]

The River Slaney/ Wexford Harbour at this location corresponds to the Annex I habitat Estuaries. EC (2013) describes this habitat as the downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. The River Slaney/ Wexford Harbour waterbody has been selected as Key Ecological Receptor of the proposed development.

Buildings and Artificial Surfaces (BL3)

The most common habitat in the footprint of the proposed development is built land in the form of old foundations and hard standing. All former industrial buildings on the site have been demolished. Generally built habitats are not considered of high ecological significance.

Buildings and Artificial Surfaces/ Amenity Grassland (BL3/GA2)

This habitat mosaic refers to domestic dwellings within gardens which are found in the wider area.

Character of Habitats

The site of the proposed development has been highly modified from its natural state over centuries of urbanisation and navigation. It is urban in its character.

Significance of Habitats

The habitats present on the site were assessed in accordance with best practice guidance (TII, 2009). The River Slaney/Wexford Harbour itself, although highly modified, is the habitat with the highest biodiversity value within the site. The River Slaney/Wexford Harbour immediately adjacent to and within the proposed development footprint corresponds to the Annex I habitats 'Estuaries' and 'Mudflats and Sandflats not covered by water at low tide'. Furthermore, the estuary is regarded as being a receptor of International Importance on the basis of its designation as an SAC and SPA.

7.4.2 Fauna

Terrestrial Mammals

Badger

No evidence of badger was recorded on the Trinity Wharf Site and there is limited suitable habitat in the area. Therefore, badger have not been included as a Key Ecological Receptor.

Otter

European Otter is listed on Annex II and Annex IV to the Habitats Directive and is also protected under the Wildlife Acts. Otter is a Qualifying Interest for the River Slaney Valley SAC. During the otter survey, the edge of the site and 150m along the shore were walked slowly in order to search for signs of Otter. No signs of otter were recorded during the walkover survey; however, an otter was seen along the northern side of Trinity Wharf during the bat activity survey. In-stream works and artificial lighting have the potential to increase barriers of connectivity for otter commuting between the Estuary and the River Slaney. This species may be impacted by the proposed development and has been included as a Key Ecological Receptor.

Bats

All nine resident breeding bat species in Ireland are legally protected and roost sites (whether in use or not) are also protected under both European and Irish legislation. All bat species occurring in Ireland are listed on Schedule V of the Wildlife Acts as protected species.

The bat suitability assessment conducted in June 2018 during the walkover survey did not identify any potential bat roosts within the study area.

A bat activity survey was undertaken on the 24th September 2018 in suitable weather conditions. Details of the survey is presented in Table 7.10 below.

Table 7.10 Bat Survey Details

Date	Start Time	End Time	Temperature	Wind and Rain
24th September 2018	19:45	21:35	7-9°C	Very calm, no rain.

Bat activity during the survey was low. Only one species of bat, Common Pipistrelle (*Pipistrellus pipistrellus*), was recorded during the activity survey. The first recording was made of a bat foraging along the embankment on the land-side of the proposed development. The second was made of a bat commuting (flying directly) across the site in an east-west direction.

Bats could be negatively impacted by poorly-designed or excessive artificial lighting during the construction and operation of the proposed development. Therefore, bats have been included among the Key Ecological Receptor of the proposed development.

Marine Mammals

No sightings or evidence of any marine mammals were recorded during the multidisciplinary survey. The marine mammal risk assessment (MMRA) listed four species of marine mammal that have been recorded in Wexford Harbour (Appendix 7.3). The MMRA also concluded that the likelihood of cetaceans being in the area is very low. Only harbour porpoise and common dolphin have been reported from the area and only very occasionally. There are important haul out sites for both harbour and grey seal in the mouth of Wexford Harbour and at the Raven. The proposed development occurs within an SAC for which harbour seal is a Qualifying Interest. These haul out sites are typically >2km away from the construction site but individual seals are likely to forage within the harbour and thus may occur in the water near the proposed development. All cetaceans and grey seals are part of a larger population and are very mobile, with records of movements of grey seals between SE Ireland and west Wales.

Piling and installing rock armour could lead to temporary disturbance including injury to marine mammals. While the construction of the marina is expected to increase boat traffic, this would occur over an extended period, allowing seals adjacent to the site to accommodate this increase. Wexford Harbour is already a busy site with recreational and fishing activity, thus any increase in recreational traffic is against a back drop of high levels of use and will not significantly increase long term disturbance of the haul-out sites.

On the basis that marine mammals could be impacted through construction activities, they have been included as a Key Ecological Receptor of the proposed development.

Birds

Table 7.11 lists the birds that were recorded during the multidisciplinary walkover survey in June 2018.

Table 7.11 Bird species recorded during the walkover survey

Common Name	Scientific Name
Bar-tailed Godwit	*Limosa lapponica*
Black-headed Gull	*Chroicocephalus ridibundus*
Jackdaw	*Corvus monedula*

The buildings proposed in the Trinity Wharf Site include buildings with glass facades. Glass poses a risk of collision to certain groups of birds, particularly passerines. Poorly designed buildings could impact on local populations including night-time migrants (e.g. warblers, thrushes), falcons and kingfisher. The proposed development may lead to direct impacts on certain groups of birds, therefore, birds have been included as a Key Ecological Receptor.

Reptiles and Amphibians

The multidisciplinary walkover surveys did not record any evidence of common frog, smooth newt or common lizard within the study area. There are no ponds or ditches within or close to the site. The historical use of the site and means that the site is unlikely to be used by common lizard. If small numbers of lizard are present on the site, the loss of this habitat will not be important in the context of the local population in Wexford Harbour. Therefore, reptiles and amphibians have not been included as a Key Ecological Receptor.

7.4.3 Flora

No flora listed on the Flora Protection Order were recorded within the study area. One species, rock sea-spurrey *(Spergularia rupicola)* is listed on the Irish Red List No. 10 Vascular Plants (Wyse Jackson et al., 2016) as Internationally Significant. This species is frequently found around Ireland's coasts and is on the Red List because Ireland holds >25% of the European population. Table 7.12 below provides a list of plant species recorded during the field survey in June 2018.

Table 7.12 Plant species recorded during the survey

Common name	Scientific name
Alexanders	*Smyrnium olusatrum*
Bird's-foot Trefoil	*Lotus corniculatus*
Bramble	*Rubus fruticosus* agg.
Butterfly Bush	*Buddleja davidii*
Cleavers	*Galium aparine*
Cock's Foot	*Dactylis glomerata*
Common Bent Grass	Agrostis capillaris
Common Bird's-foot Trefoil	*Lotus corniculatus*
Common Couch Grass	*Elymus repens*
Common Hogweed	*Heracleum sphondylium*
Common Mallow	*Malva sylvestris*
Common Nettle	*Urtica dioica*
Common Salt-Marsh Grass	*Puccinellia maritima*
Cordyline	*Cordyline* sp.
Cotoneaster	*Cotoneaster* sp.
Cow Parsley	*Anthriscus sylvestris*
Creeping Buttercup	*Ranunculus* repens
Curled Dock	*Rumex crispus*
Cut-leaved Crane's-bill	*Geranium dissectum*
Dandelion	*Taraxacum agg.*
Docks	*Rumex* ascetosa
Elder	*Sambucus nigra*
Field Horsetail	*Equisetum arvense*
Flowering Currant	*Ribes sanguineum*
Fuchsia	*Fuchsia magellanica*
Goat's-beard	*Tragopogon pratensis*
Gorse	*Ulex europaeus*
Hawthorn	*Crataegus monogyna*
Hedge Bindweed	*Calystegia sepium*
Herb-robert	*Geranium robertianum*
Himalayan Balsam	*Impatiens glandulifera*

Common name	Scientific name
Hogweed	*Heracleum sphondylium*
Ivy	*Hedera helix*
Japanese Knotweed	*Fallopia japonica*
Kidney Vetch	*Anthyllis vulneraria*
Lancelote Plantain	*Plantago lancelota*
Leylan Cypress	*Cupressus × leylandii*
Meadow Buttercup	*Ranunculus acris*
Nettle	*Urtica dioica*
Pale Flax	*Linum bienne*
Privet (non-native)	*Ligustrum* sp.
Red Clover	*Trifolium pratense*
Red Fescue	*Festuca rubra*
Red Valerian	*Centranthus ruber*
Ribwort Plantain	*Plantago lanceolata*
Rock Sea-spurrey	*Spergularia rupicola*
Rosebay Willowherb	*Epilobium* angustifolium
Scarlet Pimpernel	*Anagallis arvensis*
Scurvygrass	*Cochlearia officinalis*
Sea Arrowgrass	*Triglochin maritima*
Sea Plantain	*Plantago maritima*
Silverweed	*Potentilla anserina*
Short-fruited Willowherb	*Epilobium obscurum*
Sycamore	*Acer pseudoplatanus*
Thistles	*Cirsium sp.*
Three-cornered Leek	*Allium triquetrum*
White Clover	*Trifolium repens*
Willow	*Salix* spp.
Winter Heliotrope	*Petasites fragrans*
Yorkshire Fog	*Holcus lanatus*

7.4.4 Invasive Species

Two species, Japanese Knotweed and Three-cornered Leek, which are subject to restrictions as listed on the Third Schedule of the Habitats Regulations were recorded in the study area. A number of examples of other unlisted but invasive species, including Butterfly Bush, Winter Heliotrope and Cotoneaster were recorded within the study area. Himalayan Balsam (*Impatiens glandulifera*) is present in close proximity to the site but not within it. The location of Japanese Knotweed is shown in Figure 7.2 of Volume 3. Invasive species pose a threat to biodiversity in the area and have been included as a Key Ecological Receptor.

7.4.5 Ecological Corridors

Article 10 of the Habitats Directive recognises the importance of ecological networks as corridors and stepping stones for wildlife, including for migration, dispersal and genetic exchange of species of flora and fauna. The Directive requires that ecological connectivity and areas of ecological value outside the Natura 2000 network of designated ecological sites are maintained and it recognises the need for the management of these areas through land use planning and development policies.

Ecological corridors are important in connecting areas of local biodiversity with each other and with nearby designated sites to prevent islands of habitat from becoming isolated. Ecological corridors include linear features such as treelines, hedgerows, disused railway lines, rivers, streams, canals and ditches as stepping stones for wildlife moving within their range. They are particularly important for mammals, especially bats, and small birds. The River Slaney is an important ecological corridor and provides a range of habitats and facilitate networks and linkages between the sea and freshwater habitats upstream. The River Slaney and Wexford Harbour waterbodies has been selected as a Key Ecological Receptor of the proposed development.

7.5 Key Ecological Receptors

This section of the report provides details of the Key Ecological Receptors that were identified during the desk study and the field surveys. The desk study provided information on rare and protected species and on designated sites of conservation interest in relation to the proposed development. This included an assessment of features of interest of Natura 2000 sites with the potential to be impacted by the proposed development and also a study of sites that are designated under national legislation (Nature Reserves and NHAs) and international conventions (Ramsar sites). Features of Proposed Natural Heritage Areas (pNHAs) were also considered within the study area.

Key Ecological Receptors Identified During Desk Studies and Field Surveys

The Key Ecological Receptors identified are described in greater detail in Table 7.13 together with an ecological evaluation for each.

Table 7.13 Key Ecological Receptor Description and Evaluation

Key Ecological Receptor	Description	Importance/Ecological Valuation (TII, 2009)
Key Ecological Receptor 1 Mudflats and Benthic Habitats	The proposed development is immediately adjacent to and within mudflats and benthic habitats, the former being a Qualifying Interest of the Slaney River Valley SAC and the Wexford Harbour and Slobs SPA ("Wetlands and Waterbirds" [A999]). The proposed development will result in a total maximum habitat loss of 2,168 m^2 of this habitat. A breakdown of the habitat loss associated with the proposed development is presented in Table 7.14.	**International Importance** on the basis that mudflats form an integral part of two Natura 2000 sites and supports habitats and species listed on Annexes I, II and IV of the Habitats Directive and Annex I of the Birds Directive.
Key Ecological Receptor 2 River Slaney and Wexford Harbour waterbodies	The proposed development is located on the banks of the River Slaney Estuary which includes the waters that are subject to the tidal influence from the sea. This habitat forms a link between salt and freshwater systems and is important for migrating fish moving between feeding and breeding grounds. The estuary provides an important nursery habitat for fish. The proposed development will result in the loss of 969 m^2 of subtidal habitat from the River Slaney Estuary to construct the marina and boardwalk piles and the sea walls which could lead to impacts on water quality. Water will be allowed to circulate freely under the boardwalk and marina. A breakdown of the habitat loss associated with the proposed development is presented in Table 7.14.	**International Importance** on the basis that this habitat forms an integral part of a Natura 2000 site and supports habitats and species listed on Annexes I, II and IV of the Habitats Directive and Annex I of the Birds Directive.
Key Ecological Receptor 3 Migratory Fish	Twaite Shad, Atlantic Salmon and Sea Lamprey and River Lamprey are all Qualifying Interests for the Slaney River Valley SAC. These species require unimpeded passage upstream to spawn. European Eel also require unimpeded passage from sea to freshwater habitats in the River Slaney. Fish could be impacted by increased barriers to connectivity and reduced water quality as a result of accidental pollution events and disturbance during construction and operation.	**International Importance** on the basis that species listed on Annex II of the Habitats Directive are present at critical phases in their life cycles.
Key Ecological Receptor 4 Otter	Otter is a Qualifying Interest of the Slaney River Valley SAC. Otter are protected wherever they occur and were confirmed as present at the site during the surveys. No otter shelters (holts or couches) were recorded within 150m of the proposed development.	**International Importance** on the basis that this species listed on Annex II and IV of the Habitats Directive and that the population represents more than 1% of the national population. No holts or couched were identified with 150 m of the proposed development.

Key Ecological Receptor	Description	Importance/Ecological Valuation (TII, 2009)
Key Ecological Receptor 5 Marine Mammals	Harbour porpoise, common dolphin, harbour seal and grey seal have been recorded in Wexford Harbour. Harbour seals are known to breed in Wexford Harbour. Harbour Seal is known to use the sandbanks in Wexford Harbour as haul-out sites for breeding, moulting and resting. At their haul-out sites, seals are extremely unlikely to be disturbed by human activities at a distance more than 850 m. As there are no haul-out sites within 2 km of the proposed development, the proposed development will not give rise to disturbance impacts on seals. Piling and installing rock armour could lead to temporary disturbance including injury to marine mammals.	**International Importance** on the basis that a species listed on Annex II and Annex IV of the Habitats Directive and protected under the Wildlife Acts breeds within the Zone of Influence.
Key Ecological Receptor 6 Bats	Bats are protected wherever they occur. One species, Common Pipistrelle, was recorded within the site of the proposed development during the survey. Bats could be negatively impacted by poorly-designed or excessive artificial lighting during the construction and operation of the proposed development. Vegetation removal could also result in habitat deterioration for this Key Ecological Receptor.	**Local Importance (Higher Value)** on the basis that these species are listed on Annex IV of the Habitats Directive and protected under the Wildlife Acts are present within the study area, however not occurring in county or nationally important numbers.
Key Ecological Receptor 7 Invasive Species	Japanese knotweed and three-cornered Leek were identified within the proposed development site. Invasive species are present within the study area and could potentially be spread further by the proposed development. Construction and operation could lead to the introduction of invasive marine species through the equipment and ballast water.	Invasive species have the potential to impact negatively on native species diversity and structures. There is a risk of spread of invasive species associated with the proposed development.
Key Ecological Receptor 8 Birds	Certain groups of birds are vulnerable to collision with glass facades and windows. Poorly designed buildings could impact on local populations including night-time migrants (e.g. warblers, thrushes), falcons and kingfisher.	**County Importance** on the basis that birds listed on Annex I of the Birds Directive, the BOCCI Red List and protected under the Wildlife Acts are present within the study area and are at risk of colliding with glass facades and windows.

7.6 'Do Nothing' Scenario

If the proposed development does not proceed, there will be no loss of mudflat, estuarine or terrestrial habitat.

The limited value of the site to otter, pollinators, birds and bats would continue.

Pressures and threats associated with infrastructure projects, such as noise, lighting and the fragmentation of habitats, would not be introduced to the area.

Mussel farming would continue in Wexford Harbour, which covers approximately half of the subtidal seabed area. Harvesting mussels involves dredging which is highly disruptive to benthic habitats.

Japanese Knotweed would likely spread and in time it would become the dominant species.

Due to the proximity of the site to the River Slaney, the Japanese Knotweed would act as a source of dispersal to other areas of the Lower River Slaney and Wexford Harbour.

The site would continue to be eroded by the sea, which will lead to the release of contaminants into Wexford Harbour.

7.7 Description of Likely Impacts (Unmitigated)

7.7.1 Impacts on Designated Areas

The proposed development occurs within two Natura 2000 sites; the Slaney River Valley SAC and the Wexford Harbour and Slobs SPA. Seven other designated sites occur within the Zone of Influence (Table 7.4). Some of these designated sites refer to the same areas with multiple designations.

As likely significant effects on the Natura 2000 sites could not be excluded at the screening stage, an Appropriate Assessment (AA) was deemed necessary and a Natura Impact Statement (NIS) was prepared. The NIS presents all of the predicted impacts on the sites and their Qualifying Interests and also provides a detailed analysis and evaluation of these impacts in the context of the Conservation Objectives. The NIS also prescribes mitigation to eliminate adverse effects on the integrity of the Natura 2000 sites.

7.7.2 General Impacts on Key Ecological Receptors

General impacts on biodiversity that are typical of development are described in this section. These potential negative effects are considered with reference to the previously defined Key Ecological Receptors.

Habitat Loss

The proposed development will lead to the permanent loss of estuary and intertidal mudflat habitat. This includes a narrow strip around the seaward perimeter of the site. This reclamation is required to prevent the need for excavation of the existing site, which contains contaminants originating from its former industrial use. The new sea wall will prevent the further infiltration of contaminants into the River Slaney. The other areas that will be reclaimed are the small area at the north-western corner for the boardwalk landing and the areas occupied by the steel piles for the boardwalk and marina (the method of restraint for the marina will be decided at detailed design and, for the purposes of this assessment it has taken into account the largest surface area possible)

The maximum area of Annex I habitat that will be lost is 2,168 m^2, 621 m^2 of which is outside the Natura 2000 network and 1,547 m^2 of which is inside the Natura 2000 network. Of the 1,547 m^2 within the Natura 2000 network, 969 m^2 is within the Slaney River Valley SAC and 999 m^2 is within the Wexford Harbour and Slobs SPA (there is an overlap of 421 m^2 between these two areas). The 969 m^2 within the Slaney River Valley SAC is classified as both "Estuaries" and "Mudflats and sandflats not covered by seawater at low tide" and represents c. 0.005% and c. 0.009%, respectively, of the estimated total area of these habitats within the SAC. The 999 m^2 within the Wexford Harbour and Slobs SPA is classified as "Wetlands and Waterbirds" and represents c. 0.002% of the total area of wetland habitat within the SPA.

A breakdown of Annex I habitats which will be lost is presented in Table 7.14 and Figure 7.1 below. The overall area of the marina and boardwalk has not been included as water will be allowed to circulate freely underneath these structures. The mudflats and benthic habitats have been found to have low faunal diversity (RPS, 2018) and are not an important area for wintering birds (Natura, 2016).

Table 7.14 Annex I Habitat Loss Breakdown

Slaney River Valley SAC	**Inside Slaney River Valley SAC (m^2)**	**Outside Slaney River Valley SAC (m^2)**
Estuaries [1130]; *Mudflats and sandflats not covered by seawater at low tide* [1140]	969	1,199
Wexford Harbour and Slobs SPA	**Inside Wexford Harbour and Slobs SPA (m^2)**	**Outside Wexford Harbour and Slobs SPA (m^2)**
Wetland and Waterbirds [A999]	999	1,169

The terrestrial habitats are considered to be of Local Importance (Lower Value) and are not considered further. 'Mudflats and Benthic habitats' and the 'River Slaney/ Wexford Harbour waterbody' have been identified as Key Ecological Receptors are discussed in Table 7.15 below.

Figure 7.1 Annex I Habitat Loss Breakdown

Habitat Fragmentation

The construction and operation of the proposed development within the River Slaney could potentially inhibit the movement of fish species which migrate upstream and downstream through the estuary or which make extensive use of the estuary throughout their lives. Artificial light, visual disturbance, noise and vibration may create barriers to connectivity for fish, marine mammal, otter and bats.

Disturbance

Disturbance may occur during construction and operation as a result of noise, lighting and vibration. The new marina will lead to an increase in boat traffic which could disturb birds, seals and other species. The new marina will mainly facilitate leisure craft already in the harbour where tidal restrictions currently limit vessel access to moorings further upstream (pers. comm. Captain Philip Murphy, Senior Marine Officer, Wexford County Council). The increase in leisure craft is expected to be modest and any impacts insignificant in comparison to the current levels of recreational and commercial boat traffic as well as the fishing and aquaculture activities which take place in Wexford Harbour.

Trinity Wharf Marina will be competing with other marinas in nearby towns and the long navigational channel that is required to travel through coming into Wexford Harbour, may discourage some vessels passing along the coast. However, an increase in the volume of boats and boating activity adjacent to the marina and its approaches should be anticipated. The MMRA carried out (IWDGC, 2018) found that while small vessels tend to produce broadband low frequency sound which harbour seals would detect, seals in the area are already accustomed to existing boat traffic, including recreational and fishing activity, and seals are known to be quite tolerant to boat traffic (See Appendix 7.3).

Reduction in Water Quality

Construction and operational activities within and adjacent to surface waters can negatively impact on water quality.

The driving of piles for the boardwalk/bridge, sheet-piling and placement of sloped revetments for coastal protection and the construction of restraints for the marina (either tubular steel piles, helical anchors or weighted anchors) could lead to sediments containing contaminants being disturbed and becoming suspended in the water column. This may lead to agitation of harmful material which has accumulated in high concentrations on the river bed.

Surface water run-off from construction areas has the potential to contain high levels of suspended sediments (and also contaminants). Such run-off, if not attenuated and treated prior to discharge, has the potential to cause significant ecological impacts. Large amounts of fine sediment deposition can smother benthic habitats, leading to changes in biological composition. Disturbance of fine sediments can also increase the amounts and persistence of chemical contaminants in the receiving habitat, leading to further changes in the biological composition and overall condition of habitats.

During construction, concrete, grout or other pollutants may spill directly into the local environment or be washed into the water in construction site run-off. These materials are highly alkaline and, consequently, can drastically alter the pH of the receiving water body. This can lead to profound ecological impacts and can affect the condition of habitats by causing damage to pH-sensitive species.

Vehicles, plant and equipment which will be used during construction rely on hydrocarbons such as diesel, petrol and lubricating oils. Leaks from poorly maintained vehicles, plant, equipment or storage tanks provide for a risk of input of hydrocarbons into the environment. In the absence of appropriate mitigation, hydrocarbons from the construction site may spill directly into Wexford Harbour or be washed into the river in construction site run-off. This has the potential to cause negative ecological impacts on the estuary, including intertidal habitats. Hydrocarbons can have direct toxic effects, including reducing the ability of organisms to absorb water and nutrients. Hydrocarbons can also alter the nutrient balance and microbiota in soil and water, which can benefit some species while detrimentally affecting others. Such changes have the potential to alter the biological composition of the habitat.

Inadequate treatment of waste water from on-site toilets and washing facilities also provides for potential water quality impacts which could lead to ecological effects in the estuary. Faecal contamination can alter the nutrient balance in soils and water, causing significant changes in microbial communities and reductions in oxygen levels. This can have significant effects on the biological composition of receiving habitats.

The increase in boat traffic as a result of the new marina brings an increased risk of accidental pollution through fuels, oils and sewage.

Direct Mortality

Piling during construction may lead to injury or mortality of fish and marine mammals during the construction phase. The operation of the proposed development, specifically the use of glass facades and windows, has the potential to lead to bird mortality through collision.

Spread of Invasive Species

Construction activities could aid the of spread of Japanese knotweed and three-cornered leek within the site. In the absence of control measures, there is a possibility that these species may be inadvertently spread during construction through the movement of equipment and contaminated soil to, from or within the site.

7.7.3 Impacts on Key Ecological Receptors

Impacts on the Key Ecological Receptor as defined in the preceding sections are described in Table 7.15.

Table 7.15 Impact characterisation for Key Ecological Receptors based on EPA (2017) and TII (2009)

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 1 Mudflats and Benthic habitats	The proposed development is on lands immediately adjacent to and within Wexford Harbour. The habitat around the proposed development conforms to two Annex I habitats; '*Estuaries'* and '*Mudflats and sandflats not covered by seawater at low tide'*. Direct impacts of the proposed works on this Key Ecological Receptor potentially include the following: Permanent loss of subtidal and intertidal habitats within the footprint of reclaimed land. Permanent loss of sub-tidal benthic habitat. Temporary and permanent displacement, injury and death of fauna. Habitat fragmentation and barrier effect may occur if Otter and aquatic species are not able to migrate along the watercourse during the construction of the proposed development. This impact could also affect birds and bats that may use this section of the river as a commuting route. Accidental pollution events may result in pollutants entering the environment and affecting water quality during the construction phase.	Habitat fragmentation and barrier effect as a result of lighting and the potential release of pollutants are ongoing direct impacts during the operational phase of the proposed development.	The proposed development involves the loss of 2,168 m^2 of intertidal and subtidal habitat. This is considered to constitute a **Permanent Significant Negative Impact** over a very small area of a receptor of International Importance. This impact will not affect the integrity or favourable conservation status of this habitat. The potential for habitat fragmentation and barrier effects during construction and operation as a result of lighting, noise and vibration is considered to constitute a **Temporary and Permanent Moderate Negative Impact.** The construction of the marina will prevent mussel farming taking place in this area in the future, thereby allowing natural habitats to develop. This will constitute a **Potential Permanent Positive Impact.** The risk of pollution of the estuary during the construction phase is considered to constitute a **Potential Temporary Significant Negative Impact** as, if it were to occur, it would have the potential to impact sensitive receptors such as wintering birds over a short period of time and over a far wider area than the site itself.

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 2 River Slaney/ Wexford Harbour waterbody	The proposed development is on lands immediately adjacent to and within Wexford Harbour. The habitat around the proposed development consisting of tidal water conforms to the Annex I habitat, '*Estuaries*'. Instream structures include a marina, boardwalk and new sea walls with some reclamation of land from the estuary. Direct impacts of the proposed works on this Key Ecological Receptor potentially include the following: Permanent loss of habitat within the footprint of reclaimed land and under the marina and associated piles/ restraints. Temporary displacement of fauna during construction. Habitat fragmentation and barrier effect may occur if Otter and aquatic species are not able to migrate along the watercourse during the construction of the proposed development. This impact could also affect birds and bats that may use this section of river as a commuting route. Accidental pollution events may result in pollutants entering the river and affecting water quality during the construction phase.	Habitat fragmentation and barrier effect as a result of lighting and the potential release of pollutants are ongoing direct impacts during the operational phase of the proposed development	The proposed development involves the loss of 2,168 m^2 of intertidal and subtidal habitat. This is considered to constitute a **Permanent Significant Negative Impact** over a very small area of a receptor of International Importance. This impact will not affect the integrity or favourable conservation status of this habitat. The potential for habitat fragmentation and barrier effects during construction and operation as a result of lighting, noise and vibration is considered to constitute a **Temporary and Permanent Moderate Negative Impact.** The construction of the marina will prevent mussel farming taking place in the area in the future, thereby allowing natural habitats to develop. This will constitute a **Potential Permanent Positive Impact.** The risk of pollution of the river during the construction phase is considered to constitute a **Potential Temporary Significant Negative Impact** as, if it were to occur, it would have the potential to impact sensitive receptors such as Atlantic Salmon and Twaite Shad over a short period of time and over a far wider area than the site itself.

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 3 Migratory Fish	Direct impacts to fish at the construction phase include habitat fragmentation and barrier effect. Direct mortality or injury or temporary disturbance due to vibration during in-stream piling and the construction of the marina. Fish may be impacted indirectly by a deterioration in water quality during the construction phase caused by run-off of sediment and/or pollutants entering the river.	Habitat fragmentation and barrier effect as a result of lighting and the potential release of pollutants are ongoing direct impacts during the operational phase of the proposed development.	The potential for habitat fragmentation and barrier effect during construction is considered to constitute a **Temporary Slight-Moderate Negative Impact** as it applies to the migratory fish that commute upstream. The risk of pollution of the river during the construction phase is considered to constitute a **Potential Short-term Significant Negative Impact** as, if it were to occur, it would have the potential to impact sensitive receptors such as Atlantic Salmon and Twaite Shad over a short period of time and over a far wider area than the site itself. Operational impacts include disturbance due to the increase in boat traffic. Following consultation with the Harbourmaster, this impact is considered to be **Permanent Imperceptible Negative Impact** as the increase in the number and frequency of vessels and their movements will be very small. Activities such as jet-skiing and water-skiing are very infrequent and require permission of the harbourmaster. Habitat fragmentation and barrier effects during operation are considered to constitute a **Permanent Slight Negative Impact.** Significant impacts on migratory fish are not anticipated at the International, National or County Level.

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 4 Otter	Otter may be impacted by noise associated with construction activities. None of the habitat in the vicinity of the proposed development is considered to be of particular significance as otter habitat. No holts or couches were recorded within 150m of the proposed development. Construction and operation may lead to habitat fragmentation and barrier effect.	Habitat fragmentation and barrier effect as a result of lighting and the potential release of pollutants are ongoing direct impacts during the operational phase of the proposed development.	No significant direct impacts are anticipated on this species given the nature of the habitats and given that no breeding or resting places were recorded near the proposed development. Construction phase impacts include an increase in noise and lighting. This is considered to be a **Temporary Slight Negative Impact.** The risk of pollution and reduced prey availability during the construction phase would be considered to constitute a **Potential Short-term Moderate Negative Impact** as, if it were to occur. Operational impacts include disturbance due to the increase in noise and lighting. It is considered to be **Permanent Slight Negative Impact.** Significant impacts on Otter are not anticipated at the National or County Level.
Key Ecological Receptor 5 Marine Mammals	Piling and the construction of the rock armour revetments could lead to displacement and injury of marine mammals.	The marina will lead to an increase in boat traffic using Wexford Harbour which may lead to disturbance of marine mammals, especially seals at haul out sites.	The impacts of piling and the construction of the rock armour revetments are considered to be a **Potential Temporary Moderate Negative Impact.** The increase in boat use in Wexford Harbour is considered to be a **Permanent Imperceptible Negative Impact** as the increase in the number and frequency of vessels and their movements will be very small.

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 6 Bats	Bats may be temporarily displaced from the construction footprint during construction due to habitat degradation.	Habitat fragmentation, barrier effects and habitat deterioration due to presence of artificial lighting are potential ongoing direct impacts during the operational phase.	It is considered that indirect impacts on bats are likely to be **Long-term Slight Negative Impacts** resulting from loss of foraging habitat through vegetation removal and artificial lighting. The habitat loss associated with the proposed development is considered to be minor given the available habitat in the wider area (along the railway line primarily). It is considered that there is the potential for **Permanent Slight Negative Impacts** on a resource of Local Importance (Higher Value) associated with the displacement of bats away from existing commuting and foraging areas within and adjacent to the site.
Key Ecological Receptor 7 Invasive Species	Two invasive species, Japanese knotweed and three-cornered leek were found within the site. invasive species may be inadvertently spread during construction through the movement of machinery within and outside the site. Importation of unscreened material and works close to the land-ward boundaries of the site may lead to the introduction if invasive species. The use of ships and barges during the construction phase could lead to the introduction of marine invasive species in ship's ballast water and may have a range of effects, from undetectable to the complete detriment of native communities. The risk of spreading marine invasive species by smaller craft is difficult to control and depends on regular maintenance.	Boats can facilitate the spread of invasive species.	Construction and operation of the proposed development may lead to the introduction and spread of invasive species.

Key Ecological Receptor	Construction-phase impacts	Operational-phase impacts	Ecological significance if unmitigated
Key Ecological Receptor 8 Birds	Direct impacts are the loss of nesting sites within the site footprint and the displacement of birds from within the site and from the surrounding area.	Bird collision with glass facades is considered to be the only operational impact. The planting of trees and hedges will provide additional nesting opportunities for birds.	The loss of nesting sites is considered to be a **Short-term Significant Negative Impact at the Local Scale.** Collision with glass is considered to be a **Long-term Moderate Negative Impact.**

7.8 Mitigation

This section describes the measures that are in place to mitigate any harmful or negative impacts associated with the proposed development and the identified Key Ecological Receptors, as described in the preceding sections. General mitigation measures included within the design of the proposed development are described first, with more specific measures to prevent or minimise impacts on the individual receptors provided subsequently.

7.8.1 General Mitigation

Mitigation by Avoidance

The proposed development minimises landtake from ecologically sensitive areas and has been constraints-led from the initial phase, through an iterative design process; and, into the final proposed development. The design has followed the basic principles outlined below to eliminate the potential for ecological impacts on Key Ecological Receptors where possible and to minimise such impacts where total elimination is not possible. The proposed development has been selected to avoid, as far as possible, direct, in-direct or secondary adverse impacts on Natura 2000 sites or other sites designated for nature conservation. The proposed development has been designed to minimise direct or indirect impacts on any habitats or species or other ecological features that were classified as being of Local Importance (Higher Value) or above. All piling within the Harbour will be restricted to the periods between the 1st June and the 31st January to avoid impacts on migratory fish. Wintering Bird surveys (Natura, 2016) carried for the proposed development concluded that "*The bird numbers present in this area* [within 1km of Trinity Wharf] *represent a small proportion of the total numbers in the Wexford Harbour and Slobs SPA*." The report also found that very few individuals occurred within 200m of Trinity Wharf owing to the lack of suitable habitat. The hydrodynamic modelling report concluded that *"the nearby environmentally sensitive areas will be not be adversely impacted by any changes in the sediment transport as a result of either the landside development in isolation or the landside development in combination with the marina".*

Mitigation by Design

The proposed development has been developed having regard to European and national legislation and all relevant guidelines in relation to ecology and engineering best practice for the planning and construction of proposed developments. These guidelines and best practice provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment. The following is an overview of the design measures that will be employed to minimise and avoid significant impacts on the ecological receptors within the Zone of Influence.

- An Outline Construction and Environmental Management Plan (OCEMP) has been produced to ensure that the construction does not lead to any unanticipated negative impacts on the environment. A Construction Environmental Management Plan (CEMP) and Environmental Management Plan will be completed by each Contractor in line with Appendices 4.1 and 4.2 of this EIAR prior to construction works commencing.
- Vibratory driven sheet piles forming the sea wall on the site perimeter and the option of tubular steel piles, screw piles (helical anchors), or, weighted anchors with chains for the foundation of the marina and boardwalk elements (to be decided during detailed design) have been selected as their installation minimises disturbance and landtake from benthic habitats and mudflats.

- The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.20 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.
- Street lights will be located so that the rear shields are adjacent to the estuary and planted areas or optics are selected that stop back light.
- The drainage has been designed to provide a high level of attenuation and water quality controls, as described in detail in Chapter 04: Description of the Proposed Development.
- The buildings will have blue-green roofs. Species will include native coastal species and a variety of sedums which are pollinator friendly. The landscaping of the site will include trees, shrubs and a wildflower meadow which will provide opportunities for nesting and foraging birds. Details of the Planting Plan are in Appendix 4.6 which includes Drawing No. L-PP-01.
- A suitably qualified Project Ecologist and Marine Mammal Observer (this can be the same person) will be appointed by Wexford County Council for the duration of the proposed development.
- Each contractor will appoint a Site Environmental Manager to carry out environmental monitoring and to ensure that the mitigation measures proposed in this EIAR is followed.

7.8.2 Specific Mitigation Measures

Specific measures are described in relation to individual receptor types in the following sections.

Key Ecological Receptor 1 & 2- Mudflats and Benthic Habitats & River Slaney/ Wexford Harbour Waterbody

<u>Habitat Loss</u>

The loss of estuarine habitats cannot be mitigated for. In spite of the permanent loss of these habitats, this overall impact is considered insignificant given the total area is small (as described in section 7.7.2), has low faunal diversity (ASU, 2018) and is not an important area for wintering birds (Natura, 2016). Water will still be allowed to circulate underneath the marina and boardwalk and the new hard surfaces to which epifauna and seaweeds will attach, will add to the species diversity in the area (ASU, 2018).

<u>Water Quality</u>

Construction Phase

The following mitigation measures relating to the protection of water quality shall apply during the construction of the proposed development:

<u>Sedimentation and surface water run-off</u>

- In order to attenuate flows and minimise sediment input into the River Slaney from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged.

- Sheet piling for the new seaward site boundary shall be installed prior to any excavation on the landward side (other than the access road and level crossing) and demolition of the existing wharf boundary. This will form an effective barrier to run-off from the site during construction.
- Any material stockpiled shall be located a minimum of 30m from the seaward boundary of the site and shall also be covered and remain stockpiled for as short a time as possible.
- The Contractors shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in Wexford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events.
- The placing of anchor blocks (if required) shall be undertaking so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.

Cementitious materials

The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Slaney from the landside elements of the construction. However, the following measures shall also apply:

- All shuttering shall be securely installed and inspected for leaks prior to concrete being poured and all pouring operations shall be supervised monitored for spills and leaks at all times.
- In order to eliminate any remaining risk of input of cementitious material into the River Slaney, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather.
- In order to prevent input of cementitious materials into the River Slaney from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible.
- Where concrete or other wet materials are to be used over water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials.
- Any such materials collected on these platforms shall be disposed of in accordance with the Construction and Demolition Waste Management Plan (CDWMP) (Appendix 4.1).

Hydrocarbons and other chemicals (See also Chapter 09 and 10 of this EIAR)

- Land-based vehicles and plant shall be refuelled off-site, where possible.
- All land-based fuelling of machinery shall be undertaken on an impermeable base in bunded areas at least 50 m from the seaward boundary of the site.
- Marine based fuelling will only be undertaken using specifically designed nozzles to prevent spillages and spill kits will be available.
- All fuelling equipment shall be regularly inspected and serviced.
- Any petrol- or diesel-fuelled pumps or other machinery shall be located within temporary bunded units.

- All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impermeable base which shall be bunded to 110% capacity and appropriately secured.
- All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery.
- Spill kits shall be available on site during construction, including on the jack-up barge during pile driving.
- All waste oils, empty oil containers and hazardous wastes shall be disposed of in accordance with the Waste Management Act, 1996 (as amended).
- Owing to the presence of contaminants within the construction site, excavation shall be limited to the absolute minimum necessary.

Painting of the boardwalk

- Paints containing organotin compounds, e.g. TBT, shall not be permitted.
- In order to minimise the risk of paint spillage into Wexford Harbour, the majority of the deck shall be painted over land, prior to be lifted into position over the estuary, and painting of the remaining sections (mostly at joining points) shall be carried out above bunded platforms which will capture any spilled paint.

Operational Phase

The surface water drainage of the proposed development will include blue-green roofs, rain gardens at building perimeters and soft landscaping features such as vegetated swales. The surface water drainage design will allow for storage during a 1-in-100-year flood event. The surface water drainage for the development site comprises a Sustainable Drainage System (SuDS) approach. The surface water drainage network will drain by gravity to the outfall locations around the site and will be designed to store the 1 in 100-year 6-hour rainfall event plus climate change (between tidal cycles). Surface water run-off from the proposed multi-storey car park will pass through a hydrocarbon interceptor. Details of the drainage for the proposed development are presented in Section 4.3.4.4 of Chapter 04.

The foul sewer will be directed to the public wastewater infrastructure. The risk to the River Slaney has been found to be low and the potential impact assessment is deemed to be imperceptible. See further impact assessment in Chapter 09 Hydrogeology. The bye-laws listed in the Wexford County Council Harbour and Piers Bye-Laws 2014 will apply to vessels using the proposed marina.

Lighting and Shade

Construction Phase

Light spill onto the estuary during hours of darkness has the potential to form a barrier to the migration of nocturnal species and to encourage night-time activity of diurnal species, causing them to become more vulnerable to nocturnal predators. Owing to the scale of the proposed development, it will not result in significant shading impacts.

Turning off construction lighting over the river outside of working hours will eliminate any risk of these impacts outside of those hours. This will eliminate the risk of such impacts occurring during the months of April to September, inclusive, and restrict such impacts to before 7:00 pm and after 7:00 am on weekdays and before 4:30 pm and after 8:00 am on Saturdays during the months of October to March, inclusive. This would ensure at least 12 hours free of artificial light every night of the year and more at weekends. The remaining level of artificial lighting is considered unlikely to result in the significant effects discussed above. However, the risk of such effects occurring can be minimised further by ensuring that construction lighting is limited to the minimum area required, thereby minimising any light spill onto the river channel.

Therefore, subject to any Health & Safety and navigational requirements, construction lighting within 10m of the estuary shall be turned off outside of working hours. In addition, construction lighting will be limited to the minimum area required to be lit. The Project Ecologist will ensure that these measures are adhered to during the construction stage.

Operational Phase

The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths, and onto the estuary (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.

Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Slaney.

Key Ecological Receptor 2 - Migratory Fish

Mitigation measures prescribed for Migratory Fish below are relevant for nocturnal and diurnal fish species, fish of small body size and hearing specialists (fish with highly specialised auditory sense).

Noise and Vibration

The following are the mitigation measures which will apply to all pile driving for the marina, boardwalk and outer sea wall:

- There shall be no pile driving of the marina, boardwalk and sea wall permitted in the period beginning on 1st February and ending on 31st May in any year.
- All pile driving of the marina, boardwalk and sea wall shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.
- Pile driving shall be restricted to between 7:00 am and 7:00 pm from 1st June to 30th September, inclusive, and to between 8:00 am and 6:00 pm from 1st October to 31st January, inclusive.
- All breaks between pile driving of the marina and boardwalk shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent. This measure shall not apply to vibratory driven piles for the sea wall.
- A 30-minute soft-start/ramp-up procedure shall apply to each pile drive. This measure shall not apply to vibratory driven piles for the sea wall, however, a risk assessment will be undertaken in line with the MMRA (Appendix 7.3), and if underwater noise levels from vibratory piling are expected to reach the threshold SPL_{peak} of 170 dB re 1 µPa at 1 m, a soft start approach will be adopted.
- A trained and experienced Marine Mammal Observer (MMO) shall be appointed by WCC to perform that function in accordance with DAHG (2014) and the MMRA which is included in Appendix 7.3.

- If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCC, the NPWS and IFI.
- All of the above measures shall be enforced by the WCC Project Ecologist and the SEM appointed by each Contractor.

Lighting and Shade

The mitigation prescribed for impacts of artificial lighting (above) are considered more than adequate to eliminate any risk of significant such impacts on Migratory Fish during the construction and operation of the proposed development.

Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Slaney and the migratory fish species present.

Water quality

Given the full and proper implementation of the water quality protection measures, described above, the operation and maintenance of the proposed development will not give rise to any adverse effects on Migratory Fish through a deterioration of water quality.

Key Ecological Receptor 3 – Otter

Pre-construction Otter Survey

Prior to any works being carried out, a pre-construction otter survey will be undertaken to ensure that no otters have taken up residence within 150m of the proposed development.

Noise and Vibration

The mitigation prescribed for noise and vibration impacts (above) are considered more than adequate to eliminate any risk of significant direct and indirect noise and vibration impacts on otters during the construction of the proposed development. Therefore, no further mitigation is required in respect of noise and vibration impacts on this species.

Lighting

The mitigation prescribed for impacts of artificial lighting (above) are considered more than adequate to eliminate any risk of significant such impacts on Otter during the construction and operation of the proposed development. There will be no spillage of light to the river or to land within 10m of the estuary outside of working hours. Therefore, no further mitigation is required in respect of lighting impacts on this species.

Key Ecological Receptor 4- Marine Mammals

Marine Mammals may be injured as a result of marine-based piling and rock armour construction. The following mitigation measures for part of the proposed development:

- A qualified and experienced Marine Mammal Observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
- Unless further information specific to the location and proposed development is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with WCC, NPWS and IFI, pile driving activity shall not commence if

marine mammals are detected within a 500m radial distance of the pile driving sound source.

- Pre-Start Monitoring

  Pile driving activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.

  An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

  The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.

  This prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO.

- Ramp-Up Procedure

  In commencing a pile driving operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds $\mathrm{SPL}_{\mathrm{peak}}$ of 170 dB re 1 µPa at 1 m, an appropriate Ramp-up Procedure (i.e., "soft-start") must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information (see section 3 of Appendix 7.3 of the EIAR).

  Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e. an $\mathrm{SPL}_{\mathrm{peak}}$ not exceeding 170 dB re 1 µPa at 1 m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes.

  This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

  Where the measures outlined in the previous steps are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output.

  In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

  Once an appropriate and effective Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

- Breaks in sound output

  If there is a break in pile driving sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start

Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

For higher output pile driving operations which have the potential to produce injurious levels of underwater sound (see Appendix 7.3 MMRA sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

- Reporting

  Full reporting on MMO operations and mitigation undertaken must be provided to the NPWS.

Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. These seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines.

Signage at the marina will provide information to boat owners about the importance of Wexford Harbour for seals. It will also give information on how to avoid disturbance and signs of disturbance (head up etc).

Key Ecological Receptor 6 – Bats

Lighting during the construction phase will avoid direct illumination of the estuary. Follow the removal of vegetation within the sites, new areas will be planted which will include pollinator friendly, and therefore bat friendly species.

The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.

Key Ecological Receptor 7- Invasive Species

Regulation 49 of Habitats Regulations includes legislative measures to deal with the dispersal and introduction of Invasive Species, which are listed in the Third Schedule of the Regulations.

Japanese knotweed and three-cornered leek are present within the site. The construction works have the potential to spread invasive species within and outside the site. Prior to any works being carried out, a pre-construction invasive species survey will be undertaken to ensure that additional invasive have not been introduced to areas within or close to the proposed development footprint. The Invasive Species Management Plan that is currently in place is presented in Appendix 7.4.

Vessels associated with the construction of the sea walls, the boardwalk and the marina have the potential to introduce invasive species to Wexford Harbour. Vessels should adhere to the industry recommended guidelines for preventing the introduction of non-native marine species. UKMarineSAC (2009) recommends that vessels comply with International Maritime Organisation guidance wherever possible, seek guidance from the Wexford Harbour authority regarding areas where ballast water uptake should be avoided (e.g. near sewage outfalls), encourage the exchange of ballast water in the open ocean, and discourage/prohibit the unnecessary discharge of ballast water in the harbour area.

Signage will be put in place at the marina informing the public of the marine invasive species that are associated with small craft and marinas and the importance of boat maintenance.

Key Ecological Receptor 8 – Birds

The protection of bird breeding habitats during the breeding season (1st March to 31st August, inclusive), are set out in the Wildlife Acts. Any removal of vegetation within this period will require the supervision of a suitably qualified and experienced ecologist to ensure no breeding birds are present. As part of the landscaping of the site, trees, shrubs, a hedgerow and a wildflower meadow will be planted (Appendix 4.6, Drawing No. L-PP-01 (Planting Plan). This will provide nesting and feeding opportunities for birds.

The mitigation prescribed for bats with regard to lighting (above) is considered more than adequate to eliminate any risk of significant direct and indirect lighting impacts on birds during the construction of the proposed development.

Bird-friendly glass (e.g. www.ornilux.com), which will reduce the reflectivity of glass facades and windows, will be used on all buildings.

7.9 Residual Impacts on Key Ecological Receptors

Table 7.16 Assessment of the Residual Impacts Scale and Significance based on EPA (2017) and TII (2009)

Key Ecological Receptor	Pre-Mitigation Impacts	Ecological Significance Following Mitigation
Key Ecological Receptor 1 Mudflats and Benthic Habitats	• Direct loss of habitat; • Displacement, injury and death of fauna; • Habitat fragmentation and barrier effects; and, • Potential accidental pollution.	The direct loss of mudflat and benthic habitat cannot be mitigated for as this lies within the footprint of the proposed development. The impact of this habitat loss will be a permanent significant negative impact over a small area (as outlined in section 7.7.2). These habitats in the vicinity of the proposed development are described as having low faunal diversity (ASU, 2018) and of are no importance to wintering birds (Natura, 2016). Therefore, habitat loss is not considered to be a significant impact on 'Mudflats and Benthic Habitats' and their associated species in Wexford Harbour. The displacement of fauna around the site during construction will be a temporary moderate impact act the local scale. Within the footprint of the marina structure outside of the piles/ restraints, the benthic habitats will be unavailable for mussel farming and will remain in a natural state. This will be a potential positive impact. There will be no other residual impacts on this Key Ecological Receptor associated with the construction phase. During operation, provided all of the mitigation measures recommended are implemented in full, residual impacts are expected to be confined to temporary disturbance of sub-tidal benthic habitats and short-term disturbance of intertidal hard benthos habitats associated with construction phase activities. Long-term changes associated with the loss of soft and hard benthos will be largely offset by the provision of additional hard benthic surfaces on piles, restraints and rock-armour flora and fauna will colonise. In addition, the proposed development will contain any contaminants inside the site. Taken in total these changes can be described as a slight permanent negative impact.

Key Ecological Receptor	Pre-Mitigation Impacts	Ecological Significance Following Mitigation
Key Ecological Receptor 2 River Slaney and Wexford Harbour waterbodies	• Direct loss of habitat; • Displacement, injury and death of fauna; • Habitat fragmentation and barrier effects; and, • Potential accidental pollution.	The direct loss of estuarine habitat cannot be mitigated for as this lies within the footprint of the proposed development. The impact of this habitat loss will be a permanent significant negative impact over a small area (as outlined in section 7.7.2). This habitat, in the vicinity of the proposed development, are described as having low faunal diversity (ASU, 2018) and of are no importance to wintering birds (Natura, 2016). Therefore, habitat loss is not considered to be a significant impact on 'River Slaney and Wexford Harbour waterbodies' and the associated species in Wexford Harbour. The displacement of fauna around the site during construction will be a temporary moderate impact at the local scale. Within the footprint of the marina structure outside of the piles/ restraints, the benthic habitats will be unavailable for mussel farming and will remain in a natural state. This will be a potential positive impact. There will be no other residual impacts on this Key Ecological Receptor associated with the construction phase. Provided all the mitigation measures recommended are implemented in full, residual impacts are expected to be confined to temporary disturbance of the estuarine habitats and short-term disturbance of intertidal hard benthos habitats associated with construction phase activities. Long-term changes associated with soft and hard benthos will be largely offset by the provision of additional hard benthic surfaces on piles, restraints and rock-armour which flora and fauna will colonise. In addition, the proposed development will contain any contaminants inside the site. Taken in total these changes can be described as a slight permanent negative impact.
Key Ecological Receptor 3 Migratory Fish	• Habitat fragmentation and direct mortality; and, • Potential accidental pollution.	No significant residual impact on this Key Ecological Receptor at any scale.

Key Ecological Receptor	Pre-Mitigation Impacts	Ecological Significance Following Mitigation
Key Ecological Receptor 4 Otter	- Habitat Fragmentation and barrier effects.	No significant residual impact on this Key Ecological Receptor at any scale.
Key Ecological Receptor 5 Marine Mammals	- Habitat loss and barrier effects. - Injury	No significant residual impact on this Key Ecological Receptor at any scale.
Key Ecological Receptor 6 Bats	- Habitat loss and barrier effects.	Habitat loss as a result of lighting and vegetation removal will constitute a permanent slight negative impact at the local scale. No significant residual impact on this Key Ecological Receptor at any scale.
Key Ecological Receptor 7 Invasive Species	- Construction and operation of the development may lead to the spread of invasive species.	No significant residual impact on this Key Ecological Receptor at any scale.
Key Ecological Receptor 8 Birds	- Direct Mortality through collision. - Habitat Loss	No significant residual impact on this Key Ecological Receptor at any scale.

7.10 Assessment of Cumulative Effects

Cumulative effects are impacts that result from incremental changes caused by other existing or proposed plans or projects, together with the Trinity Wharf Development. Cumulative impacts were assessed within a 1km buffer of the Slaney Estuary as far upstream as Ferrycarrig Bridge. An online planning search was also carried out for plans and projects within Wexford Town and the wider area within 15km of the proposed development for plans and projects which could have pathways for cumulative impacts to occur.

This assessment has considered cumulative impacts that are:

(a) Likely;
(b) Significant; and,
(c) Relating to a future event, reasonably foreseeable.

The cumulative assessment evaluates the additional change resulting from the Trinity Wharf Development in relation to the theoretical baseline scenario. None of the developments identified during the cumulative assessment were determined to result in significant adverse cumulative effects with regard to biodiversity, as described in Chapter 17: Inter-relationships, Major Accidents and Cumulative Effects.

7.11 Ecological Enhancements

Current planning policy requires that proposed developments minimise ecological damage and should contain elements of ecological enhancement where possible. Action 1.1.3 of the National Biodiversity Action Plan 2017-2021 states that "*all Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting and/or investment in Blue-Green infrastructure*". The following ecological enhancements are proposed as part of the proposed development:

- The Landscape Planting Plan (Appendix 4.6 Drawing No. L-PP-01 (Planting Plan)) has been cognisant of pollinators and includes a wildflower meadow and pollinator friendly trees and shrubs. All buildings will have blue-green roofs which includes drifts of native pollinator friendly species.
- Eight No. 17A Schwegler Swift Nest Boxes (triple cavity) will be incorporated into the development. These will be positioned on the north faces of the buildings out of the prevailing wind and at least 4.5m high. The type and position should be confirmed by the Project Ecologist. *Notes on the Common Swift and Setting up nest boxes* (Linda Huxley, 2014) provides guidance on setting up swift boxes.
- Ten bird boxes will be placed around the site. These should include boxes for a variety of species and should be placed out of direct sunlight and the prevailing wind. The positioning of the bird boxes should be decided by the Project Ecologist.
- Blue-green roofs may act as an enhancement measure by providing new nesting habitat for ground nesting birds such a ringed plover, lapwing, skylark, and terns.
- The construction of the marina will prevent potential mussel farming in approximately 25,000m^2 of sea bed (not including a buffer) which is not currently licensed. This will improve the quality of the benthic habitat in this area in the long term.
- The floating breakwaters will provide additional roosting habitat for wintering birds.
- Signage with information relating to the biodiversity of Wexford Harbour will be installed at the proposed development location to encourage an understanding and respect for the natural environment of the area. This will refer specifically to disturbance by boats and loose dogs.

7.12 Conclusions

This chapter has assessed the ecological impacts of the construction and operation of the Trinity Wharf Development. The assessment described herein has examined the receiving natural environment and identified the Key Ecological Receptors likely to be impacted upon by the proposed development, namely the Mudflats and Benthic habitats, River Slaney/Wexford Harbour waterbody, Migratory Fish, Otter, Marine Mammals, Bats, Invasive Species and Birds. Each Key Ecological Receptor was characterised in terms of its conservation value on a geographical scale. The chapter has analysed the potential impacts of the proposed development on these Key Ecological Receptors and characterised their likely effects in terms of their magnitude, extent, duration, frequency and reversibility, thereby determining their significance on a geographical scale.

Two of the Key Ecological Receptors, Mudflats and Benthic Habitats, and, the River Slaney/ Wexford Harbour waterbody, were considered to have impacts following mitigation relating to direct habitat loss within the footprint of the proposed development. These impacts are not considered to be significant.

The Natura Impact Statement concluded, in view of best scientific knowledge and the Conservation Objectives of European sites, that the proposed development, either individually or in combination with other plans or proposed developments, will not adversely affect the integrity of any European site.

Provided that the development proposed in the Trinity Wharf Development is constructed and operated in accordance with best practice guidelines and the mitigation measures described, there will be no significant negative impacts on the ecology of the Zone of Influence at the international, national or county level.

The loss of mudflats and benthic habitats is significant at the local scale; however, this impact is mitigated by the fact that these habitats are of low quality and the new hard surfaces will increase the diversity in the local area. In addition, the release of contaminants from the existing site will be prevented by the new outer sea wall. Therefore, the favourable conservation status of these Annex I habitats will not be compromised.

There are no other residual effects likely to be significant at the local, county, national or international level.

Furthermore, the assessment found no significant impacts arising from the cumulation of the impacts from the proposed development with the impacts from other existing or approved developments.

Following consideration of the residual (post-mitigation) impacts, it is noted that the proposed Trinity Wharf Development will not result in any significant impacts on any of the identified Key Ecological Receptors.

7.13 References

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Appendix 7.1 Marine Benthic Study

ROUGHAN & O'DONOVAN

Trinity Wharf Marina Development

Marine Benthic Assessment

(October 2018)

Commissioned by: RPS Group
Carried out by: Aquatic Service Unit, UCC.
November 2018

1 Introduction & Brief

Aquatic Services Unit were requested by RPS Group to undertake a marine benthic assessment of the subtidal and intertidal communities within the area of proposed marina development at Trinity Wharf, Wexford.

2 Methodology

2.1 Soft Benthos Survey

2.1.1 Soft Sediment Sampling

A total of 15 samples were collected in Trinity Wharf. 12 samples were collected from the subtidal area using a 0.1m^2 stainless steel Van Veen grab. 3 samples were collected from the intertidal area using a 0.028m^2 stove pipe core. All samples were collected on the 24th October, 2018. Pre-determined sampling positions were navigated to and once on site, the precise location of each sampling station was collected using a Trimble Geo-XM GPS. A full list of the stations sampled are presented in Table I and these stations are displayed on a map (Figure 1).

	Easting (m)	Northing (m)		Easting (m)	Northing (m)
Wexford_01 (c)	705596.4	621176.2	Wexford_09 (g)	705371.8	621478.7
Wexford_02 (c)	705622.2	621218.5	Wexford_10 (g)	705429.6	621474.3
Wexford_03 (g)	705666.3	621292.1	Wexford_11 (g)	705488.9	621474.6
Wexford_04 (g)	705648.1	621347.5	Wexford_12 (g)	705452.3	621531.4
Wexford_05 (g)	705590.8	621374.5	Wexford_13 (g)	705382.6	621527.7
Wexford_06 (g)	705543.0	621423.3	Wexford_14 (g)	705306.0	621620.1
Wexford_07 (g)	705449.8	621458.0	Wexford_15 (g)	705680.9	621441.4
Wexford_08 (c)	705384.1	621380.6			

Table I: Positions of sub-tidal soft sediment sampling stations. All positions are provided in Irish Transverse Mercator (ITM). (g – Subtidal grabs; c – Intertidal cores)

At each sediment station:

- 1 x 0.1m^2 Van-Veen grab taken for benthic faunal analysis (12 Stations).
  or
- 1 x 0.028m^2 Stove pipe core, taken to a depth of 20cm.

- 1 x 0.1m^2 Van-Veen grab from which a small amount of sediment was retained for Particle Size Analysis and Loss on Ignition Analysis (10 stations) - Two stations were unsuitable for detailed particle size analysis as the sediment consisted primarily of live mussels (Wexford S11) or Mussel/gravel (Wexford S06)
  or
- A surface scrape of sediment (3 Stations)

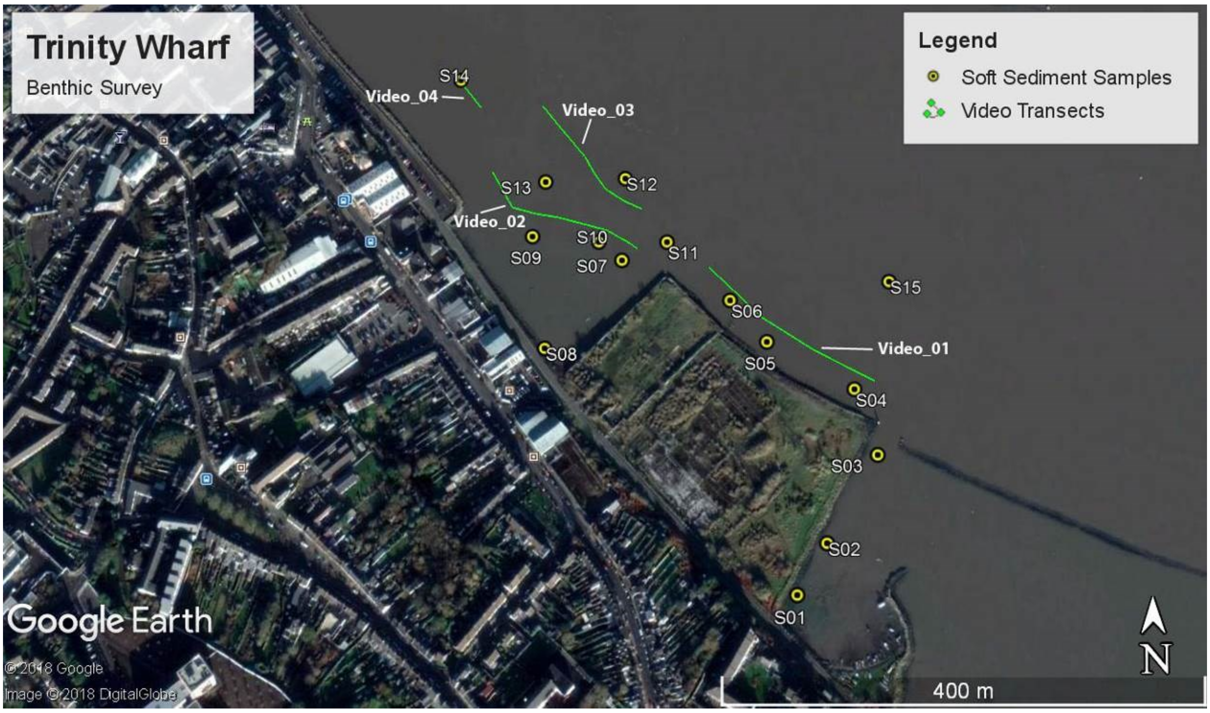

Figure 1: Map showing the positions of sediment samples (yellow dots) and video transects (green lines).

All samples were processed within 24 hours of collection. Samples were sieved through a 1mm mesh sieve and preserved in 4% formalin (buffered with sea water). All fauna were identified to the lowest taxonomic level possible using standard keys to north-west European fauna by specialist taxonomists.

A number of biotic indices were calculated from the species / abundance matrix from the benthic samples. Epifaunal taxa marked present/absent were removed from this analysis. These indices included Simpson's Dominance Index (where values range from low dominance [0] to high dominance [1]), Shannon-Wiener Diversity Index (Values ranging from low diversity [0] to high diversity [4]) and Pielou's Evenness Index (values ranging from low i.e. dominated by a few species [0] to high evenness i.e. a more even spread of species [1]).

Granulometric Analysis

Granulometric analysis was carried out on oven dried sediment samples from each station using the protocols described by Holme & McIntyre (1984). The sediment was passed through a series of nested brass test sieves with the aid of a mechanical shaker. The sediments were analysed to determine three fractions: % Gravel (>2mm), % Sand (<2.0mm >63µm) and % Silt-Clay (<63µm).

Organic Matter Analysis

Organic matter was estimated using the Loss on Ignition (LOI) method. One gram of dried sediment was ashed at 450˚C for 6 hours and organic carbon was calculated as % sediment weight loss.

2.1.2 Subtidal Video Survey

Four video transects were undertaken within, and adjacent to, the footprint of the proposed marina development. Fieldwork was carried out on the 24th October 2018. The precise location of each sampling station was collected using a Trimble Geo-XM GPS. A complete list of stations sampled are presented in Table II and these stations are displayed on a map (Figure 1).

Station	Co-ordinates (ITM)		Station	Co-ordinates (ITM)	
	Easting (m)	Northing (m)		Easting (m)	Northing (m)
	In			Out	
Vid_01	705536.7	621451.9	Vid_01	705621.4	621361.8
Vid_02	705343.1	621538.9	Vid_02	705461.1	621472.7
Vid_03	705375.9	621591.6	Vid_03	705463.2	621507.8
Vid_04	705305.1	621623.4	Vid_04	705322.0	621609.4

Table II: Positions of shallow water sub-tidal video survey stations. All locations given in Irish National Grid.

A total of 4 stations were sampled using a drop down video camera system. Data was recorded as MPEG4 format files. At each station a single recording was taken at each location. The video camera was lowered to above the sediment surface, and video imagery was recorded.

2.1.3 Intertidal Survey

The rocky intertidal shores in and adjacent to the Trinity Wharf development were assessed during a walkover survey on November 8th 2018 during low spring tide. During the survey, the weather was mostly dry with little or no wind. The area surveyed is within the Slaney River Valley SAC although none of the hard benthic habitats surveyed are included in the sites Conservation Objectives falling instead into the general habitat type ‘Estuaries’.

3 Results

3.1 Soft Sediment Benthos

3.1.1 Particle Size and Loss on Ignition Assessment

Results from the sediment grainsize analysis indicates the subtidal area is dominated by muddy shell gravel, consisting primarily of mussel shell and muds. The intertidal areas located adjacent to the Trinity Wharf consist of soft muds (Fig. 2 & Table III)

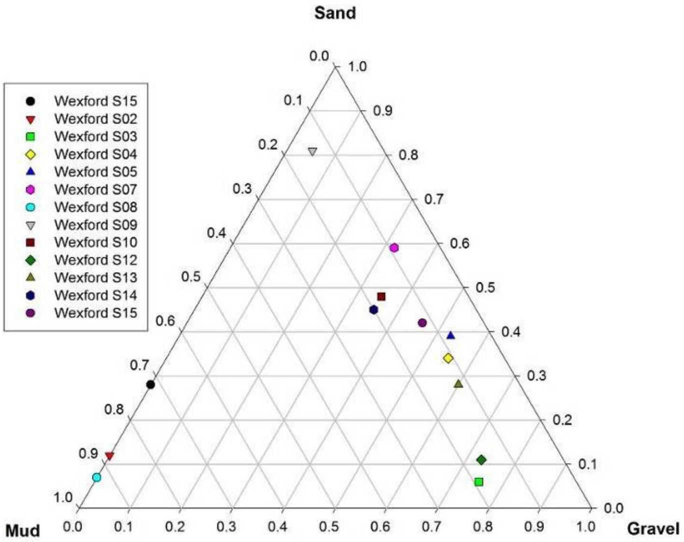

Figure 2: Ternary Plot of granulometric results from Trinity Wharf.

	Wexford_01	**Wexford_02**	**Wexford_03**	**Wexford_04**	**Wexford_05**
% Gravel	0.1%	0.1%	75.3%	55.8%	52.9%
% Sand	27.6%	11.9%	6.1%	33.5%	38.7%
% Mud	72.3%	88.0%	18.6%	10.7%	8.4%
% LOI	8.17%	10.53%	5.70%	2.05%	2.57%
Textural Group	Sandy Mud	Sandy Mud	Muddy Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel
	Wexford_06	**Wexford_07**	**Wexford_08**	**Wexford_09**	**Wexford_10**
% Gravel	100%	31.8%	0.0%	4.7%	34.8%
% Sand	0%	59.2%	7.3%	81.7%	48.2%
% Mud	0%	9.0%	92.7%	13.6%	17.0%
% LOI	No Sample	1.40%	10.73%	1.73%	4.39%
Textural Group	Gravel*	Muddy Gravelly Sand	Mud	Slightly Gravelly Muddy Sand	Gravelly Muddy Sand
	Wexford_11	**Wexford_12**	**Wexford_13**	**Wexford_14**	**Wexford_15**
% Gravel	N/A	73.6%	60.7%	35.2%	45.8%
% Sand	N/A	10.6%	27.8%	44.9%	42.4%
% Mud	N/A	15.8%	11.5%	19.9%	11.8%
% LOI	No Sample	3.64%	2.80%	1.56%	1.59%
Textural Group	Live Mussels*	Muddy Gravel	Muddy Sandy Gravel	Muddy Gravelly Sand	Muddy Sandy Gravel

Table III Granulometric and Loss on Ignition results from samples taken within the survey area adjacent to Trinity Wharf. * Indicates no grainsize and LOI sample was collected at this site

3.1.2 Infaunal Assessment

A total of 38 taxa were recorded in the benthic samples collected from Trinity Wharf (Table IV & Table V). The highest number of species were recorded at Wexford_06 (19 taxa) and the highest numbers of individuals were recorded at Wexford_03 (1,400 individuals) and Wexford_13 (1,140 individuals). The lowest numbers and diversity were recorded at the intertidal stations; Wexford_01 (2 taxa, 2 individuals), Wexford_02 (1 taxa, 1 individual) and Wexford_08 (1 taxa, 1 individual).

All species identified in the present survey (Table V) are typical of shallow subtidal communities, and all are common in Irish coastal waters. The oligochaetes *Tubificoides benedii* (12 sites) & *Tubificoides pseudogaster* (11 sites), the polychaetes *Tharyx* sp. A (12 sites), *Streblospio shrubsolii* (11 sites), *Nereis diversicolor* (11 sites) & *Polydora cornuta* (10 sites) and the amphipod *Melita dentata* (11 stations) were present in most subtidal stations. The mollusc *Mytilus edulis* was present in 9 sites, although it was present in high numbers (≥50) at only 2 stations; Wexford_S11 returned 232 mussels and Wexford_S13 returned 50 mussels.

	Wexford_01	Wexford_02	Wexford_03	Wexford_04	Wexford_05	Wexford_06	Wexford_07	Wexford_08
No. of Species	2	1	13	13	14	19	9	1
No. of Individuals	2	1	1400	1150	911	226	117	1
Shannon-Wiener	0.693	0	1.89	1.96	2.08	2.26	1.68	0
Pielou's Evenness	1	****	0.739	0.765	0.79	0.767	0.764	****
Simpson's Dominance	0.5	1	0.193	0.17	0.148	0.145	0.24	1

	Wexford_09	Wexford_10	Wexford_11	Wexford_12	Wexford_13	Wexford_14	Wexford_15
No. of Species	3	6	8	15	15	16	16
No. of Individuals	5	7	477	450	1140	750	456
Shannon-Wiener	1.05	1.75	1.14	2.01	2.02	1.47	1.94
Pielou's Evenness	0.96	0.976	0.55	0.744	0.745	0.529	0.699
Simpson's Dominance	0.36	0.184	0.391	0.166	0.17	0.353	0.212

Table IV Diversity indices derived from the benthic samples collected from the survey area.

Table V: Species / abundance matrix for fauna identified within the survey area at Trinity Wharf.

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15
Tharyx sp. A	-	-	144	252	64	4	41	-	2	1	4	56	24	418	168
Tubificoides benedii	-	-	204	284	208	14	12	-	2	2	2	12	184	114	42
Melita dentata	-	1	-	40	40	62	1	1	1	-	183	112	276	32	22
Nereis diversicolor	-	-	108	36	8	5	6	-	-	1	6	6	28	73	8
Streblospio shrubsolii	-	-	168	132	152	34	35	-	-	1	6	72	64	53	20
Tubificoides pseudogaster	-	-	492	184	124	8	13	-	-	1	5	42	292	38	16
Polydora cornuta	-	-	152	152	160	19	3	-	-	-	39	100	100	11	104
Mytilus edulis	-	-	6	12	35	35	-	-	-	-	232	2	50	3	18
Nereis virens	-	-	16	4	4	3	-	-	-	1	-	-	28	1	2
Carcinus maenas	-	-	2	5	7	1	-	-	-	-	-	1	5	-	5
Spirobranchus lamarcki	-	-	-	16	4	21	-	-	-	-	-	26	4	1	40
Heterochaeta costata	1	-	92	28	92	7	-	-	-	-	-	10	82	-	-
Cerastoderma edule	-	-	2	1	-	-	2	-	-	-	-	1	1	-	1
Microdeutopus versiculatus	-	-	-	-	12	4	-	-	-	-	-	6	-	-	4
Parvicardium exiguum	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
Mya truncata	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-
Harmothoe indet.	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-
Sthenelais boa	-	-	4	-	-	-	-	-	-	-	-	2	-	-	-
Eteone longa	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2
Heteromastus filiformis	-	-	8	-	-	1	-	-	-	-	-	-	-	-	-
Janira maculosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Hyas araneus	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Pisidia longicornis	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Crangon crangon	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Pomatoschistus minutus	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Sphaeroma serratum	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Corophium volutator	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Lepidonotus squamatus	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Glycera alba	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Autolytus langerhansi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Malacoceros vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Capitella capitata (complex)	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15
Paranais litoralis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semibalanus balanoides	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-
Elminius modestus	-	-	P	-	-	-	-	-	-	-	-	-	P	-	P
Balanus crenatus	-	-	P	-	P	P	-	-	-	-	-	P	P	-	P
Membranoptera alata	-	-	-	-	-	P	-	-	-	-	-	P	-	-	P
Flustra foliacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P

3.1.3 Video Assessment

Drop 1:

A large mussel bed is present across large parts of the video transect (Plate 1 – a & d). These beds consist of live mussels in muddy sand/sandy mud. Occasional areas of shell gravel are present across the transect (Plate 1 – b & c)

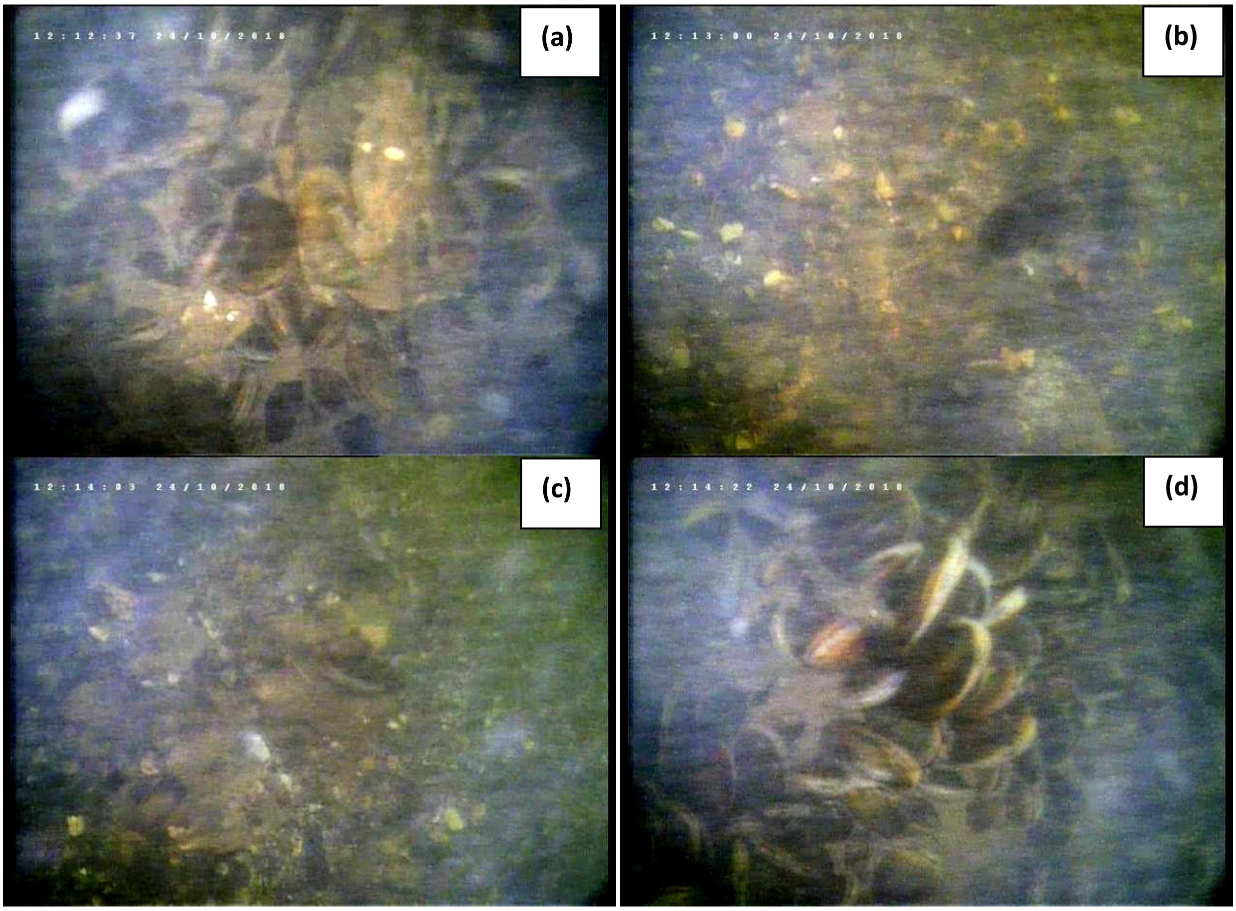

Plate 1: Video frame grabs from Video Transect 1. (a) Live mussels with a common shore crab *Carcinus maenas* present. (b) Shell gravel in muddy sand matrix. (c) Shell gravel with occasional live mussel present in muddy sand matrix. (d) Live mussels.

Drop 2:

Coarse and shell gravel sediment dominates this transect, with a thin layer of fine sediment visible on the surface of the gravel. Occasional live mussels are presetn in the area, and dead mussel shells are present within the gravel matrix.

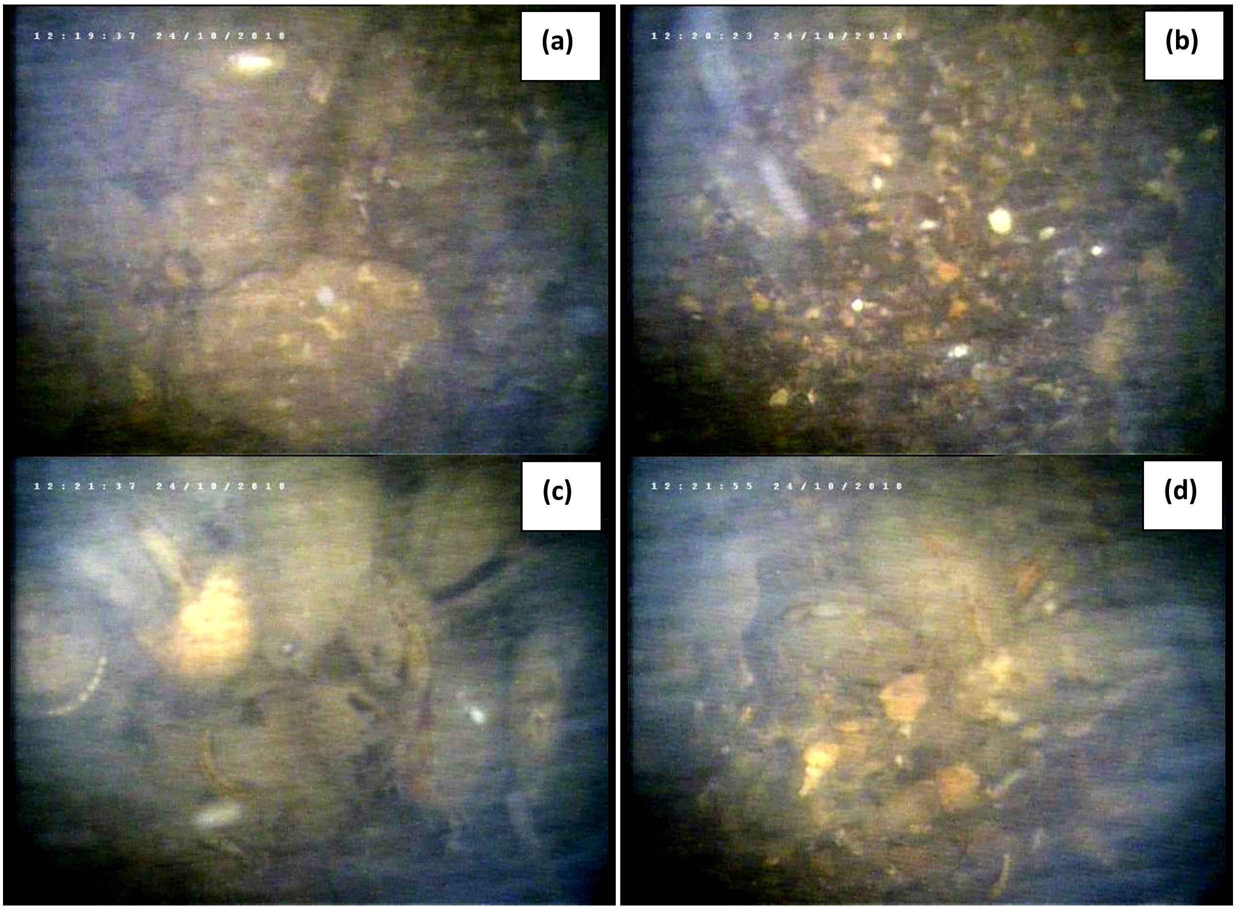

Plate 2: Video frame grabs from Video Transect 2. (a) – Coarse gravel with epifauna – keelworms (*Spirobranchis lamarcki*) and barnacles. (b) Shell gravel in muddy sand matrix. (c) Live mussels in sandy mud. (d) Live mussels in shell gravel and sandy mud.

Drop 3:

The area consists of live mussels interspersed with shell gravel and coarse gravel.

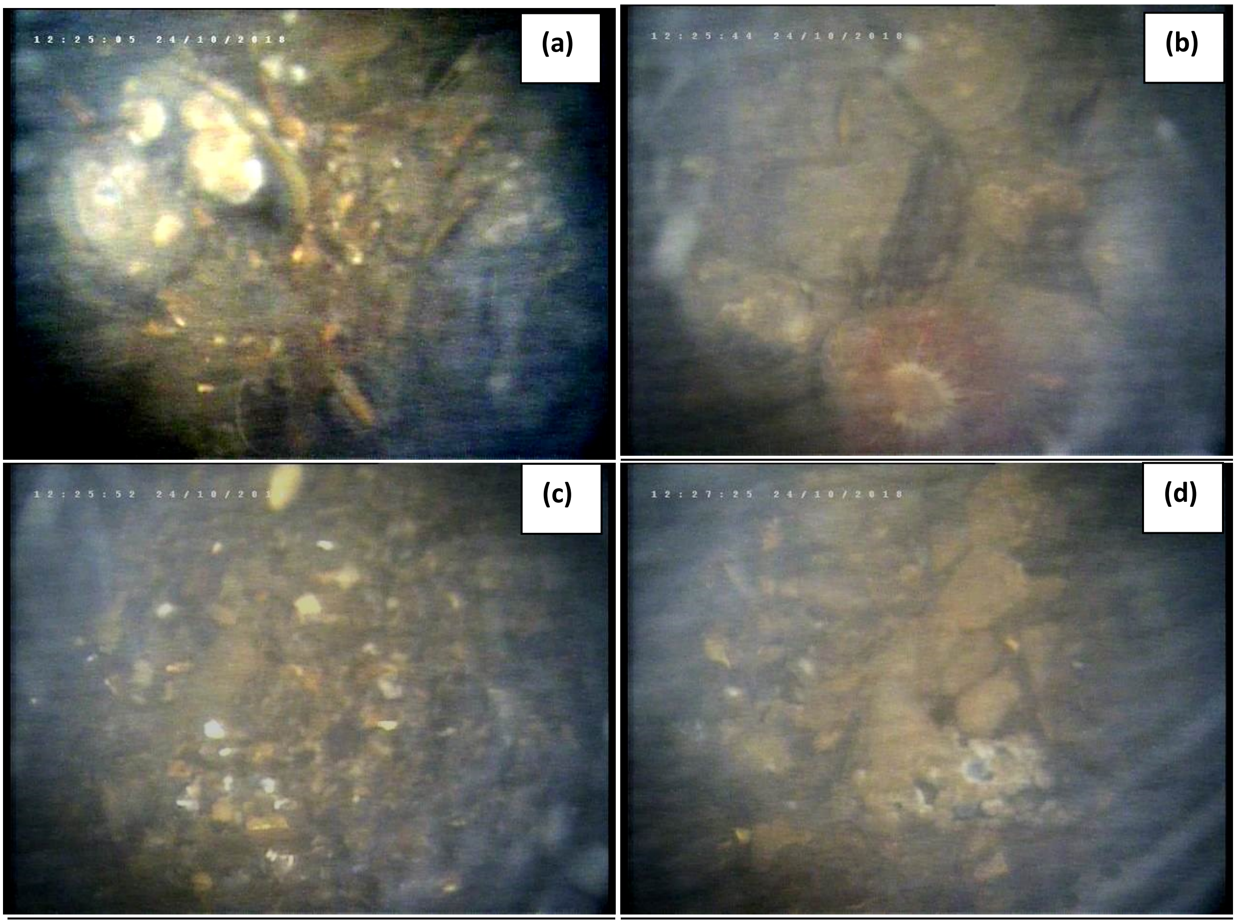

Plate 3: Video frame grabs from Video Transect 3. (a) – Live mussels with barnacles (possibly *E. modestus*) in coarse gravel on muddy sand. (b) Coarse gravel with anemones, possibly *Haliplanella lineata*, in a muddy sand matrix. (c) Shell gravel present in muddy sand matrix. (d) Coarse gravel with barnacles and keelworm present on hard surfaces.

Drop 4:

The area consists primarily of shell gravel in a muddy sand sediment. Occasional live mussels were identified in parts.

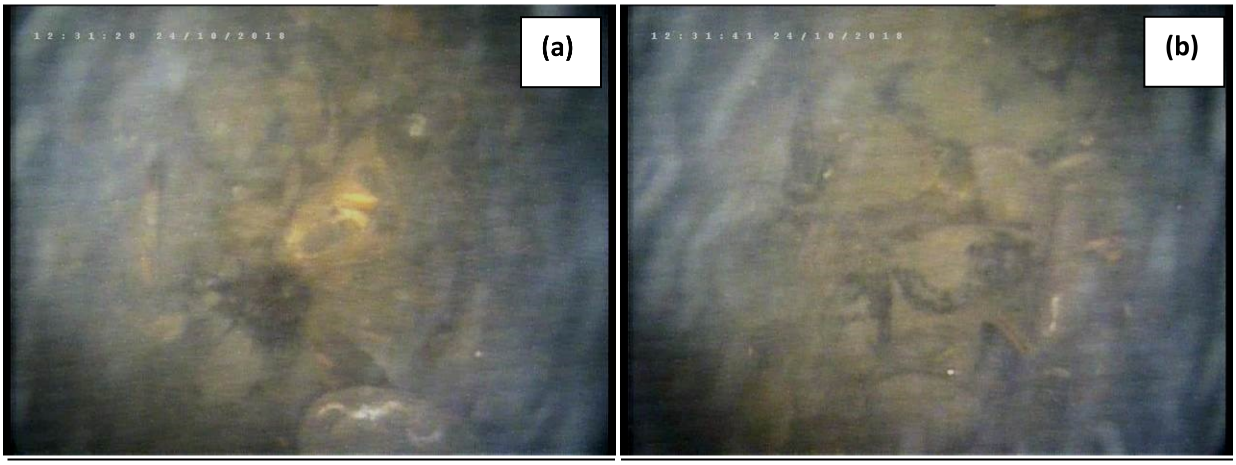

Plate 4: Video frame grabs from Video Transect 4. (a) – Coarse gravel with keelworms (*S. lamarcki*) and barnacles. (b) Coarse gravel in muddy sand matrix.

3.1.4 Habitat Assessment

Surveys by NPWS identified a single faunal community in the vicinity of the Trinity Wharf complex. This '*Estuarine muds dominated by polychaetes and crustaceans community complex*' is recorded along the shore from Ferrycarrig Bridge to Wexford Bridge and covers 1,269ha of subtidal benthos within the SAC. It also identified a Mixed sediment community complex along the northern parts of Wexford Harbour, and this makes up 200ha of the subtidal benthos within the SAC (NPWS, 2011).

Additional surveys undertaken in 2005 and 2007 (Aquafact 2007) which reported similar species and abundances to those identified in the present survey. This highlights the relatively stable nature of the benthos in this area. In addition, intertidal samples collected from the mudflats immediately adjacent to Trinity Wharf returned little or no fauna, which is reflected in the present survey.

The benthos in the vicinity of the proposed development consists primarily of mixed sediments, dominated by shell and coarse gravels. Occasional patches of mussels are present in the area, and mussels were present in 9 of the 12 subtidal sampling locations. However, it should be noted that large number of mussels were present at only 1 location indicating the scattered nature of these mussel aggregations. This is confirmed in the video data which highlights the presence of scattered clusters of mussels interspersed with shell gravel on muddy sands / sandy muds.

The subtidal community identified in the survey area conforms well to the Estuarine mud complex, although there are also elements of the mixed sediment community complex present. This agrees with NPWS findings on the distribution of this community complex within Wexford Harbour (NPWS 2011).

The soft sediment intertidal community is typified by low faunal densities and diversity at all intertidal sites. The sediment consists of fine muds, with diatoms present on the sediment surface. Bird tracks were present on site during the time of sampling.

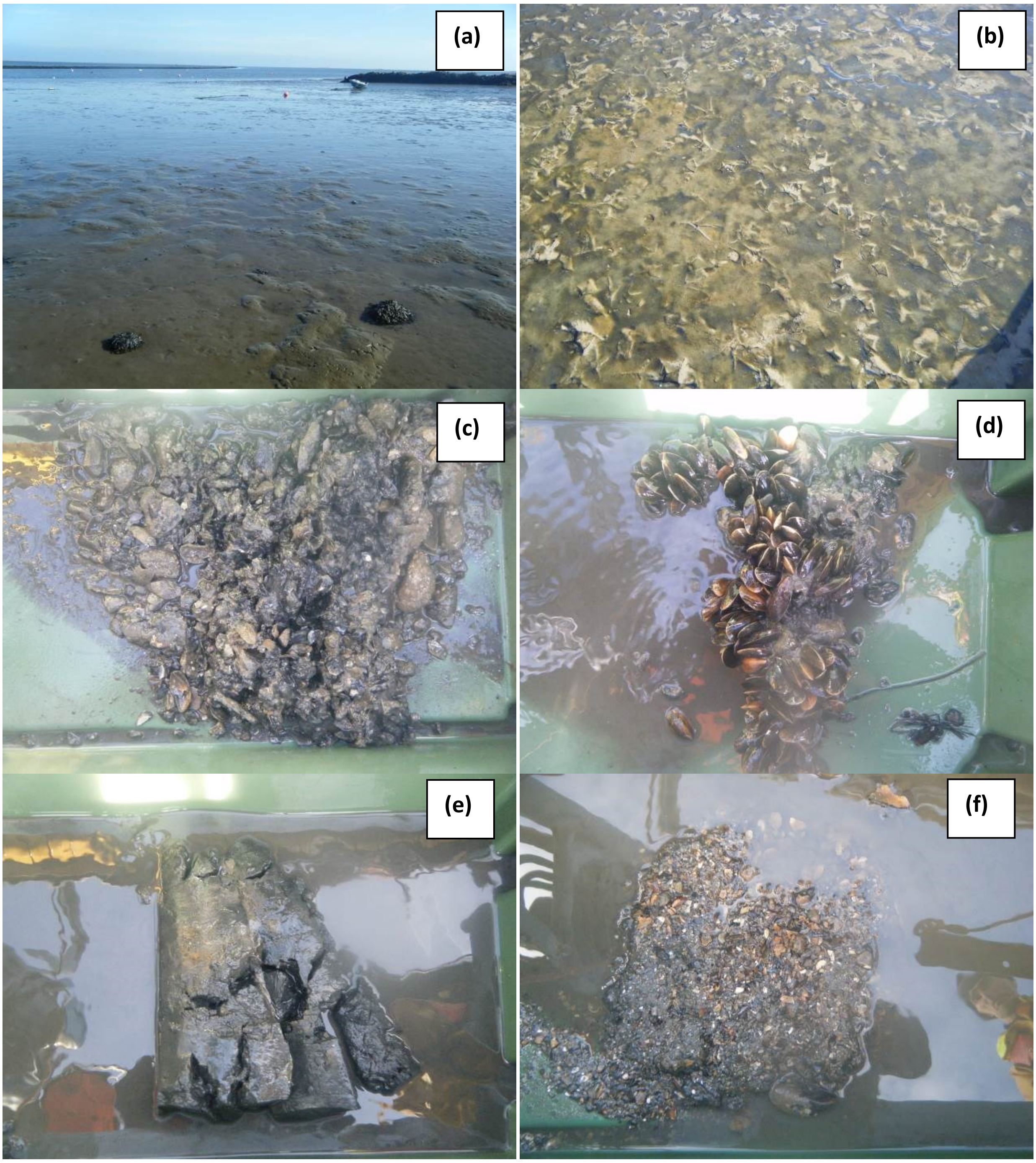

Plate 5: (a) View of the soft sediment flats located adjacent to the South Easter wall of Trinity Wharf; (b) View of the sediment surface at Wexford_S08; (c) Shell gravel from Wexford_S03; (d) Wexford_S11 showing grab full of live mussels; (e) Sediment taken at Wexford_S10; (f) Muddy Shell gravel from Wexford_S14.

3.2 Intertidal Hard Benthos

The survey area can be divided into 3 areas for convenience (i) the small boat harbour to the south, (ii) the main reclaimed Trinity Wharf area in the centre and (iii) the Wexford town shore to the north of the survey area (Figure 3).

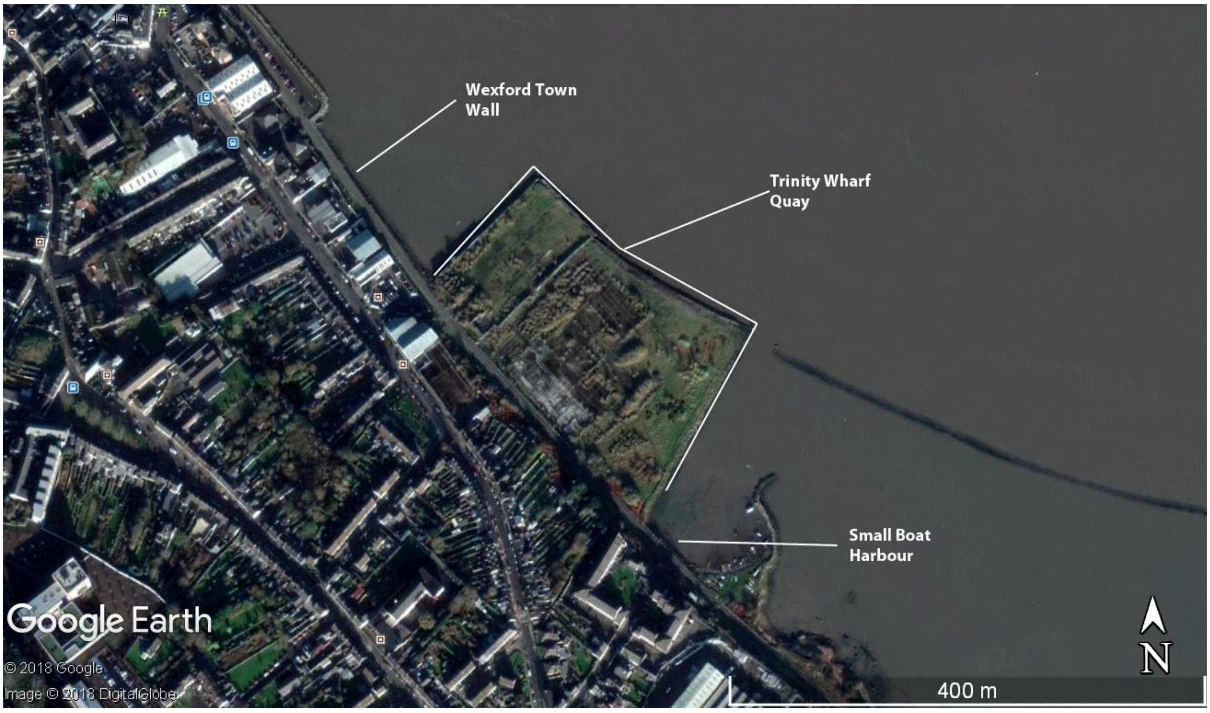

Figure 3: Map showing indicative locations for the Intertidal Hard Benthos survey.

3.2.1 Southern Boat Harbour

This small embayment is bounded to the south and east by a crescent-shaped rock-armour breakwater, to the west by the railway embankment and to the north by the Trinity Wharf southern shore (Plate 6a). The outside of breakwater which faces south and east comprises an upper shore and supra-littoral of mainly bare rock armour elements with a scattered grey and yellow lichen zone, below which is a short shore dominated by fucoid seaweed, mainly *Ascophyllum nodosum* with scattered epiphytic *Polysiphonia lanosa*, some scattered *Fucus vesiculosus* and at the base of the shore some *Fucus serratus* (Plate 6b). On the border between the fucoid dominated zone and the mainly bare rock of the supralittoral, there are scattered stunted plants of *Pelvetia canaliculata* and *Fucus spiralis* and above these are scattered rock armour elements with a light covering of *Ulva intestinalis*. In the mid to lower shore there is a patchy understorey of reds such are *Rhodothamniella floridula*, *Gelidium, Hlidenbrandia* and *Mastocarpus stellatus* (Plate 6c). The faunal diversity was very low with scattered or locally dense barnacle cover dominated by *Elminius modestus* and with very occasional *Littorina obtusata/mariae* and scattered large blue mussels (*Mytilus edulis*) between large cobbles/rock armour. Inside the harbour the breakwater was above the tidal level and associated mainly with higher plants typical of marine areas including sea beet rock samphire, sea aster and red fescue (Plate 6d). On the western side of the harbour the shore was bounded above by the railway embankment with a short intertidal dominated by the sloped stone of the embankment at the base followed by scattered cobble on muddy gravel merging seaward into soft flocculent mud. This shore was dominated by *Ulva intestinalis,* especially toward the upper part of the shore and by scattered clumps of *F. spiralis*, *F. vesiculosus* and *Ascophyllum* larger substrate elements (Plate 6e). The shore was very silted and the dominance of *Ulva intestinalis* points to a freshwater influence from the embankment.

3.2.2 Trinity Wharf Quay

The large reclaimed area of land which will form the terrestrial footprint of the proposed development is here referred to as the Trinity Wharf quay for ease of presentation. The southern shore of the Trinity Wharf quay forms the northern shore of the small southern harbour. It comprises a low narrow shore of dilapidated stone and rock armour elements about 3-5m wide merging into the main muddy sand area of the southern harbour (Plate 7a). The upper section of the shore has a loose scattered grey and yellow lichen zone merging abruptly into a fucoid covered shore dominated by *Ascophyllum* cover with scattered *P. lanosa* and a lesser amount *of Fucus vesiculosus*. Apart from *E. modestus* barnacles no intertidal fauna was in evidence. The top of the shore merges into terrestrial habitat with sea beet, sea spurrey, sea aster and red fescue.

The longer eastern side of the Trinity Wharf quay consists mainly of a vertical concrete wall, which in places toward the southern end is breached by what appear to be small solidified concrete slopes (Plate 7b). The lower 1-2m of wall is dominated by fucoid seaweed either dropping immediately into the shallow subtidal or extending for about 2m horizontally to the subtidal. At the top of the vegetated zone zone *F. spiralis*, formed a very narrow 'zone' followed below by *F. vesiculosus* and *Ascophyllum* covering most of the shore's substrate and with a small scattered zone of *F. serratus* at the base as the shore merges into the shallow subtidal. In crevices in the upper part of the shore there were very occasional small pockets of the red alga *Catenella caespitosa*, and occasional patches of the encrusting *Hildenbrandia rubra* (Plate 7c) Below this there were patches of *Rhodothamniella floridula* and also large patches of *Cladophora rupestris* and *Ceramium virgatum* in places (Plate 7d). Scattered plants of *Mastocarpus stellatus* were present in the *F. serratus* zone often on silted concrete or bedrock. Fauna comprises very scattered *Littorina obtusata/mariae*, *Elminius modestus* which were locally common in patches, and hydroids epiphytic on *Ascophyllum* mainly and other fucoid seaweeds also. Some bryozoans were encrusting on *F. serratus* fronds and bedrock.

The northern shore of the Trinity Wharf quay was very similar to the eastern shore but had no horizontal extension, i.e. all of it dropped vertically into the shallow subtidal (Plate 7e). The top of the wall was concreted in places but all of the intertidal comprised cut stone, with localised gaps. The top of the intertidal had a very narrow intermittent zone of *Pelvetia* with a similarly patchy and narrow *F. spiralis* zone. The main area of the shore was dominated by *Ascophyllum* with scattered cover *of F. vesiculosus*. The understorey was very and silted and comprised patches of *Hildenbrandia*, *Rhodothamniella floridula* and barnacles (*Eminius modestus*). (Plate 7f)

3.2.3 Wexford Town Wall

The Wexford town shore to the north of the Trinity Wharf quay is faced with very large rock armour elements forming a vertical coastal barrier facing east. This drops vertically into the subtidal and is dominated in the mid to lower intertidal by *F. vesiculosus* and *Ascophyllum* with scattered clumps of *Pelvetia* and *F. spiralis* above and *F. serratus* at the water's edge (Plate 8a). The red alga, *P. lanosa* was common on *Ascophyllum* and there was a silted understorey with scattered patches of *R. floridula*, occasional plants *Ulva lactuca* and *Mastocarpus stellatus* and frequent localised clumps of blue mussels in crevices (Plate 8b). There was localised high cover values of *Elminius modestus*, which was the only barnacle recorded in this section of the intertidal.

3.2.4 Habitat Evaluation and Classification.

The shore is typical of a sheltered rocky intertidal with an estuarine influence. It is dominated by a small range of plant and animal species none of which is rare or threatened and all of which are tolerant of silty and turbid waters. The dominant habitat present is closest to the JNCC Classification of LR.LLR.FVS.AscVS (Ascophyllum nodosum and Fucus vesiculosus on variable salinity mid eulittoral rock) which is described as follows: *Very sheltered to extremely sheltered mid eulittoral bedrock, boulders or cobbles subject to variable salinity characterised by an impoverished community dominated by a mixture of the wracks Ascophyllum nodosum and Fucus vesiculosus. Underneath the canopy are a few green seaweeds including Enteromorpha intestinalis and Cladophora spp., while the red seaweed Polysiphonia lanosa can be found as an epiphyte on A. nodosum. On the rock and among the boulders are the winkles Littorina littorea and Littorina saxatilis, the crab Carcinus maenas, the barnacles Semibalanus balanoides and Elminius modestus and even the occasional mussel Mytilus edulis. Among the seaweeds and underneath the boulders a variety of gammarids can be found.*

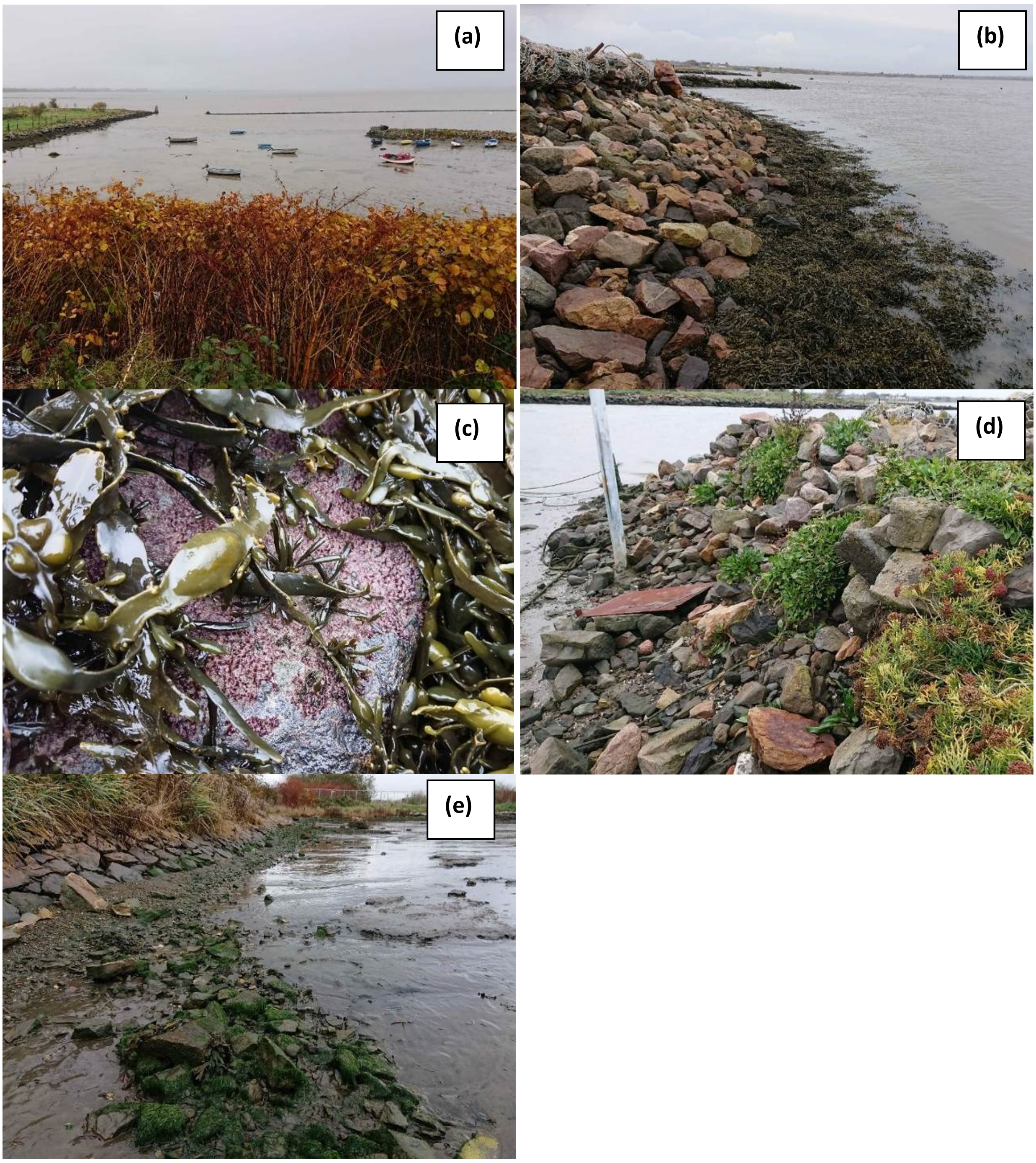

Plate 6: (a) View of southern harbour facing east with Trinity Wharf southern shore to the left and the crescent shaped breakwater on the right mid ground; (b) Outer face of crescent-shaped breakwater of southern harbour – facing north; (c) *Rhodothamniella floridula* on boulder beneath *Ascophyllum*; (d) Sea beet and rock samphire on inner side of southern harbour breakwater; (e) Heavy coating of *Ulva intestinalis* along the western side of the southern harbour.

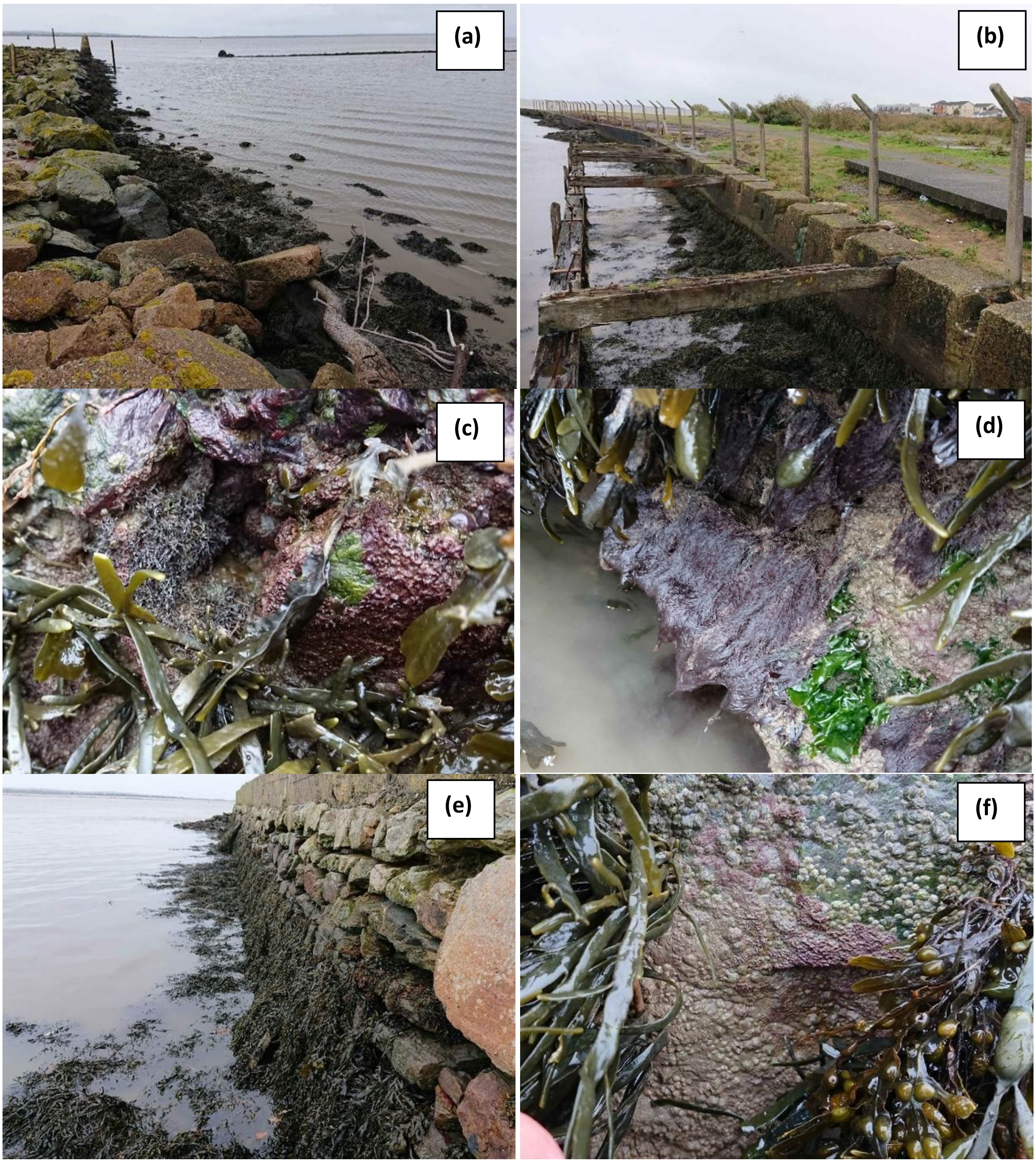

Plate 7: (a) Southern shore of trinity wharf facing east showing rock armour elements with yellow and grey lichens above and a fucoid dominated intertidal below; (b) Eastern side of Trinity Wharf looking south with concrete wall face dominated by fucoid seaweeds and with horizontal extension in places at the base; (c) *Catenella*, *Hildenbrandia*, *Rhodothamniella* and *Ascophyllum* at top of eastern quay wall; (d) *Ceramium* and *Ulva* as understorey beneath fucoid alga in lower shore of Trinity Wharf eastern shore; (e) Trinity Wharf northern shore –looking toward north eastern corner of the quay; (f) Trinity Wharf northern shore –silted understorey with red algae and barnacles.

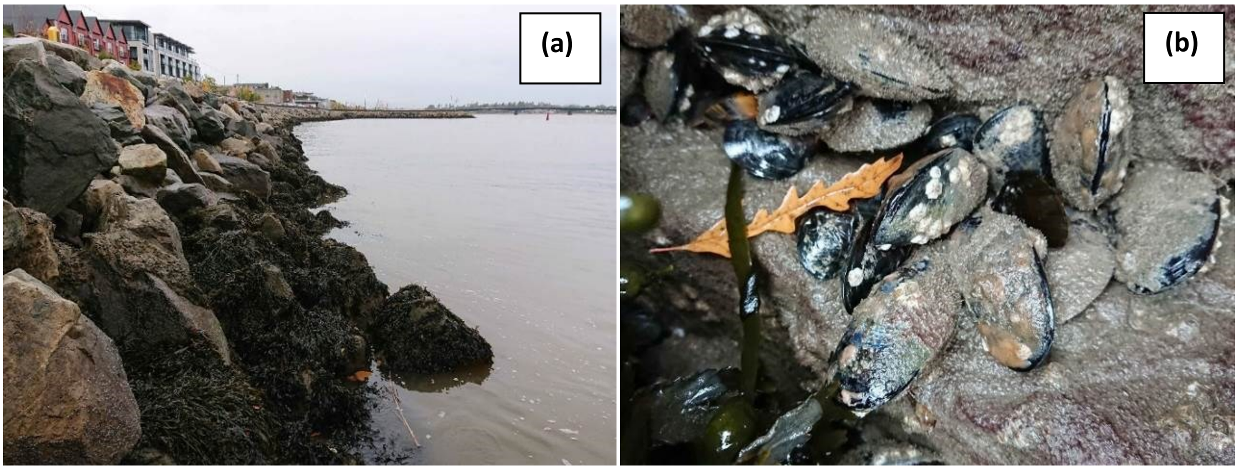

Plate 8: (a) Wexford Town shore showing very large rock armour elements covered with fucoid seaweed in mid to lower shore – view to the north; (b) Wexford Town with mussels (*Mytilus edulis*) and barnacles (*E. modestus*) in crevices in the rock armour.

4 Impact Assessment

4.1 Relevant Characteristics of the Proposal

The proposed development at Trinity Wharf involves the construction of a *c.* 60 berth marina, with a series of floating breakwaters and the construction of a sloping revetment along parts of Trinity Wharf. A number of elements of this proposal will have potential to impact on the marine habitats within the survey area.

The floating breakwater will be anchored to the seabed using *c.* 600mm circular piles grouted into *c.* 900mm sockets. It is expected that there will 42 socket/pile combinations installed, resulting in the net loss of 26.72m^2 of subtidal benthos.

In addition, it proposes the construction of an access bridge from Trinity Wharf to Wexford Town. This will require the infilling of 582m^2 of subtidal habitat adjacent to the Northern corner of Trinity Wharf. In addition, it will require the installation of 11 steel piles with a diameter of 750mm to support the walkway along its length resulting in a loss of *c.* 4.m^2.

The Trinity Wharf quay will be strengthened around its entire northern, eastern and southern perimeters by insertion of a vertical sheet pile wall. The installation of the revetment requires the placement of 0.5T rock armouring along two stretches of Trinity Wharf. The full area of the South Eastern shoreline will be reinforced, covering an area of 1,200m^2 of intertidal habitat. A smaller area along the North West perimeter of Trinity wharf will also be reinforced, covering 330m^2 of intertidal habitat. The eastern shore will not have a rock armour facing. In addition the area to be reclaimed on the north eastern corner of the quay will be delineated by a sheet pile facing.

The proposed marina is located within the Slaney River Valley SAC (site code: 0781) and is within the priority listed habitat '*Estuaries*'. This habitat area has been estimated as 1,905ha.

4.2 Impact Assessment

4.2.1 Habitat Disturbance

The construction of the marina and associated walkway will result in the placement of 42 number 900mm diameter and 11 number 750mm piles into the seabed immediately north of Trinity Wharf. It is thought that the placement of these piles will require the use of a jack-up barge, which will need to be manoeuvred into place to facilitate the installation of the piles. This use of a jack-up barge will result in a temporary displacement of benthos during construction.

Habitat disturbance as a result of the placement of the legs from the jack-up barge will result in the temporary displacement of fauna within the direct footprint of these legs. These impacts would be considered localised with slight adverse effects on the benthos. The impacts will be temporary, with recovery occurring rapidly following the completion of all construction works.

4.2.2 Habitat Loss

The placement of piles into the seabed will result in the permanent loss of *c.* 31m^2 of subtidal benthos (26.72m^2 from the marina development and 4.2m^2 from the walkway construction). An additional 582m^2 of subtidal benthos would be reclaimed as part of the construction of the walkway. This would result in a total net loss of *c.* 0.0613ha of subtidal habitat.

The loss of this habitat would be considered permanent. However, due to the overall size and extent of the area to be impacted, in relation to similar habitat throughout the SAC, this impact is assessed as slight due to the loss of <0.005% of the overall habitat within the Slaney River Valley SAC.

The loss of soft-sediment benthos will be off-set by the creation of new hard-benthos structures to which epifauna and seaweeds will attach once the piles are inserted. This is likely to increase diversity within the area.

The replacement of all the eastern side of the Trinity Wharf quay and two thirds of the northern side with sheet piles rather than rock armour or concrete will probably reduce the density of brown seaweeds on these structures, although species such as barnacles, mussels and other encrusting fauna are likely to become more prominent along with some green and red algae such as *Ulva intestinalis* higher up and *Ceraminum, Cladophora* and other species closer to the base of the piles. These changes will be in species dominance more than in presence/absence of current species. However, some reduction in fucoid alga production is likely. This will be substantially offset by the provision of a rock armour facing along the southern shore and part of the northern shore which will considerably increase the hard substrate surface area in these areas for colonisation by brown seaweeds and associated faunal species. In addition, the placement of these rock armour revetments will result in overlay by the rock armour of a narrow strip of soft sediment of approximately 2 meters wide along the southern quay side and about 4-5 meters wide along northern quay. This will result in a change of habitat type, from soft sediment habitat with very low species diversity and abundances to hard benthos with increased levels of algae and associated epifauna once these have been recolonised. Overall, these changes are considered permanent, and slight negative.

4.2.3 Oil Leaks and Spills

There is a possibility of hydrocarbon leaks and spills associated with poorly maintained construction vehicles or during re-fuelling of plant on-site. Considering the volumes of fuel involved, and taking into consideration that a good environmental management plan will be in place, the likelihood of this happening is considered very low.

The release of hydrocarbons into the environment would have adverse effects on the benthos in the vicinity of the proposed development, resulting in the temporary removal of benthic fauna from the impacted area. Due to the volumes involved, and considering the implementation of an environmental monitoring plan and suitable mitigation, the likely extent of the effects of hydrocarbon leaks on the benthos would be localised and considered temporary and slight. Such impacts can be readily avoided however through basic mitigation.

4.2.4 Cement Spills

Cement is expected to be used on site. The circular piles required for the floating breakwater and marina will require the pouring of cement through the centre of the pile into the socket. In addition, concrete is to be poured for the capping beam to the sheet piled walls. Cement spilled into the environment would have adverse effects on the benthos in the vicinity of the proposed development, resulting in the removal of biological communities within the footprint of the affected area. The extent of this would be expected to be localised due to the low likelihood of large volumes of cement being lost in a supervised site. The impact of cement spills on the benthos has the capacity to be significant with the benthos suffering temporary to short-term effects.

4.2.5 Hydrodynamic changes

Modelling undertaken by RPS in relation to the proposed development indicate that there would be virtually no detectable impact on the tidal regime, and no significant changes in the sedimentation levels in the immediate vicinity of the proposed marina.

4.2.6 Marina operations

The mooring of up to 60 vessels has the potential to impact on the water quality in the immediate vicinity of the marina through the release of BOD and nutrients in bilge water during pump-out operations and the potential for hydrocarbon spillage during fuelling of vessels is possible without proper environmental management procedures. If this were to occur it could see a localised changes in the benthic community favouring more pollution tolerant species such as the polychaete worm *Capitella capitata*. It can classified as a moderate, negative, long-term impact, without mitigation.

4.3 Mitigation Measures

It is recommended that where feasible, any boulders, cobble or bedrock present along the Trinity Wharf shores should be included in the rock armour portion of the proposal and/ or placed at the toe of the sheet pile wall along the eastern boundary of the quay as these will re-colonise more rapidly than new rock armour and will also provide an increase in habitat diversity, especially along the eastern side of Trinity Wharf.

All plant and construction vehicles should be inspected for oil leaks on a daily basis and a full service record of all plant and machinery used should be maintained.

Measures should be made in the Environmental Management Plan prior to commencement of the project with regard the storage of fuel and lubricants for all plant and construction vehicles. All fuels, oils and lubricants should be stored in a fully bunded area in the construction site compound.

Spill kits should be made available across the site works during the course of all construction works, including on the jack-up barge during piling operations.

Vehicles and plant should be refuelled off site where possible. Where re-fuelling on-site is necessary, precautions on the re-fuelling will need to be made to ensure that no fuel is released into the environment.

Standing plant and machinery should be placed on drip-trays.

All surface run-off from the site should be directed into a hydrocarbon interceptor before discharge.

Clear construction best practice guidelines should be drawn to prevent the spilling of any concrete or fuel oil or oil-based hydraulic fluids into the marine environment during the construction phase.

All shuttering works must be securely installed and inspected for leaks prior to cement being poured. All pouring operations should be supervised monitored for spills and leaks at all times.

Fuelling of vessels should be undertaken in specially bunded areas. All fuelling equipment should be regularly inspected and serviced.

Sewage pump-out facilities should be available to all vessels which use the marina. All pump-out equipment should be regularly inspected and serviced.

5 Residual Impacts

Provided all the mitigation measures recommended are implemented in full, residual impacts are expected to be confined to temporary disturbance of sub-tidal benthic habitats and short-term disturbance of intertidal hard benthos habitats associated with construction phase activities. Long-term changes associated with soft and hard benthos will be largely offset by the provision of additional hard benthic surfaces on piles and rock-armour for fauna and flora re-colonisation. Taken in total these changes can be described as a slight negative – permanent impact.

6 Conclusion

The design of the Trinity Wharf marina is open, thereby allowing a continuation of the existing active water movement within the study area, as the footprint of permanent structures within the open water area is confined to well-spaced small diameter circular piles. The extension of the north east corner of Trinity Wharf to facilitate the construction of the suspended walkway will result in the reclamation of just over 600m^2 of soft benthos. In addition a further approximately 800m^2 of soft sediment adjoining the new rock armour revetments will be overlaid by new rock armour elements resulting in a change of habitat type from soft to hard benthos. None of these will result in an adverse impact on the integrity or functioning of the Slaney River SAC, nor will it cause any habitat fragmentation. Within that area of the SAC the only habitat designated as a Conservation Objective is Estuaries (1130) and the habitat alterations arising from the development (i.e. mainly changing from soft to hard benthos) will not change this habitat designation. During the operation phase of the development, the provision of pump-out facilities coupled with the continued good water movements at the site, will insure no significant adverse impacts from this phase of the project. Overall, therefore the proposed development can be classified as having a slight, negative, permanent impact associated with the alterations to the permanent structures associated with the developments and their effects on the benthic habitats present.

7 References

Aquafact (2007) Sublittoral Survey of a Select Area of Wexford Harbour in Relation to a Marine Development. April 2007. A Report to Deerland Construction Ltd.

Holme, N.A. and McIntyre, A.D. (1984): Methods for the Study of Marine Benthos. Second Edition IBP Handbook 16.–399 pp. Oxford-London-Boston: Blackwell Scientific Publications.

NPWS (2011) Slaney River Valley SAC (site code: 0781). Conservation objectives supporting document – marine habitats and species. Version 1, August 2011.

Appendix 7.2 Bird Survey Report

ROD
ROUGHAN & O'DONOVAN

TRINITY WHARF WEXFORD HARBOUR

WINTER BIRD SURVEYS 2015/16

DRAFT REPORT

March 2016

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1. INTRODUCTION

Natura Environmental Consultants was commissioned by Wexford County Council to carry out a survey of waterbirds in the vicinity of Trinity Wharf, Wexford Town during the winter 2015/16. The area below High Water Mark is included within the Wexford Harbour and Slobs Special Protection Area (SPA) is legislated for under the Birds Directive (Council Directive 79/409/EEC on the Conservation of Wild Birds).

2. METHODOLOGY

Study area

The study area for these surveys was the tidal area within a 1km radius of Trinity Wharf (Figure 1). The shoreline is largely artificial sea wall to the north of Trinity Wharf. To the south of the Wharf there is a small area of intertidal mudflat at Batt Street Harbour. The remainder of the coast to the south of the Wharf is rocky shore with dense seaweed cover.

Figure 1: Study area for waterbird counts

Count methods

Surveys of the entire study area were carried out within 2 hours of low tide and 2 hours of high tide on five separate dates between November 2015 and March 2016 (Table 1). All waterbirds in this area were mapped and counted using 10x binoculars and 35x telescope.

Table 1. Survey dates and tide times

Date	High Water time	HW Survey times	Low Water time	LW Survey times
19/11/2015	11:06	11:30-13:00	17:25	15:00-16:20
10/12/2015	17:33	15:30-16:40	11:15	10:30-12:00
07/01/2016	16:34	14:25-15:55	10:50	10:00-11:30
15/02/2016	11:10	11:15-12:30	17:26	16:00-17:00
08/03/2016	18:30	17:00-18:15	12:40	13:00-14:30

3. RESULTS

A summary of results of the winter bird surveys is given in Table 2. A total of 23 species of waterbirds were recorded in this survey. Of these, 15 species are qualifying interests of Wexford Harbour and Slobs SPA (NPWS 2012).

Trinity Wharf itself does not hold any waterbirds. The northern and eastern edges are steep concrete walls and have no suitable foraging or roosting habitat. The southern side of the wharf is bordered by intertidal mudflat at Batt Street Harbour. This generally holds very small numbers of waders including Oystercatcher, Bar-tailed Godwit, Curlew, and Redshank at low tide. Single Grey Heron and Little Egret also occur in Batt Street Harbour at low tide.

The most important features for waterbirds in this area are the North and South training walls one either side of the mouth of the River Slaney. These areas are used at both low tide and high tide especially by roosting Lapwing (peak 552), Oystercatcher, Cormorant, Black-headed Gull and Herring Gull. The walls also provide foraging habitat at low tide for Oystercatcher and Turnstone.

The other main high tide roost site approximately 500m to the north-west of Trinity Wharf is the ballast structure in the centre of the river. This artificial structure is used at high tide by significant numbers of roosting Oystercatcher (peak 120) as well as Lapwing, Black-tailed Godwit, Turnstone and Black-headed Gull.

The shallow waters lying to the south of the South Training Wall and north of the North Training Wall are used for foraging by several species of waterbirds including Great Crested Grebe (peak 27), Red-breasted Merganser (peak 78), Goldeneye (peak 4) and Cormorant.

Table 2. Peak numbers of waterbirds within 1km of Trinity Wharf at high tide and low tide 2015/16 and average peak numbers for the entire Wexford Harbour and Slobs SPA.

Species	Scientific name	Peak Population High Tide	Peak Population Low Tide	Mean Peak Population Wexford Harbour & Slobs SPA[1]
Mute Swan	*Cygnus olor*	2	2	129
Light-bellied Brent Goose*	*Branta bernicla hrota*	10	10	2445
Goldeneye*	*Bucephala clangula*	1	4	43
Red-breasted Merganser*	*Mergus serrator*	78	25	90
Cormorant*	*Phalacrocorax carbo*	31	47	17
Shag	*Phalacrocorax aristotelis*	3	0	91
Little Egret	*Egretta garzetta*	1	5	320
Grey Heron*	*Ardea cinerea*	6	9	2
Little Grebe*	*Tachybaptus ruficollis*	1	2	17
Great Crested Grebe*	*Podiceps cristatus*	27	27	11
Oystercatcher*	*Haematopus ostralegus*	155	81	474
Lapwing*	*Vanellus vanellus*	355	552	3602
Black-tailed Godwit*	*Limosa limosa*	13	1	1944
Bar-tailed Godwit*	*Limosa lapponica*	0	3	838
Curlew*	*Numenius arquata*	3	12	498
Redshank*	*Tringa totanus*	12	10	13
Greenshank	*Tringa nebularia*	0	2	335
Turnstone	*Arenaria interpres*	29	15	33
Black-headed Gull*	*Chroicocephalus ridibundus*	351	331	1414
Common Gull	*Larus canus*	3	3	299
Lesser Black-backed Gull*	*Larus fuscus*	4	5	11
Herring Gull	*Larus argentatus*	60	35	194
Great Black-backed Gull	*Larus marinus*	16	4	97

1. Mean of peak counts over three winters 2011/12 to 2013/14. Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a joint scheme of BirdWatch Ireland and the National Parks and Wildlife Service of the Department of Arts, Heritage & the Gaeltacht.

*Qualifying interest of Wexford Harbour and Slobs SPA.

4. CONCLUSIONS

A total of 23 species of waterbirds were present within 1km of Trinity Wharf in winter 2015/16. The most abundant species here were Black-headed Gull, Oystercatcher and Lapwing. The most important habitats are the training walls on either side of the river mouth. The bird numbers present in this area represent a small proportion of the total numbers in the Wexford Harbour and Slobs SPA. Very few individuals occurred within the immediate vicinity (200m) of the Wharf because there is limited suitable habitat here.

5. REFERENCE

NPWS (2012) Conservation Objectives: Wexford Harbour and Slobs SPA 004076. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Appendix 7.3 Marine Mammal Risk Assessment

ROD
ROUGHAN & O'DONOVAN

MARINE MAMMAL RISK ASSESSMENT OF A PROPOSED DEVELOPMENT AT TRINITY WHARF, WEXFORD

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1 | INTRODUCTION

The Irish Whale and Dolphin Group (IWDG) were contracted by the engineering and environmental consultants Roughan & O'Donovan to carry out a Marine Mammal Risk Assessment of the potential impact on marine mammals of the proposed Trinity Wharf Development in Wexford. The proposed construction site is within the Slaney River Valley SAC, which includes harbour seal as a qualifying interest. The proposed works will take place over a maximum of 80 months, with the works within the marine environment expected to be 10.5 months in duration, with potential for it to be condensed into less if the marina and boardwalk works are undertaken at the same time.

Figure 1. Trinity Wharf, Wexford, showing location

Proposed works

The main construction elements and activities of the development relevant to this MMRA are as follows:

- **Sea wall and revetment works:** the construction of the replacement sea wall will consist of driving steel sheet piles around the entire coastal boundary of the site with the addition of rock armour revetment placement along the south-east edge.
- **Increased boat traffic from the marina:** and potential to cause disturbance to seals, especially those hauled out in the vicinity.

The first main element of work to be constructed will be the sea wall around the coastal edge of the site. The sea wall will comprise the installation of steel sheet piles and a rock armour revetment along the south-east edge of the site with a smaller section along the northern section. The construction of the boardwalk / pedestrian link bridge from Paul Quay to the northern corner of Trinity Wharf will require the driving of 11 No. 700 mm diameter vertical tubular steel piles which will support the deck. The piles for the boardwalk (and potentially marina and breakwater) will be driven by impact hammer. This will overlap in programme with the sheet piling of the new sea wall.

A pile-driving rig will mobilise and begin vibro-piling sheet piles immediately in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The design of the wall considers the use of granular fill material being compacted behind the sheet piles. Upon installation of the sheet piles, the existing sea wall will be broken up in-situ and left in place with granular backfill material being placed around this. Construction of sheet piling wall and rock armour revetment is planned to last 4 months with sheet piling will be continuous but piling for the foundations could be intermittent for this period.

Along the south east edge of the site, a rock armour revetment is required to be constructed immediately in front of the sheet pile wall. Rock armour consisting of rocks of approximately 0.5 to 1 tonne will be placed on the sea bed to the required profile in parallel with the installation of the sheet pile wall such that at no point during the construction can waves reflecting off the vertical wall significantly affect the moored vessels at Goodtide Harbour. The marina and floating breakwater units may also be restrained by vertical steel piles, but this has not yet been confirmed.

The design of the sheet pile sea wall requires the use of tie backs, consisting of tie-bars and a row of smaller sheet piles to be installed approximately 12m behind the sea wall. Installation of the earthworks, drainage and services and sheet pile wall anchorage walk is planned to last 6 months. Once all sheet piles are installed around the boundary of the site, the tie-bars will be installed between the two rows and the reinforced concrete capping beam will be constructed to the sea wall. Once the sheet piles and associated anchorage system is in installed correctly, backfilling works can commence.

2 | METHODS

The risk assessment was based on a review of the available literature and data sources. Maps of the distribution of cetacean sightings inside the sand dunes at the mouth of the Wexford Harbour, were prepared using data from the Irish Whale and Dolphin Group's casual sightings database (IWDG, accessed 25 November 2018).

3 | LEGAL STATUS

Irish cetaceans and pinnipeds are protected under national legislation and under a number of international directives and agreements which Ireland is signatory to. All cetaceans, as well as grey and harbour seals, are protected under the Wildlife Act (1976) and amendments (2000, 2005, 2010 and 2012). Under the act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except under license or permit). The act applies out to the 12 nml limit of Irish territorial waters.

All cetaceans and pinnipeds are protected under the EC Habitats Directive. All cetaceans are included in Annex IV of the Directive as species 'in need of strict protection'. Under this Directive, the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) are designated Annex II species which are of community interest and whose conservation requires the designation of Special Areas of Conservation.

Ireland is also signatory to conservation agreements such as the Bonn Convention on Migratory Species (1983), the OSPAR Convention for the Protection of the Marine Environment of the northeast Atlantic (1992) and the Berne Convention on Conservation of European Wildlife and Natural Habitats (1979).

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Culture, Heritage and the Gaeltacht produced a '*Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters* (NPWS, 2007). These were subsequently reviewed and amended to produce '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (NPWS, 2014) which include mitigation measures specific to dredging. The guidelines recommend that listed coastal and marine activities (including dredging) be subject to a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process.

Once the listed activity has been subject to a risk assessment, the regulator may decide to refuse consent, to grant consent with no requirement for mitigation, or to grant consent subject to specified mitigation measures.

4 | BASELINE ENVIRONMENT

4.1 | Ambient Noise Levels

The ambient noise levels at the site are not known. Ambient noise in Wexford Harbour is expected to be dominated by environmental noise (e.g. tidal movement of water and sediment) and shipping noise, especially with peaks in noise due to recreational and fishing vessels transiting the harbour between Wexford town and the Irish Sea. Mussel fishing vessels are particularly common in Wexford Harbour with a large area of the harbour licenced under active Aquaculture licences.

The harbour is also known for recreational use, with the Wexford Harbour Boat and Tennis Club being located 2km north of the Trinity Wharf site and the Wexford Quays being a popular recreation area for locals. A weekend long Maritime Festival is held every year during the summer with multiple events being held on the water.

4.2 | Cetaceans

A review of cetacean (whale, dolphin and porpoise) records submitted to the IWDG provided only three validated records (Table 1). This consisted of one harbour porpoise sighting and one common dolphin *(Delphinus delphis)* sighting. A third sighting of a large group on 5 July were reported as harbour porpoise but the group size is large and were most likely dolphins, probably common dolphins (Table 1). Both of these latter sightings were closer to Rosslare Harbour.

Table 1. Cetacean sightings (including IWDG downgrades) recorded in Wexford Harbour and adjacent waters from 2000-2018.

Date	Species	No. animals	Observer
18 March 2017	harbour porpoise	1	Richie Conroy
05 July 2012	dolphin species, possibly harbour porpoise	15-20	Charlotte Steele
01 March 2004	common dolphin	2	Kevin McCormick

Figure 2. Map of all cetacean sightings submitted to the IWDG between 2000 to present (blue dots are harbour porpoise, green dots are dolphins)

Harbour porpoise are the most widespread and abundant cetacean in inshore Irish waters, with highest abundances in the Irish Sea (Berrow et al. 2010). Harbour porpoise are frequently sighted off southeast Wexford and are known to particularly associate with areas of strong tidal currents for foraging (Berrow et al. 2014). Common dolphins are distributed around the entire Irish coast with highest concentrations are off the south west and west coasts (Berrow et al. 2010). However, in the winter large numbers of common dolphins enter the Celtic sea to feed on schools of pelagic fish such as herring and sprat. Spawning grounds for herring occur off south Wexford with fish moving into inshore waters in December to February (Volkendandt et al. 2014).

4.3 | Pinnipeds

Grey and harbour seals are distributed around the entire Irish coast with grey seals being generally more abundant along the western seaboard and off the southwest coast (Cronin *et al.* 2004; O'Cadhla *et al.* 2007; O'Cadhla and Strong 2008). The conservation status of grey and harbour seals in Ireland has been assessed as favourable (NPWS 2008, 2013).

Harbour Seal (Phoca vitulina)

Wexford Harbour

Harbour seals have been reported in Wexford Harbour during National Parks and Wildlife Service (NPWS) surveys in 2003. Lockley (1966) reported an average of 10 Harbour (Common) seals in Wexford Harbour between 1964 and 1965. Cronin et al. (2004) reported 17 seals hauled out at two sites in Wexford Harbour on 19 August 2003 during an aerial survey.

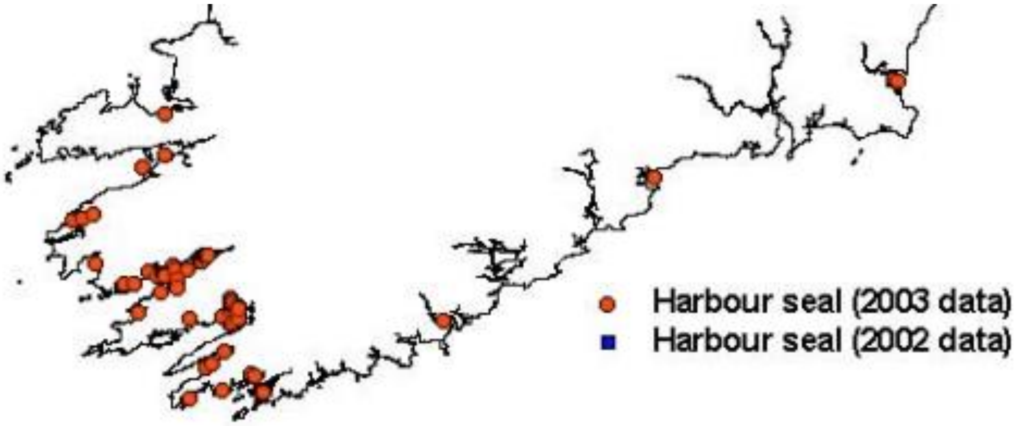


Figure 6. Map of the locations of groups of harbour seals recorded on the south coast of Ireland, August 2003 (from Cronin et al. 2004).

Slaney River Valley SAC

The Slaney River Valley SAC (Site Code 000781) hosts regionally significant numbers of Harbour Seal. Harbour seal occurs year-round in Wexford Harbour where several sandbanks are used for breeding, moulting and resting activity (NPWS 2011). NPWS report in their site synopsis that at least 27 individuals regularly occur within the site (Lockley 1966, Cronin et al. 2004) and unpublished National Parks and Wildlife Service records.

The Conservation Objectives for Harbour Seal in the Slaney River Valley SAC are:

- Species range within the site should not be restricted by artificial barriers to site use.
- The breeding sites should be maintained in a natural condition.
- The moult haul-out sites should be maintained in a natural condition.

- The resting haul-out sites should be maintained in a natural condition.
- Human activities should occur at levels that do not adversely affect the harbour seal population at the site.

According to NPWS (2011) haul out sites for harbour seals occur up to 2km from the proposed development (Figure 7).

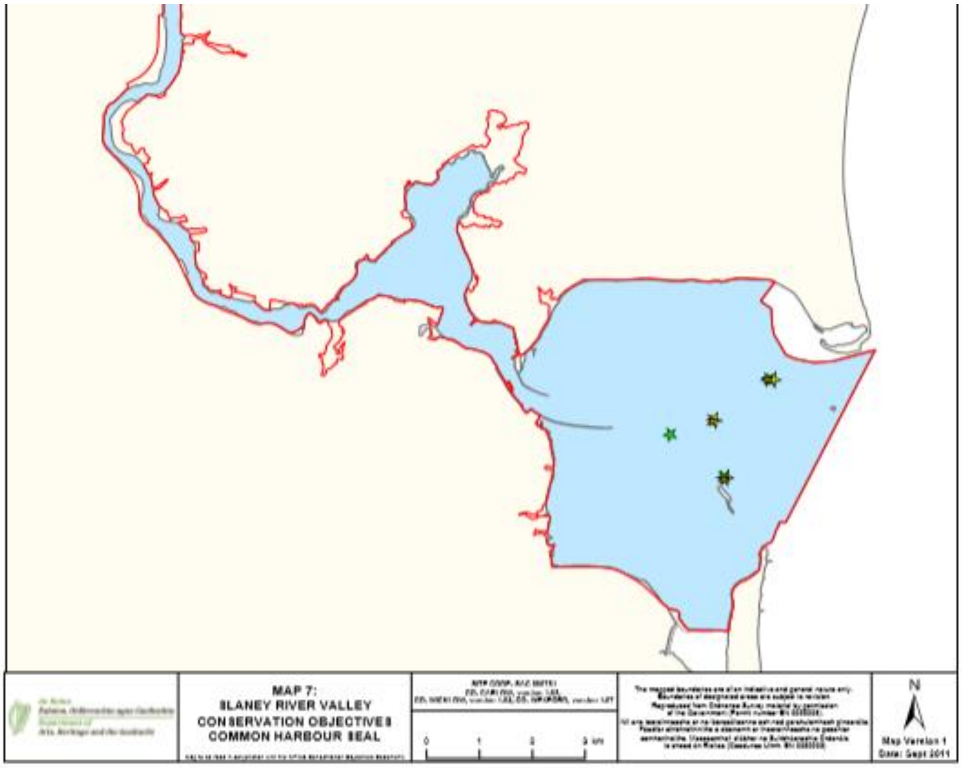


Figure 7. Harbour seal haul out sites (from NPWS 2011)

Grey Seal (*Halichoerus grypus*)

Grey seals are regularly reported hauled out on sandbanks in the mouth of Wexford Harbour and on the Raven sandbar. Kiely et al. (2000) carried out 14 surveys of the Raven Point between June 1997 and December 1998 and counted a mean of 75 grey seals hauled out. Numbers peaked in the summer but were consistently high during the breeding season and female moult period.

Cronin et al. (2004) reported 25 seals hauled out on 19 August 2003 during an aerial survey for harbour seals. A further 30 grey seals were reported at Carnsore Point and 17 on Tuskar Rock on the same day. O'Cadhla *et al.* (2007) reported 130 hauled out on the Raven spit and banks on 6 March 2007 during an aerial survey during the moulting period, which are numbers of national significance. Only 1 grey seal pup was reported during an aerial survey of grey seal breeding sites in 2005, suggesting the site is more important for moulting and resting than breeding.

The nearest protected site for seals in Great Saltee SAC off the south Wexford coast over 50km by sea from Wexford Harbour. Grey seals forage locally and may also range long distances and may occasionally swim upriver when foraging. Kiely et al. (2000) reported individual grey seals moving between colonies off southwest Wales and the Raven Point, suggesting some of the seals recorded during the high counts in the moulting period could originate from colonies outside Ireland.

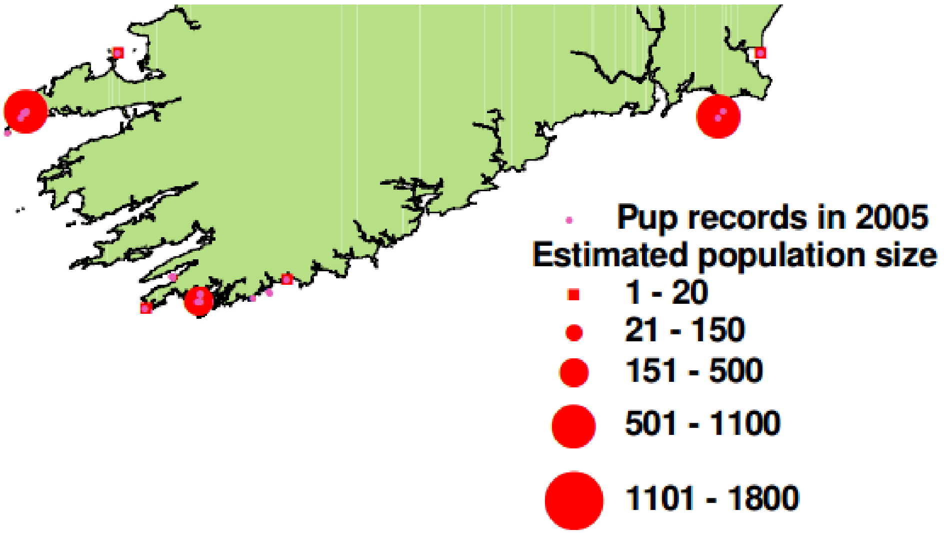


Figure 8. Map of the locations of grey seals pupping locations recorded on the south coast of Ireland in 2005 (from O'Cadhla et al. 2007).

5 | IMPACT ASSESSMENT

5.1 | Description of Activities

As part of the proposed site works piling and rock armour activities are most likely to impact on marine mammals, especially when considering the potential for acoustic trauma.

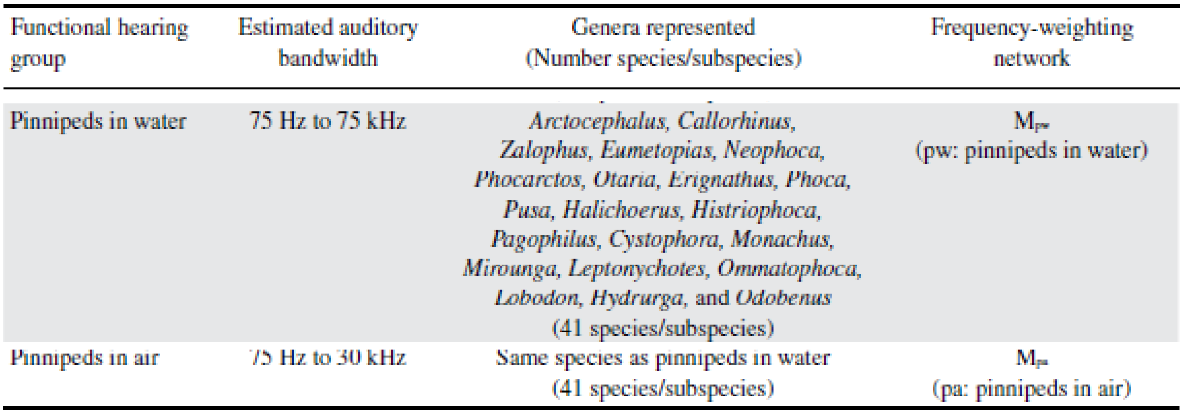
5.1.1 Piling Impacts

Pile driving is classed as a multi pulse source of impulsive sound. The potential impacts on marine mammals from piling activity include Permanent Threshold Shift (PTS), Temporary Threshold Shift (TTS) and behavioural disturbance; each of which have varying degrees of severity for exposed individuals.

If a marine mammal's received sound exposures, irrespective of the anthropogenic source (pulse or nonpulse), exceed the relevant criterion, auditory injury (PTS) is assumed to be likely. It is measured effects on marine mammals are largely based on work by Southall *et al.* (2007), who proposed a dual criterion based on peak sound pressure level (SPL) and sound exposure level (SEL), where the level that is exceeded first is what should be used as the working injury criterion (i.e. the precautionary of the two measures).

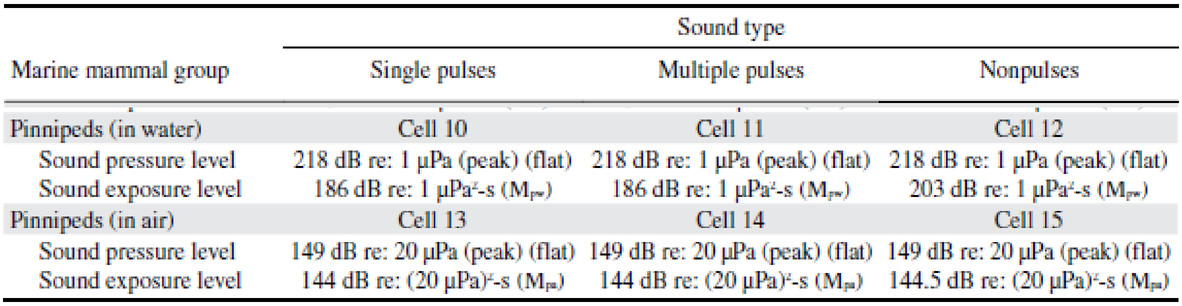
As all marine mammals do not hear equally across all frequencies, the use of frequency weightings is applied to compensate for differential frequency responses of their sensory systems. The M-weighting (for marine mammals) is similar to the C-weighting for measuring high amplitude sounds in humans. At present there are no data available to represent the onset of PTS in marine mammals but Southall *et al.* (2007) estimated it as 6 dB above the SPL (unweighted) and 15 dB above the SEL (M-weighted according to the relevant marine mammal functional group, see Figure 1) based on the onset of TTS. Therefore, Southall *et al.* (2007) proposed SPL criteria of 230 dB re 1 µPa (peak broadband level) for PTS onset in cetaceans and 218 dB re 1 µPa for pinnipeds. They also recommended TTS can occur at 224 dB re 1 µPa (peak broadband level) for cetaceans and 212 dB re 1 µPa for pinnipeds (Southall *et al.* 2007; Bailey *et al.* 2010) (Table 2). While, the SEL criteria proposed by Southall et al. (2007) include TTS onset at 183 dB re 1 µPa^2 -s for cetaceans and 171 dB re 1 µPa2 -s for pinnipeds, and PTS onset is expected at 15 dB additional exposure (Bailey *et al.* 2010) (Table 3).

Table 2. M-frequency weightings for pinnipeds from Southall et al. (2007)



Functional hearing group	Estimated auditory bandwidth	Genera represented (Number species/subspecies)	Frequency-weighting network
Pinnipeds in water	75 Hz to 75 kHz	*Arctocephalus, Callorhinus, Zalophus, Eumetopias, Neophoca, Phocarctos, Otaria, Erignathus, Phoca, Pusa, Halichoerus, Histriophoca, Pagophilus, Cystophora, Monachus, Mirounga, Leptonychotes, Ommatophoca, Lobodon, Hydrurga*, and *Odobenus* (41 species/subspecies)	M_{pw} (pw: pinnipeds in water)
Pinnipeds in air	75 Hz to 30 kHz	Same species as pinnipeds in water (41 species/subspecies)	M_{pa} (pa: pinnipeds in air)

Table 3. Proposed injury criteria for seals from Southall et al. (2007)



Marine mammal group	Sound type		
	Single pulses	Multiple pulses	Nonpulses
Pinnipeds (in water)	Cell 10	Cell 11	Cell 12
Sound pressure level	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)
Sound exposure level	186 dB re: 1 µPa^2-s (M_{pw})	186 dB re: 1 µPa^2-s (M_{pw})	203 dB re: 1 µPa^2-s (M_{pw})
Pinnipeds (in air)	Cell 13	Cell 14	Cell 15
Sound pressure level	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)
Sound exposure level	144 dB re: (20 µPa)^2-s (M_{pa})	144 dB re: (20 µPa)^2-s (M_{pa})	144.5 dB re: (20 µPa)^2-s (M_{pa})

Most concerns of the effects of pile driving on marine mammals has been around the construction of offshore wind farms (Richardson *et al.* 2011). There has been limited work on the effects of piling during coastal and harbour works. Attenuation of sound pressure levels at coastal sites will be more rapid depending on the topography and nature of the bedrock. Recently, Graham *et al*. (2017) modelled the source levels estimated for impact piling from a single-pulse sound exposure level of 198 dB re 1 lPa2 s and, for a 192 dB re 1 lPa source level for vibration piling during harbour construction works. Predicted received broadband SEL values 812 m from the piling site were markedly lower than source level due to high propagation loss (133.4 dB re 1 lPa2 s (impact) and 128.9 dB re 1 lPa2 s (vibration). Simultaneous acoustic monitoring of bottlenose dolphins and harbour porpoises at the site showed they were not excluded from sites in the vicinity of impact or vibration piling; nevertheless, some small effects were detected with bottlenose dolphins spending a reduced period of time in the vicinity of construction works.

The maximum TTS in harbour seals, measured 1-4 minutes after exposure for 120 minutes to the 148 dB re 1 µPa noise band (187 dB SEL), was around 10 dB (i.e. hearing was 10 dB less sensitive than normal). Recovery to the pre-exposure threshold was estimated to be complete within one hour post-exposure. Significant TTSs (in this study of > 3 dB) occurred at SELs of ~170 and 178 dB re 1 µPa2s (Kastelein et al., 2011). Kastelein et al. (2011) also showed that the two young harbour seals used in this study were more vulnerable to noise-induced TTS than another older animal using a noise band centered at 2.5 kHz, found a TTS onset at a higher SEL of 183 dB re 1 µPa2s). To assess the effects of pile driving sounds on TTS, harbour seals were exposed to low-repetition rate pulses (playbacks of pile driving sounds) with an energy peak at 630 Hz (most energy was between 0.4 and 5 kHz) and with 90% of their energy within a 124 ms period. No measurable TTS was induced, probably because the received level was too low. If TTS did occur it was of such low magnitude that hearing probably recovered during the interval between the pulses. Behavioural observations showed that one of the seals swam away from the sound source during the first two sessions, and hauled out at a 2 dB higher level. The other seal did not swim away from the transducer when the pile driving sounds were played back, which demonstrates individual variation between animals in behavioural reactions to sounds. Behavioural response studies should involve as many animals as possible to gain insight into natural variation in responses to sounds (Kastelein et al, 2011). Harbour seal auditory threshold is at around 1 kHz and would ranges up to around 40 kHz (Richardson et al., 2011).

As the likelihood of any cetaceans being in the vicinity of the construction site is extremely low there is an insignificant risk of sound exposure and impact, however the likelihood of seals being in the water close to the site is high.

Although no modelling of attenuation has been carried out at the current site, McKeown (2014) carried out modelling of piling in Dublin Bay and the River Liffey associated with the Dublin Port ABR project. SPL averaged 140 dB whereas 500m upriver the SPL was 108 dB which was at background levels. The SEL at this location was 156 dB. 300m downriver the SPL was 127 dB and the SEL was 173 dB suggesting that noise from piling reduced to background levels somewhere between 300 and 500m from the source in Alexandra Basin. The predicted loss compared to the measured loss along the modelled transect indicate an over-estimate in the order of 12 dB at ranges in excess of 1 km. While the values are in general agreement, the relative transmission loss at ranges beyond 1 km are in good agreement. Given the complex environment that exists in Dublin Bay, the model can be used to provide accurate transmission loss estimates at long ranges. The modelling data is supported by site specific measurements confirming the relative transmission loss (McKeown, 2014).

Each site has different characteristics but given that Wexford Harbour is quite shallow attenuation would be expected to be greater. However, this study shows that the risk of disturbance to seals hauled out 2-5km away is very low, but the risk to seals in the water <500m away is high.

5.1.2 Rock armour and construction activities

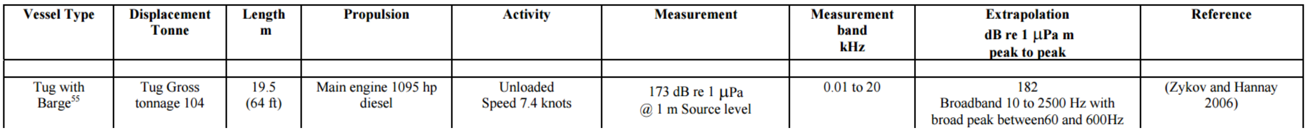
Placement of rock armour at the revetment could produce sound into the intermediate to the site, but this noise will be of short duration and dominated by low frequencies to which seals are less sensitive. Sound exposure levels from construction activities are below that expected to cause disturbance, from the noise generated or from the physical presence of land and sea-based craft. Construction activities have the potential to cause lower level disturbance, masking or behavioural impacts, for example (NPWS, 2014). The construction activities may lead to a very localised increase in noise levels and due to the long duration of construction activities, could have cumulative effects.

5.1.3 Increased marine traffic

Increased vessel traffic during construction is restricted to local craft inspecting and surveying the site will be an insignificant increase over existing traffic. Small work vessels produce low frequency sounds (Table 4). After construction it is envisaged that around 50% of the berths will be occupied by vessels already within the harbour. This leaves the other half available for visiting vessels. Trinity Wharf Marina will be competing with other marinas in nearby towns and the long navigational channel that is required to travel through coming into Wexford Harbour, may discourage some vessels passing along the coast. However, an increase in the volume of boats and boating activity adjacent to the marina and its approaches should be anticipated.

Small vessels tend to produce broadband low frequency sound from 10 Hz to 2.5 kHz (Wyatt, 2008) which harbour seals would detect as their auditory sensitivity ranges from around 1-40 kHz (Richardson et al., 2011). Seals in the area are already accommodated to existing boat traffic, including recreational and fishing activity, and seals are known to be quite tolerant to boat traffic especially if it slowly builds up over time (Richardson et al., 2011).

Table 4. Estimated noise emissions from small workboat / tug (Wyatt, 2008)



Vessel Type	Displacement Tonne	Length m	Propulsion	Activity	Measurement	Measurement band kHz	Extrapolation dB re 1 µPa m peak to peak	Reference
Tug with Barge[55]	Tug Gross tonnage 104	19.5 (64 ft)	Main engine 1095 hp diesel	Unloaded Speed 7.4 knots	173 dB re 1 µPa @ 1 m Source level	0.01 to 20	182 Broadband 10 to 2500 Hz with broad peak between60 and 600Hz	(Zykov and Hannay 2006)

5.2 | NPWS Guidance and Assessment

The NPWS (2014) '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014*' recommends that listed coastal and marine activities, undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. It is required that such an assessment must competently identify the risks according to the available evidence and consider (i) direct, (ii) indirect and (iii) cumulative effects of anthropogenic sound (NPWS, 2014). Excavation of coastal structures is not specifically listed in the NPWS (2014) guidelines but piling is covered and is of concern if large piles are to be driven and there is a risk of exposure to marine mammals.

The works are assessed for their potential to create increased noise disturbance and the receiving environment.
A risk assessment, following NPWS Guidelines, was conducted based on the published literature, data from the IWDG sightings databases and knowledge of the study area.

5.3 | NPWS Assessment Criteria

1. Do individuals or populations of marine mammal species occur within the proposed area?

The likelihood of cetaceans being in the area is very low. Only harbour porpoise and common dolphin have been reported from the area and only very occasionally. There are important haul out sites for both harbour and grey seal in the mouth of Wexford Harbour and on the Raven. The proposed development occurs wholly within a SAC with harbour seal as a qualifying interest. These haul out sites are typically >5km away from the construction site but individual seals are likely to forage within the harbour and thus occur in the water near the construction site. All cetaceans and grey seals are part of a larger population and very mobile, with records of movements of grey seals between southeast Ireland and west Wales. Harbour seals are more sedentary and generally forage within 20km of their haul out sites (Cronin *et al*. 2008); however, studies in the UK have shown that harbour seals travel further distances from haul out sites (over 100km) (Cunningham *et al*. 2009).

2. Is the plan or project likely to result in death, injury or disturbance of individuals?

The project will not cause injury or death but could cause disturbance to seals in the water from noise associated with the project, especially from piling.

Noise Impact

The activities proposed during this project consist of demolition and piling operations. TTS could occur to seals in the water if they were very close to the site when piling started. There is no risk of TTS from rock armour or general construction activities, but disturbance could occur. The construction of this marina is expected to increase boat traffic but slowly over an extended period, allowing for seals adjacent to the site to accommodate to this increase. Wexford Harbour is already a busy site with recreational and fishing activity, thus any increase in recreational traffic is against a back drop of current use and will not significantly increase long term disturbance of the haul-out sites.

Physical Impact

The risk of injury or mortality is considered very unlikely as marine mammals are rarely in the vicinity of the site.

3. Is it possible to estimate the number of individuals of each species that are likely to be affected?

No abundance estimates for cetaceans in Wexford Harbour are available but their presence is rare and intermittent. An abundance estimates for harbour porpoises from Carnsore Point of 87±36.3 calculated from a density estimate of 0.58 harbour porpoise per km^2 (Berrow et al., 2014).

NPWS (2011) report up to at least 27 harbour Seals regularly occur within the site. Up to 130 grey seals have been reported hauled out on the Raven and on sand spits in the mouth of the harbour and its likely some 10s of seals use the harbour for foraging.

4. Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?

Construction work is planned to last for 80 months and thus spans all seasons for marine mammals. Marine works are expected to occur for 10.5 months within this construction period. As cetaceans are rarely recorded at the site and there is no potential for disturbance but both grey and harbour seals are present throughout the year. The site is used by a small number of harbour seals for both pupping and resting/moulting and grey seals more for moulting than breeding with foraging in the harbour likely to occur throughout the year. There is no particular season or aspect of a seals life-cycle when they will be more vulnerable to disturbance.

5. Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?

There is no data to suggest that any particular harbour or grey seal gender or age group are more likely to forage at the site compared to other ages/sex and thus all must be expected to occur vicinity at the site.

6. Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?

While harbour porpoise and common dolphins have been reported in the area, they are rare and intermittent and thus, the harbour does not provide any important habitats. Wexford Harbour is designated as a SAC for harbour seals and a nationally important site for grey seals which occur mainly hauled out at the Raven and on sand banks in the mouth of the harbour. Seals are known to forage in the harbour and could be exposed to risk, especially from noise associated with piling.

7. How quickly is the affected population likely to recover once the plan or project has ceased?

While there may be temporary disturbance all seals in the immediate vicinity of the harbour and construction area are accommodated to human activities and are likely to recover quickly from any temporary disturbance within hours.

5.4 | Mitigation

Both harbour and grey seals could potentially be affected by the proposed operations, especially from the noise associated with piling. They regularly occur in small numbers adjacent to the construction site and in the mouth of Wexford Harbour and are the marine mammals most at risk from the proposed works. The mitigation measures recommended by the NPWS are for the presence of a trained and experienced Marine Mammal Observer (MMO) and the use of “ramp up” procedures for noise and vibration emitting operations. The proposed mitigation measures (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) recommended by the Department of Culture, Heritage and the Gaeltacht in 2014 are designed to mitigate any possible effects.

5.4.1 NPWS Guidelines

The following mitigation measures consistent with NPWS (2014) are proposed to minimise the potential impacts on seals and to allow animals to move away from the construction area:

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, pile driving activity shall not commence if marine mammals are detected within a 500m radial distance of the pile driving sound source, i.e., within the Monitored Zone, following the recommendations in McKeown (2014).

Pre-Start Monitoring

3. Pile driving activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

5. The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.

6. This prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-Up Procedure

7. In commencing a pile driving operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds 170 dB re: 1µPa @1m an appropriate Ramp-up Procedure (i.e., "soft-start") must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information (see section 3).

8. Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes.

9. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

10. Where the measures outlined in steps 8 and 9 are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output.

11. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

12. Once an appropriate and effective Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

13. If there is a break in pile driving sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

14. For higher output pile driving operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

Reporting

15. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.

5.4.2 Monthly Seal Surveys

Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. These seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines.

5.4.3 Voluntary Code of Conduct for recreational boat-users

The new facility at Trinity Wharf will provide the opportunity to educate recreational boat users on the potential for disturbance of seals hauled out. A centralised facility, which does not exist at present, enables a voluntary code of conduct to be developed in collaboration with the marina, informing boat users of minimum distances to haul-out sites, signs of disturbance (such as head-up) and promote best practice. Provision of such information will ensure disturbance is minimised and the importance of the site for seals disseminated leading to increased environmental awareness.

5.5 | Residual Impacts

With implementation of the above mitigation measures, it is very unlikely that there will be negative residual impacts from the proposed construction activity on marine mammals in the area. It is also very unlikely that any animals will be injured or killed as a result of the proposed works. Seal haul out sites are between 2 and 5km from the proposed construction site. Seals using the inner harbour will be accommodated to vessel noise and resident individuals will have habituated to current vessel traffic. No significant increase in traffic is expected post construction and any animals which might be displaced from the vicinity of the construction site can be expected to quickly re-establish use of the area following cessation of the works.

Cetaceans are not present within the harbour and are occur occasionally outside the harbour and are therefore very unlikely to be impacted on by the works.

5 | SUMMARY

Sightings of cetaceans are extremely rare at or adjacent to the proposed site but the harbour is an SAC with harbour seals as a qualifying interest. The proposed construction site is adjacent to important seal haul out and pupping sites. Due to extended time period (up to 10.5 months) during which activities such as pile driving are scheduled, the potential impacts on seals exposed to this is activity could be significant.

Mitigation is required during piling activities. The proximity of the proposed works to important haul out sites and the likelihood of seals foraging near the construction site requires mitigation during all piling activities, which could have a significant impact on marine mammals in the absence of mitigation. Recommended mitigation involves the use of a Marine Mammal Observer to ensure no seals are within an agree mitigation zone on start-up and regular seal surveys are carried out to monitor use of known seal haul out sites in the area.

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Appendix 7.4 Invasive Species Management Plan

ROUGHAN & O'DONOVAN

Invasive Alien Species Management Plan

Trinity Wharf, Wexford

[Nov, 2017]

Prepared by Envirico on behalf of Wexford County Council

www.envirico.com

Action	**Personnel**	**Company**	**Date**
Revision: 1 (Jan, 2018)			
Report Prepared By:	Dr. Amanda Greer	Envirico	Nov, 2017
Reviewed By:			

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1. INTRODUCTION

Envirico have been engaged by Wexford County Council to carry out an invasive alien species survey and prepare an invasive species management plan for Trinity Wharf and the footprint of the proposed Trinity Wharf Development. The survey was conducted as a walkover by land on 3rd November, 2017. Two invasive alien species listed in the Third Schedule of S.I. 477/2011 were recorded during the course of the survey – **Japanese Knotweed** (*Fallopia japonica*; 1,377m^2), and **Three-Cornered Leek** (*Allium triquetrum*; 245m^2).

This invasive alien species management plan (IASMP) has been prepared in accordance with current Irish best practice guidelines such as 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' – NRA (2010); Best Practice for Control of Japanese Knotweed *Fallopia japonia* – Inland Fisheries Ireland; Best Practice Management Guidelines Japanese Knotweed *Fallopia japonia* – Invasive Species Ireland (2008).

1.1 Site Manager/Owner: Wexford County Council

1.2 Site Address: Trinity Wharf

Wexford

1.3 Site Description:

The survey area covered the both the Trinity Wharf itself and the section of Dublin to Rosslare railway track running along the southwestern boundary of the wharf, up to the boundary with residential and commercially owned properties. GPS co-ordinates are from N: 52.334411, E; -6.452088 at the north corner to N: 52.331829, E: -6.451053 in the south. The site is earmarked for significant development, with commercial units, hotel, and outdoor public amenity space planned. Access to the wharf is likely to be across the railway line at the north-western corner of the wharf.

1.4 Site Management Objectives and Threats to Objectives:

The site management objectives, threats to achieving those objectives and the planned strategies for minimising these threats are outlined in Table 1.

Table 1. Site management objectives, threats and mitigation for these threats.

Objective	Threat(s)	Mitigation
1. To prevent the spread of invasive species as a result of the construction works.	Movement of equipment and personnel throughout areas contaminated with invasive species Digging amongst invasive species or areas containing propagules Movement of contaminated clay	Before works begin, Japanese knotweed and Three-Cornered Leek will be treated with herbicides to the reduce their regenerative capacity. Strict biosecurity protocols will be implemented, as outlined in the IASMP. All machinery that is working in infested areas must be thoroughly washed down and certified as clean before leaving a designated zone. Japanese knotweed will be left in-situ wherever possible and subjected to ongoing treatment with herbicides. All contaminated clay will be treated according to the procedures outlined in the IASMP.
2. To enable construction to go ahead in a timely fashion without compromising objective 1.	Works may be delayed due to the implementation of biosecurity protocols, licence applications, waste classification, on-site treatment of or removal of contaminated spoil offsite.	Delays will be minimised by following the protocols laid out in this management plan.
3. To reduce the likelihood of the reintroduction of Japanese knotweed onto the site.	There is a significant amount of Japanese knotweed present close to the site along the Dublin to Rosslare railway line that forms a likely source of reintroduction to the site.	Iarnród Éireann will be engaged with and the merits of a comprehensive survey and treatment programme to all involved will be stressed. The aim is to establish an ongoing treatment and monitoring programme for this line to minimise the risk of reintroduction of Japanese Knotweed onto the Trinity Wharf Development Site.

2.1 Japanese Knotweed

Japanese Knotweed (*Fallopia japonica*) was introduced to Europe by the horticultural activities of Philippe von Siebold, who plucked the plant from the side of a Japanese volcano in the 1840s. It is a fast growing, perennial, herbaceous plant, native to East Asia (Japan, northern China, Taiwan and Korea). In its home range, the plant is not a threat because a host of native predators, fungi and herbivorous insects keep it in check. However, outside Japan it is classified as one of the World's Worst Invasive Species (World Conservation Union). The date of its first introduction to Ireland is not known, but is believed to be in the mid to late 19th century.

Japanese Knotweed can grow >3m high, with young shoots in spring growing up to 10 - 30cm per day, quickly resulting in dense stands that shade out other species. The leaves are a distinctive shape with a tapered tip and a flat base (up to 18cm long) and the mature hollow stems have nodes and look somewhat like bamboo canes. The underground rhizome system can be vast, extending up to 3m deep and 7m horizontally from the nearest visible growth. Japanese Knotweed produces small cream or white flowers in late summer or early autumn. There are only female plants in the UK and Ireland so sexual reproduction is negligible; however, hybrids with related plants can be produced (e.g. Giant knotweed; Russian Vine) and are found occasionally.

Even without sexual reproduction, the plant spreads at a rapid rate by rhizome extension. New plants can also grow from tiny fragments of rhizome (as little as 0.7 grams) or stems, which means that traditional control methods such as cutting or strimming will actually further spread a knotweed infestation. Some of the most likely routes for knotweed spread are via our roads, rivers and railway lines as tiny fragments are dragged along these routes enabling them to quickly colonise new areas. Knotweed is also often spread by the movement of contaminated soils offsite and the improper disposal of the weed in garden clearings. It can grow on a wide range of soil types, pH and salinity; has the ability to withstand droughts, heat, cold, sulphurous soil; and is tolerant towards heavy metals. This hardiness ensures a wide distribution across habitat types.

Japanese Knotweed's massive rhizome system and vigorous growth can seriously damage walls, foundations, roads and buildings, including historic sites. The plant can also disrupt the integrity of man-made flood defense structures, increasing costs in repair and maintenance. Railway tracks, roads, pavements, and other constructions are also frequently affected.

Other highly invasive knotweeds that occur in Ireland are Giant Knotweed, *Fallopia sachalinensis*, Himalayan Knotweed *Persicaria wallichii* and Bohemian Knotweed *Fallopia x bohemica*, which is a hybrid between Japanese and Giant Knotweed. These other knotweeds are increasingly found in Ireland, though still to a much lesser extent than the Japanese Knotweed.

In Ireland, Japanese Knotweed is classified as a High-Impact Invasive Species with a Risk Assessment Score of 20. It is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations) and spoil contaminated with Japanese Knotweed waste is classified as a vector material in Part 3 of the Third Schedule (see Section 3 for details of this legislation).

2.2 Three-Cornered Leek

Three-Cornered Leek (AKA Three-Cornered Garlic, White Bluebell) *Allium triquetrum* is a bulbous, perennial herb native to Mediterranean countries. It was introduced to the British Isles for cultivation in the 1750s and had become established in the wild on Guernsey & Jersey Islands by the 1850s. In Ireland, it is particularly prevalent along the south-eastern seaboard. This species thrives along road verges, at the base of hedges and in disturbed ground and is easily identified in springtime by its strong garlicky smell and pretty white flowers. Its green leaves are long and slender.

All parts of Three-Cornered Leek are edible, from flowers to leaves to bulbs, and all are strongly reminiscence of garlic. This plant can reproduce by dividing its bulbs or setting seed. Interestingly, its seeds are ant-dispersed. Three-Cornered Leek seeds have an appendage with oil attached, and the ants carry the seeds away in order to eat the oil. Then they discard the seed. Three-Cornered Leek is also sometimes planted by humans in the wild or can be spread accidentally by the movement of contaminated soil and garden waste. Where it becomes established this species can reduce biodiversity by growing earlier in the season than its native competitors and shading these native species out.

In Ireland, Three-Cornered Leek is classified as a Medium-Impact Invasive Species with a Risk Assessment Score of 15. This species is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations; see Section 3 for details of this legislation).

3. INVASIVE ALIEN SPECIES LEGISLATION

The Invasive Species Ireland project identified Japanese Knotweed as one of the highest risk (most un-wanted) non-native invasive species in Ireland. There is strict legislation surrounding Japanese Knotweed and Three-Cornered Leek in Ireland – namely under Irish Statuory Instrument 477/2011 and the Wildlife Acts (1976-2000). We have also ratified a number of international conventions that oblige the Government to address the issue of non-native invasive species, including the Convention on Biological Diversity, the Bern Convention and the International Plant Protection Convention

Irish Statutory Instrument 477/2011

The EC Birds and Natural Habitats Regulations introduced important legislation concerning invasive species in the Republic of Ireland. Japanese Knotweed and Three-Cornered Leek are both listed in Part 1 of the Third Schedule.

Article 49 prohibits the introduction, breeding, release or dispersal of certain species; and Article 50 prohibits dealing in and keeping certain species.

Article 49 (2) "Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence."

Article 49 (3) states that you can defend against allegations that you committed an offence under Article 49 (1) or (2) by proving that you took all reasonable steps and exercised all due diligence to avoid committing the offence:

Article 49 (3) "Subject to paragraph (4), it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

Article 50 (2) "Save in accordance with a licence granted under paragraph (7), a person shall be guilty of an offence if he or she imports or transports –

(a) an animal or plant listed in Part 1 or Part 2 of the Third Schedule

(b) anything from which an animal or plant referred to in Part 2 of the Third Schedule can be reproduced or propagated, or

(c) a vector material listed in Part 3 of the Third Schedule,

into or in or to any place in the State specified in relation to such an animal or plant or vector material in relation to that animal or plant or vector material in the third column of the Third Schedule."

The *Wildlife Amendment Act (2000)* of ***The Wildlife Act (1976)*** made it an offence to cause an exotic species of flora to grow in the wild anywhere in the state**:**

“Any person who plants or otherwise causes to grow in a wild state in any place in the State any (exotic) species of flora, or the flowers, roots, seeds or spores of flora, otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.”

4. SURVEY FINDINGS

A walkover survey was conducted on 3rd Nov, 2017. This survey confirmed the presence of two Third Schedule S.I. 477/2011 invasive alien species –Japanese Knotweed and Three-Cornered Leek. A significant amount of another medium invasive species - *Buddleia davidii* was noted to be present throughout the site; however, this species is not listed in S.I. 477/2011.

4.1 Japanese Knotweed

In total, nine distinct stands of Japanese Knotweed (JK) were recorded during the survey (see Appendix I – Drawings). Each knotweed stand was given a unique identifier or JK number. The details of each stand recorded are outlined in Table 2, including length, width, the average height of the canes, the maximum cane diameter, and any other notable features.

The total above ground area covered by Japanese Knotweed was 1,377m^2, with 1,030m^2 of this recorded along the railway lines and only 347 m^2 growing within Trinity Wharf. All of the JK surveyed appeared to have been growing at the same location for a number of years. JK01 to JK07 were all growing along the Dublin to Rosslare railway line on the western side of the tracks, while JK08 & JK09 were growing within Trinity Wharf. It was noted during the course of the survey that there was a substantial amount of Japanese knotweed present along the western side of the railway tracks continuing further east of the site and that this poses a significant threat for reintroduction (see Appendix II – Photographic Record).

Table 2. Details of each stand of Japanese Knotweed within the survey area

ID	Length (m)	Width (m)	Growth Stage	Avg. Stem Height	Max. Stem Diameter	Close to Water	Likely to Require Excavation
JK01	8.5	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK02	17.4	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK03	2.5	2	Dying Back	>2.5m	>2.5cm	No	No
JK04	15	5	Dying Back	>2.5m	>2.5cm	No	No
JK05	106	Up to 20m	Dying Back	>2.5m	>2.5cm	No	No
JK06	6	2	Dying Back	>2.5m	>2.5cm	No	No
JK07	6	2	Dying Back	1 – 2.5m	1 – 2.5m	No	No
JK08	49	5 to 15m	Dying Back	>2.5m	>2.5cm	Yes	Yes
JK09	9 to 4	10	Dying Back	>2.5m	>2.5cm	No	Yes
Total Coverage of Japanese Knotweed: 1377m^2							

*Areas may differ from length x width due to irregular polygon shapes

4.2 Three-Cornered Leek

There were two stands of Three-Cornered Leek (TCL) recorded on the site (see Appendix I – Drawings & Appendix II – Photographic Record). TCL01 was a 30m long and 1m wide strip of TCL running along the western edge of Trinity Wharf by the fence separating the Wharf from the railway tracks. The plants were approx. 20cm high and flowering/ in leaf. TCL02 ran in a 1 or 2m wide strip for 102m along the western side of the railway line. Most of these plants were 20cm high and in leaf.

5. MANAGEMENT PLANS

Please Note: Although medium-impact invasive species Buddleia was noted during the survey, as this species is not listed in the Third Schedule of S.I. 477/2011 there is no special legal requirement surrounding this species other than not to cause it to grow in the wild.

5.1 Management Plan for Japanese Knotweed

5.1.1 Summary

In order to reduce the regenerative capacity of the Japanese Knotweed present on-site, and the likelihood of reintroduction, all stands should be subject to an on-going herbicide treatment program.

Wherever possible, JK should be treated in-situ with a herbicide programme for a minimum of 5 years by a professional contractor.

Where excavation of JK is necessary due to the proposed works, strict biosecurity protocols must be adhered to. Haulage routes must be clearly defined and lined with an appropriate geo-textile to avoid ground contamination; and wash-down areas and procedures must be in place.

Two different options for the disposal of JK contaminated clay are outlined (subject to licenses/approval): 1. Off-Site Disposal; 2. Soil Screening and Bunding.

We strongly recommend that the client engage in a discussion with Iarnród Éireann and Envirico about the best strategy to tackle the significant Japanese knotweed infestations further along the railway lines in order to minimise the risk of reintroduction.

5.1.2 Herbicide Treatment

Wherever possible, JK should be treated in-situ with herbicides. For all JK stands to be left in-situ a comprehensive treatment programme should be carried out for a minimum of 5 years by a professional contractor. However, even stands that are planned for excavation should have herbicide treatment applied to them at each available opportunity before works commence, in order to reduce their regenerative capability.

All works must be carried out by a professional contractor with specialist knowledge of invasive species.

The Environment Agency (UK, 2013) recommends that wherever possible JK is treated in-situ using herbicides. In-situ treatment is the most environmentally-friendly option, and does not pose the same biosecurity risk as mechanical removal. A herbicide treatment programme is also the most cost-effective option; however, it can take 5 or more years to be completely effective and even after such time, the rhizomes cannot be assumed dead without undertaking viability testing. Therefore, not all JK stands recorded here will be suitable for treatment with herbicides alone.

Legislative Framework

All professional formulation plant protection products must only be applied by a Professional Pesticide User that is registered with the Department of Agriculture, Food and the Marine (as required by the Sustainable Use of Pesticides Directive, 2012). All herbicides will be applied in accordance with current legislation (Sustainable Use of Pesticides Directive, 2012), in compliance with the label, in appropriate weather conditions and following an environmental risk assessment. Application of pesticides near water must have prior approval from Inland Fisheries Ireland, be applied by appropriately trained personnel (PA6AW) and use only aquatic approved products.

Herbicides Effective Against Japanese Knotweed

Currently, the following active ingredients are considered to be the most effective treatment for Japanese knotweed available in the EU. Table 3 outlines some key features of these products.

Table 3. Herbicides currently licenced in Ireland that are effective against Japanese Knotweed. All herbicides are systemic (translocated).

Herbicide	*Licensed Product	PCS No.	Selectivity	Persistence	Timing of 1st Application	Aquatic Approved Product
Glyphosate	Roundup Biactive XL	04660	Non-selective	Non-persistent	Aug-Oct	Yes
Aminopyralid + Triclopyr	Icade Grazon Pro	04249 05182	Selective	Not assessed (not for use on animal feed for 1 year)	Apr-May	No
2-4D Amine	Depitox	02365	Selective	1 month	May	No

***** Only example licence products are displayed, others may be available.

Any chemical treatments for infestations close to water e.g. JK08 should use an aquatic-approved product.

In order for a chemical treatment programme to be successful, it is important that the initial leaves and stalks, and any regrowth remain as healthy as possible until the product is applied. A translocated herbicide is drawn into the plant from where it is applied, and moved to other plant organs incl. roots/rhizomes. Because of this mode of action, a translocated herbicide applied via a foliar spray will be most effective if it has a larger leaf area to cover, and the translocation of the product from the leaves down to the rhizomes will be most efficient if the plant is not damaged or water-stressed.

Table 5. Treatment Schedule

Site Visit	Action	Time	Year
1	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2018*
2	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2018*
3	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2019*
4	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2019*
5	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2020*
6	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2020*
7	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2021*
8	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2021*
9	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2022*

This schedule of works is an estimate only, as it may take fewer or additional site visits to ensure that eradication (no regrowth for 2 years) is achieved.

5.1.3 Excavation

In total there are four JK stands that *may* require excavation as part of the proposed works – JK01, JK02, JK08 & JK09. The above ground area covered by these stands totals 434m^2. When a 7m buffer is placed around these stands, there is a total area of 2,425m^2 that is potentially contaminated. The maximum lateral extent of rhizomes is typically considered 7m with a maximum depth of 3m. Therefore, the maximum volume of JK contaminated material if JK01, JK02, JK08 & JK09 require complete excavation is 7,275m^3. This figure is likely to be a gross over-estimation of the amount of clay containing JK material. A Certified Surveyor of Japanese Knotweed (CSJK) should supervise all excavations within contaminated areas and can restrict the material classified as contaminated to that which actually contains JK material. Under typical conditions, the JK rhizome network does not expand to its maximum possible extent. It is more usual to find the rhizome network contained within 3m lateral spread and 1.5m depth. Therefore, it is more likely that the amount of contaminated clay to be removed if JK01, JK02, JK08 & JK09 require complete excavation would be in the region of 2,718m^3 (calculated from typical rhizome extent of 3m, depth of 1.5m) if done under the supervision of a CSJK.

The volume of material to be excavated will depend on the final development plan and the extent of the development works that take place between the Iarnród Éireann and Wexford County Council boundaries. Depending on the final development plan, it may be that only a portion of the Japanese knotweed requires excavating. In this case, built structures can be protected by the installation of a root barrier membrane in order to keep the amount of excavated material down to a minimum.

Should it be necessary to obtain an accurate estimation of the amount of material to be removed, this can be provided by scraping back the top 25cm of top soil and digging a series of test pits within the buffer zone.

5.1.4 Biosecurity

Exclusion Zones

Any personnel or machinery entering within 7m of a Japanese Knotweed stand is entering a potentially contaminated area and as such must be subject to strict biosecurity protocols. This 7m is designated because the maximum lateral extent of the JK rhizome network is 7m from the nearest visible growth. Exclusion zones must be set up a minimum of 7m away from the nearest visible JK growth. Maps depicting the 7m buffer zones are provided in Appendix I – Drawings.

Exclusion zones should be clearly marked or fenced off in order to prevent accidental incursion.

All PPE, equipment, plant or machinery to enter an exclusion zone must be thoroughly clean before entering.

Routes within the exclusion zone should be overlaid with a geotextile that has a layer of sand on-top to protect it from being damaged by heavy machinery. The geotextile will prevent potentially contaminated clay from being transferred onto tracks, tyres or boots.

A designated wash-down area(s) lined with appropriate geo-textile will be set-up within each exclusion zone. At this/these locations all PPE, plant and equipment must be thoroughly cleaned before leaving the exclusion zone. They should be certified as clean by personnel competent at recognizing JK material incl. rhizome. Any material that has been washed off PPE, plant and equipment will be treated as contaminated and added to material to be removed for disposal or further treatment. Equipment such as a power-washer, buckets with clean soapy water, stiff brushes, hoof-picks, cloths will be available at all times at all wash-down areas.

The amount of traffic in and out of exclusion zones should be kept to a minimum at all times. Machinery should remain outside the zone where possible. For example, long-reach excavators may be utilized to dig material out of an exclusion zone and load it into a truck without having to track inside the exclusion zone at any time. The bucket and arm of the excavator that operated within the exclusion zone must be subject to the wash-down protocols out-lined above.

Loading Contaminated Material

All trucks to collect JK contaminated material should be lined with appropriate geotextile. Material will be loaded to within no more than 50cm of the top and then covered with geotextile for transport.

Banksmen should be in place during loading of contaminated material to watch for and immediately clean-up any material that is dropped during loading. This material will be added to the load to be transported.

Haulage routes should be lined with geotextile protected with a layer of sand on top and trucks will not deviate from these routes.

Trucks that have been used to transport contaminated material must be thoroughly washed down and certified as clean by a competent person before being put to an alternate use.

After Excavation

Following excavation of JK contaminated material, it must be disposed of appropriately. Currently Irish Waste legislation (Waste Management (Facility, Permit and Registration) Regulations 2007) only allows for disposal at a licensed landfill unless an exemption is granted by the EPA. However, this legislation is currently under review and may be altered in advanced of the proposed works commencing (EPA, *Pers. Comm*., 2017).

5.1.5 Option 1 – Disposal Off-Site

Disposal off-site is a quick and easy method to get rid of JK contaminated material. Currently, it is also the only way to remediate JK material without either obtaining a Waste license or an exemption from the EPA. However, it is very expensive, and the most environmentally damaging method of treating JK.

JK material that is removed off-site in Ireland is either taken to landfill and deep-buried – an unsustainable solution that uses valuable landfill space; or shipped to the Netherlands for incineration – another solution with a heavy carbon footprint.

Legislative Framework

Japanese Knotweed contaminated material can only be removed off-site by a licenced waste haulier and brought to a licenced waste facility. Under Statutory Instrument 477/2011 (Article 50(2)) it is an offence to transport Japanese knotweed contaminated material without first obtaining a licence from National Parks and Wildlife.

Documents Required for Removal of Japanese Knotweed Contaminated Waste

For disposal of Japanese knotweed material off-site two documents are required: a **licence from National Parks and Wildlife (NPWS)**; and a **Waste Classification document**.

Licence from National Parks and Wildlife Service

A licence application must include:

- As much information as possible on the removal, transportation and treatment of the species in question
- A detailed description of the biosecurity measures that will be in place
- A copy of the Knotweed Management plan
- Details of the timeframe for carrying out the work

Waste Classification Document

Japanese knotweed waste may only be transported offsite by a licenced haulier who will require a waste classification document. A soil test is required in advance. The soil can only be transported to a licenced waste facility that has been notified in advance of the nature of the waste and has agreed to accept the waste material.

5.1.6 Option 2 – Soil Screening & Bunding

*This option is subject to EPA approval.

Following excavation, trucks loaded with JK contaminated material will haul this materials along a pre-determined haulage route to a designated area on Trinity Wharf. Trucks will empty the contaminated material in an exclusion zone that is fenced off from the rest of the site and lined with geotextile. They will then move to a geo-textile lined wash-down area that has been set up adjacent to the unloading area for cleaning before they leave the exclusion zone.

The JK contaminated material will then be screened in a geo-textile lined designated area using a series of differently sized metal screens and conveyors that separate the plant material from the clay. Finally, a handpicking station will remove any remaining plant material. The screened clay will be used in the landscaping of a green area by being spread on top at a depth of no more than 0.5m. The plant material will be either removed off-site for incineration (license from NPWS required) by a licensed waste haulier; or incinerated on-site using a mobile incinerator (subject to EPA approval). This spoil used in the landscaping of the green area will be fenced off and subject to ongoing monitoring for 18 months to ensure that if any rhizomes remained after the screening process, they are eradicated as they grow. Following this time, if a layer of more suitable topsoil is required for planting, it can be added and sown.

Any machinery leaving the exclusion zone must be thoroughly washed and certified as clean by a competent person.

5.1.7 Preventing Reintroduction

Currently, there is a high likelihood that Japanese Knotweed will be reintroduced onto the site from further along the railway track if no action is taken to address the infestations present on the Dublin-Rosslare line. Given the significant investment Wexford County Council are making in the Trinity Wharf development, we strongly recommend that Wexford County Council and Iarnród Éireann arrange a meeting where stakeholders can express their concerns and come up with a mutually beneficial action plan. Envirico can attend to offer expert advice on the feasibility of measures discussed.

5.2 Management Plan for Three-Cornered Leek

5.2.1 Summary

Three-Cornered Leek should be left in-situ and subjected to an ongoing chemical treatment programme where possible. Where material that may contain this species needs to be excavated, this material must be removed to an EPA licenced waste facility. Strict biosecurity procedures (see Section 6) should be adhered to in order to minimise the risk of spread.

5.2.2 Herbicide Treatment

Three-Cornered Leek should be sprayed in April with a glyphosate-based herbicide. In order to increase the effectiveness of the herbicide application the leaves should be lightly bruised in advance of treatment. All herbicide treatments will need to be repeated every 2-3 months in order to treat whatever regrowth results from the seed and bulb bank left by this species.

5.2.3 Excavation

TCL01 will likely require excavation as part of the development works. The infestation and an area of up to 2m around and to a depth of 0.5m may contain TCL seeds and/or bulbs. This soil must be disposed of at an EPA licenced waste facility and not mixed with general spoil. It is not necessary to excavate TCL in order to prevent damage to structures that may be built. Placing concrete or any other significant structure on top of TCL will kill the plant.

6. BIOSECURITY PROTOCOLS

Persons entering an area infested with an invasive alien species must take certain precautions to prevent the spread of that species.

These guidelines are to be followed by all persons that enter an infested zone:

- All PPE, other equipment and machinery that enter an infested zone must be cleaned before entering.
- Before leaving an infested area, individuals must thoroughly inspect their clothing, PPE, any equipment and their footwear for rhizomes, or other plant fragments that may be stuck on.
- All personnel should carry a hoofpick or similar implement to thoroughly clean the treads of their footwear with. All footwear must be thoroughly cleaned before leaving an infested zone.
- All PPE, other equipment and machinery, clothing and footwear must be thoroughly cleaned with soapy water and a stiff bristled brush before leaving an infested zone.
- As good practice all staff should follow Inland Fisheries Ireland Biosecurity Protocols when they have entered water or a riparian zone.
- If machinery/plant has entered or worked in an infested zone, it must be thoroughly washed down before leaving the area or working in an uninfested location
- A power washer must be provided for effective cleaning of machinery, along with stiff bristled brushes.

7. CODES OF PRACTICE/SOURCES OF INFORMATION FOR INVASIVE KNOTWEED SPECIES

Ireland

- Invasive Species Ireland Horticultural Code of Good Practice (http://invasivespeciesireland.com/wp-content/uploads/2010/07/Horticulture-Code-Final.pdf)
- National Roads Authority – The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (http://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf)
- Invasive Species Ireland Japanese Knotweed Best Practice Management Guidelines (withdrawn since 1st Nov, 2016).
- Inland Fisheries Ireland – Best Practice Guidelines for the Control of Japanese Knotweed (http://invasivespeciesireland.com/wp-content/uploads/2012/01/Best-practice-control-measures-for-Japanese-knotweed.pdf)
- National Biodiversity Data Centre Invasive Species (http://www.biodiversityireland.ie/projects/invasive-species/)
- Invasive Species Ireland Website (http://invasivespeciesireland.com/)
- Sligo Institute of Technology Alien Species (http://staffweb.itsligo.ie/staff/dcotton/Alien_Species.html)
- Online Atlas of the British and Irish Flora (http://www.brc.ac.uk/plantatlas/) – *UK also*

UK

- Property Care Association Code of Practice for the Management of Japanese Knotweed (http://www.property-care.org/wp-content/uploads/2015/04/Code-of-Practice-for-the-Management-of-Japanese-knotweed_v2.7.pdf)
- Environment Agency – The Knotweed Code of Practice Version 3 (withdrawn since 11th Jul, 2016).
- Royal Institute of Chartered Surveyors – Japanese Knotweed and Residential Property (http://www.rics.org/uk/knowledge/professional-guidance/information-papers/japanese-knotweed-and-residential-property-1st-edition/)
- Department for Environment, Food and Rural Affairs Horticultural Code of Practice (http://www.botanicgardens.ie/gspc/pdfs/defra%20code%20of%20practice.pdf)
- GB Non-Native Species Secretariat (http://www.nonnativespecies.org)

8. ABOUT ENVIRICO

Envirico are an Irish ecological company that specialise in invasive species monitoring and control. We tackle invasive alien species found in domestic, commercial and amenity sites in terrestrial, riparian and freshwater habitats.

Our qualifications include:

- Ph.D. Ecology/Microbiology
- MSc Aquatic Ecology
- PCA Certified Surveyor of Japanese Knotweed
- PA1 – Safe use of chemicals
- PA6A – Operating hand-held pesticide equipment
- PA6AW – Operating hand-held applicators to apply pesticides near water
- PA6INJ – Operating hand-held pesticide injection equipment
- PA6MC – Operating other hand-held applicators
- Registered Professional Pesticide User of Pesticides
- SOLAS Safe Pass Certified
- CSCS Personnel
- PTS Certified
- Traffic Management
- HSE Commercial Divers
- National Powerboat Certificate (Level 2)

Our services include:

- Site-Specific, Best-Practice Management Plans
- Site Excavation and Management
- Chemical Control
- Post-Treatment Monitoring
- Completion Certificate
- Habitat Restoration
- Training in Biosecurity and Identification

APPENDIX I – Drawings

Client:
Wexford County Council
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Tel: +353 53 9196000

Consultant:

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Drawing Title:
DRAWING 1:
INVASIVE SPECIES

Project Name: Invasive Alien Species Survey (Trinity Wharf Development)

Project Code: 00082	*Drawn:* AG	*Approved:* MB

Date: 14th Nov, 2017	*Drawing Number:* *0082.1/Trinity Wharf/2017*

Source Background Digital Orthophoto:
Google Maps, 2017

APPENDIX II – Photographic Record

Fig 1. JK01

Fig 2. JK02

Fig 3. JK03

Fig 4. JK04

Fig 5. JK05

Fig 6. JK06

Fig 7. JK07

Fig 8. JK08

Fig 9. JK09

Fig 10. TCL01

Fig 11. TCL02

JAPANESE KNOTWEED IDENTIFICATION SHEET

Shield-Shaped Leaf with Flat Base

Lush green colour

Zig-Zag Stems

Can grow up to 3m height

Rhizomes are bright orange when freshly cut

Canes have regular nodes like bamboo. May be purple speckled

Crown at base of canes

Three Cornered Leek Identification Sheet

White Flowers all pointing downwards

This herb has long, narrow green leaves

Flowers also have green lines inside

Chapter 8:
Soils & Geology

ROUGHAN & O'DONOVAN

Chapter 8 Soils and Geology

8.1 Introduction

Trinity Wharf is a brownfield site, approximately 3.6 ha, located at the southern end of Wexford Town's quay-front. The site consists of reclaimed land that extends into Wexford Harbour and was gradually reclaimed with the northern part reclaimed around 1832 (initially as a dockyard area) and then extended south-eastwards through the late 1800s and early 1900s and was occupied by a number of industrial uses. Owing to the reclaimed nature of the site, the superficial soils are dominated by relatively deep layers of 'Made Ground'. Made ground has been defined as soil which has been altered in some way by human activity (imported and placed in-situ).

The characteristics of the proposed development that will impact soils and geology are described in the following paragraphs. The proposed development will involve raising the ground level using imported material. A new sea wall will also be constructed around the coastal boundaries of the site through sheet piles and the placement of rock armour along sections of the northern and southern edges. The structural design of the buildings will typically comprise a reinforced concrete superstructure. The foundation design is proposed to consist of driven steel or concrete piles extending to competent bedrock.

A 64 berth marina and associated breakwater units, pontoon walkways and finger berth is planned on the site's northern corner. The marina will be either piled or anchored. Pontoon berths and walkways will be restrained using tubular piles driven into the seabed or an alternative restraint system.

There will also be a 180m boardwalk structure at the northern corner of the site connecting Trinity Wharf with Paul Quay. The foundations for the boardwalk structure are proposed to be driven steel tubular sections which will be installed to immediately beneath the soffit level of the boardwalk deck where an integral connection will be made.

The chapter will assess the impact of these structures as part of the proposed development on the Trinity Wharf brownfield site. Full details of the project description and likely construction methodology is detailed in Chapter 4 'Description of Development'.

This chapter considers and assesses the likely significant impacts with regard to soils and geology associated with both the construction and operational phases of the proposed development. Measures to mitigate the assessed negative impacts of the development are proposed, and residual impacts are described. The chapter initially sets out the methodology used (Section 8.2), describes the existing soils and geology environment (Section 8.3), examines the predicted impacts of the proposed development (Section 8.4), proposes mitigation measures (Section 8.5), and identifies residual impacts (Section 8.6).

8.2 Methodology

This chapter has been prepared in accordance with the following guidelines:

- Institute of Geologists of Ireland (IGI) (2013) *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*;

- National Roads Authority (NRA 2008*) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*;
- Environmental Protection Agency (EPA 2017) *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports*;
- Waste Management Act 1996 (as amended)

A desk study of the site of the proposed development was carried out in order to establish baseline conditions. The desk study involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. A suite of geological maps published by the Geological Survey of Ireland (GSI) were consulted as a part of the desk study. The maps included the bedrock, quaternary sediments, groundwater vulnerability and geological heritage sites, among other themes. Aerial and site-based photographs as well as historical maps and reports were also consulted as a part of the desk study. The desk study was followed by a walkover survey of the site of the proposed development by ROD Civil engineers in October 2018, with observations used in preparation of this chapter.

Previous Studies/ Reports

The following reports were consulted in the preparation of this chapter:

- Kavanagh Mansfield and Partners (2008): Report on a site investigation for a development at Trinity Wharf Wexford;
- RPS (2018): Trinity Wharf Marina Feasibility Study (project number IBE1115/D03)
- RSK (2018): Preliminary Asbestos Walkover Survey, Trinity Wharf, Wexford

Ground Investigations procured by Kavanagh Mansfield and Partners in 2008 consisted of 13 cable percussive boreholes in overburden and 9 rotary core boreholes in the bedrock. A suite of geotechnical laboratory tests for determination of the geotechnical soil parameters was carried out on the samples from the boreholes. The ground contamination testing was carried out on seven samples. The ground contamination testing was in accordance with "Murphy Suite" which determines the suitability of the soils for acceptance into licensed landfill facilities. The results of which are discussed in Section 8.3.

A Preliminary Asbestos Walkover Survey of the Trinity Wharf site was undertaken in October 2018 Sampling and testing of seven samples was undertaken and a map of general areas impacted with Asbestos Containing Materials (ACMs) was developed. The walkover survey and samples taken were confirmed by laboratory analysis as containing asbestos. The report recommended further work to be undertaken including the development of a remedial strategy and independent validation of the site prior to proceeding with the development. The Preliminary Asbestos Survey Walkover report is attached as Appendix 8.1 for reference.

8.3 Description of Receiving Environment

The proposed development is located on reclaimed land adjacent to the southern bank of the Wexford Harbour, south of the Wexford town centre. The site is flat, with generally low and sparse vegetation. The site is rectangular in shape, connected to the original bank at its southwestern side. The other three sides (north, east and south) that make the coastline are partially protected by historical concrete and masonry sea wall.

The sea bed depth at the location of the marina ranges from -2.5m OD (Ordnance Datum) to -7m OD while the depth at the location of the proposed boardwalk ranges from 0m OD to -2m OD. The site does not contain any Geological Heritage features or quarries.

Bedrock Geology

The GSI 1:100,000 bedrock map indicates that the site is underlain by the Shelmaliere Formation consisting of white and purple quartzites with slates. Cullenstown Formation (grey-green metagreywacke & slate) and Ballysteen Formation (limestones and shales) are also found in the vicinity.

The ground investigation carried out in 2008 indicate that the site is underlain by the moderately weak to strong, thin to medium bedded, slightly cherty limestone. The limestone was locally found to be interbedded with dark calcareous mudstone. This description matches well with the Ballysteen Formation features. Only one borehole (RC15) indicated the presence of interbedded sandstones and siltstones. Refer to borehole locations Plate 8.1 below.

The bedrock in the northern part of the site is typically observed at 10.2 – 11.5 m below ground level (bgl), overlain by the 0.5 -1m of weathered bedrock returned as angular clayey gravel. The bedrock at the southern end of the site was observed at approximately 5m bgl, overlain with 1m of weathered bedrock returned as angular clayey gravel. The central part of the site exhibits a very deep zone of highly weathered bedrock. For instance, borehole RC7 shows the weathered rock, recovered as gravel and cobbles, to extend from 11m bgl down to 22m bgl, with no competent bedrock encountered in this borehole.

Soils and Subsoils

The area is entirely covered by the made ground of very heterogenous composition. Clay, rubble, stone, ash, concrete and slag were all observed as constituents. The strength and density vary accordingly and the thickness of the made ground varies from 1.5m to 4.1m.

The made ground is underlain by alluvial soil typical of riverbanks. The alluvial soils are predominantly encountered as soft to firm sandy silts and loose silty sands. The thickness of the alluvial soil ranges from 1m to 5m. These soils have undergone a degree of consolidation under the made ground layer and building loading which is why no very soft material was encountered during the ground investigation in 2008.

Firm to stiff gravelly clay (widely known as glacial till or boulder clay) underlies the alluvial soils and overlies the weathered bedrock. The thickness of the gravelly clay ranges from 2m to over 8m in BH16. (Refer to Plate 8.1).

Plate 8.1 Borehole locations investigated by IGSL in 2008

Environmental Testing

A suite of Waste Acceptance Criteria (WAC) chemical tests were undertaken on seven samples as a part of the 2008 geotechnical investigation procured by Kavanagh Mansfield and Partners and undertaken by IGSL. The WAC testing followed the Murphy Suite Criteria to determine the suitability of the soils for acceptance into licensed landfill facilities. The location of the boreholes' locations investigated by IGSL are illustrated in Plate 8.1. The samples were taken using the 'Shell and Auger' technique of soft ground boring. All boring operations sampling and / or logging of soils and in-situ testing complies with the recommendations of the British Standard Code of Practice BS 5930 (1981), 'Site Investigation' and BS 1377:1990, 'Methods of text for soils for civil engineering purposes'.

Parameters forming part of the chemical testing included:

- Polychlorinated Biphenyls (PCBs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Mineral Oil
- BTEX & Petrol Range Organics (PRO)
- Total Organic Carbon (TOC)

Leachate analysis for metals and major anions and cations was also undertaken to assess potential for movement into groundwater.

The testing found elevated levels of Polycyclic Aromatic Hydrocarbons (PAHs) and sulphates in the made ground stratum in five out of seven samples. In general, low to moderate levels of contamination have been noted. A summary of the results are presented below:

- Dissolved Mercury, Benzene, Toluene, Ethylbenzene, Total Xylene, PCB's, Total Phenols, and Dissolved Cadmium were below the respective Limit of Detection (LOD) in all boreholes.
- Elevated levels of Mineral Oil were identified at boreholes 16 and 17 (south-eastern end of the site) – all other boreholes recorded values below the LOD of 1 mg/kg.
- Slightly elevated levels of Total Dissolved Solids (TDS) were identified at a depth of 2.5m below ground level at borehole 16, with all other samples categorised as Inert in terms of WAC (< 4000 mg/kg). The levels observed at borehole 16 categorise this material as Stable Non-reactive with respect to WAC guidance.
- Dissolved Antimony was either below the LOD or was within the inert criteria limits and were below 0.06 mg/kg with the exception of borehole 22. The levels observed at borehole 22 categorise this material as Stable Non-reactive with respect to WAC guidance.
- Dissolved Arsenic, Barium, Chromium, and Copper concentrations were found to be either below the LOD or within the inert criteria limits.
- Elevated levels of Total Organic Carbon (TOC) above the inert criteria were identified in five of the seven samples. Only boreholes 12 and 16 (in the deeper soil layers) fall below the Inert Landfill Threshold of 3%. For waste disposal purposes to landfill, the levels which were observed would classify the material as hazardous.
- Elevated levels of PAHs were identified in all samples analysed. Borehole 4 was found to have the highest concentrations of PAHs among the boreholes tested.

Further detail is available in the Kavanagh Mansfield and Partners Report from 2008 as appended to this EIAR as Appendix 8.2.

The Preliminary Asbestos Walkover Survey undertaken on 18th October 2018, identified fragments of asbestos cement and floor tiles and / or floor tile debris in numerous locations across the surface of the site. Seven samples were collected by RSK and asbestos was confirmed in five out of the seven samples. The preliminary findings indicate that Asbestos Containing Materials (ACMs) are broadly concentrated along the retaining wall in the northern portion of the site; along the edges of floor slabs; adjacent to and within many of the demolition stockpiles and in the gravel track along the eastern boundary. No suspect ACMs were identified within the grassed area or were visible on the surface of the stockpiles in the southern portion of the site. The Preliminary Walkover Asbestos Report is included as Appendix 8.1 of this EIAR.

The sea bed in the vicinity of the Trinity Wharf development, corresponding to the location of the boardwalk and the sea wall / revetments was sampled and tested as a part of the Trinity Wharf Marina Feasibility Study by RPS Group (November 2018). A comprehensive sampling programme was undertaken in July 2016 by Hydrographic Surveys Ltd to inform the feasibility study, whilst the sediment quality analysis was undertaken by the RPS Laboratory Services, see sampling locations in Plate 8.2 below.

The samples from the north west side of Trinity Wharf (A, B & C) were found to have values above the upper guidance threshold for OCPs and PAH levels that are substantially in excess of the lower guidance limit (there is no upper limit established at present). Station A, furthest from the Wharf, contained the least contaminated sediments on this side of the development area with stations B & C, closer to the Wharf, showing increasing levels of contaminants.

Station B had samples taken at both the surface (B1) and 1m below the surface (B2) and held the greatest amount of contaminants out of the three stations on this side of Trinity Wharf. The sample collected at depth tended to have higher levels of contaminants than the surface sample. Metals levels above the lower guidance levels were found for arsenic, copper, nickel, lead and zinc. PAH levels were also above the lower guidance level in both the surface and -1m samples, with the deeper sample recording total values approximately twice that of the surface sample. PCB, Organotin and TPH levels were satisfactory. OCP levels were all above the threshold effects level and the parameters for which limits have been set, Lindane and HCP were both above the upper guidance level.

Station C was a surface sample and contained elevations above the lower guidance level for arsenic, cadmium, nickel and zinc in the metals suite. Polycyclic Aromatic Hydrocarbon (PAH) and PolyChlorinated Biphenyl (PCB), Organotin (TBT and DBT) and total petroleum hydrocarbon (TPH) levels were acceptable. As with the other samples in the OCP suite, the results for Lindane and HCP were both above the upper guidance level for Station C, and the other parameters tested were above the Threshold Effects Level (TEL) published in the guidance.

Station D had samples taken at both the surface (D1) and 1m below the surface (D2). The samples were collected from the small accumulation of sediment immediately adjacent to the Wharf at the boundary with the navigation channel. In the metals suite, the two samples (surface and depth) recorded generally quite similar values, with the exception of copper, where the depth sample recorded a substantially higher value and both samples were above the upper guidance level. In keeping with many of the other surrounding stations, values for arsenic, nickel lead and zinc were also above the lower guidance level. PAH levels were acceptable; with the samples taken at depth recording levels almost three times lower than the surface sample. PCB levels were found to be above the lower guidance limit; however the deeper samples were four times higher than the surface sample. Organotin and TPH levels were satisfactory. OCP levels were also generally within acceptable thresholds.

Station E had samples taken at both the surface (E1) and 1m below the surface (E2). The sample collected at depth from station E was substantially more contaminated than the surface sample. In the metals suite, Station E was the only station which did not record elevated levels of arsenic or nickel. Sample E1 (surface) recorded only slight elevation of copper and all other metals levels were acceptable. Sample E2 (at depth) had slightly raised levels of cadmium and lead with all other metals at acceptable levels. In respect of PAH, the surface sample was well within the acceptable level however the sample collected at depth was over seven times higher and above the lower guidance limit. Similarly, the surface sample was totally clean of PCBs however the sample collected at depth recorded levels over 25 times higher and was again over the lower guidance level. Organotin and TPH levels were satisfactory. OCP levels were also generally within acceptable thresholds.

Generally speaking, the area returned results showing mild levels of contamination in the sediments although in a limited number of instances there were moderate levels of contamination present. Further information on the results of this sediment Analysis are found in Appendix 4.3

The exact disposal avenue for contaminated material excavated from the site will be determined in accordance with the actual level of contamination and Waste Acceptance Criteria following a comprehensive laboratory analysis of the material taking place prior to construction.

Plate 8.21: Location of sediment sampling stations at Trinity Wharf (Source: RPS Feasibility Study, 2018).

Groundwater and Hydrology

The groundwater was observed during the 2008 GI at approximately 1.5m – 2.0m below ground level, coinciding with the sea level.

Groundwater vulnerability is indicated as low on GSI's 1:100,000 map. However, the site-specific assessment was carried out, accounting for up to 4 m of predominantly high permeability made ground and further deeper layers of glaciofluvial gravels, up to 10m of moderate permeability soils such as sandy silts and up to 7m of low permeability cohesive glacial till over bedrock. Groundwater vulnerability ranges between moderate and high across the site depending on the exact thickness of the deposits present, according to the GSI Groundwater Vulnerability Classification Table 8.1 below.

Table 8.1 GSI Groundwater Vulnerability Classification Table

Vulnerability Rating	***Hydrogeological Conditions***				
	Subsoil Permeability (Type) and Thickness			***Unsaturated Zone***	***Karst Features***
	High permeability (sand/ gravel)	Moderate permeability (e.g. sandy subsoil)	Low permeability (e.g. clayey subsoil, peat)	(Sand/ gravel aquifers only)	(<30m radius)
Extreme (E)	0-3.0m	0-3.0m	0-3.0m	0-3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

The main surface water body receptor in the study area is the Lower Slaney Estuary with made ground being the primary pathway for received precipitation.

8.4 Description of Potential Impacts

The made ground stratum exhibits low to moderate levels of contamination, primarily from PAHs and sulphates remaining from the historical industrial use of the site. In addition to that, the asbestos containing materials have been identified on the surface of the site. Mild to moderate levels of contamination with OCPs and PAHs were found in the samples from the sea bed undertaken as part of the Trinity Wharf Marina Feasibility Study by RPS Group (November 2018).

While the intention is for the construction works to be carried out with the least feasible disturbance of soils, some relatively minor amount of soil stripping or excavation can be expected. This primarily pertains to the construction of the foul sewage pumping station (located in the western corner of the site) and may be required for any deep service trenches or chambers identified during detailed design.

The pronounced heterogeneity of made ground and the relatively high compressibility of the alluvial soils can result in excess settlements stemming from structure loading. Any soil excavation has the potential to induce movement and settlement of surrounding ground during the construction phase.

All material excavated in the made ground stratum at the site shall be assumed to be contaminated. Appropriate testing of this material by a suitably qualified and licenced waste contractor shall take place for all aspects of ground contamination. Any contaminated material that is required to be excavated will be disposed of to a suitably licensed and permitted contractor to a licenced landfill site, which will be determined in accordance with the actual level of contamination and Waste Acceptance Criteria. Inert, non-hazardous and hazardous waste. Such contaminated material will be stored in separate bunds and will be disposed of to a suitable licensed facility. The mitigation measures for handling ACMs are presented in Section 4.4.5 in Chapter 4 of this EIAR.

8.5 Mitigation and Monitoring Measures

The mitigation measures for the impacts outlined in the section 8.4 above are outlined in this section.

Although the existing ground surface and all contaminated material is planned to be encapsulated in the thick imported granular material that will form the new surface, the removal of surface will be undertaken to ensure potential ACMs negative impacts to the environment is appropriately addressed prior to future development.

The following mitigation and control measures, in addition to the asbestos mitigation measures outlined in Section 4.4.4 in Chapter 4, will be adopted before the start of the construction works:

- Prior to the start of any construction works further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site. The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractor.
- All site clearance and excavation works will be required to follow the mitigation measures of this EIAR in this Chapter and those detailed in Chapter 4 as well as any future mitigation measures to be detailed in the Remediation Strategy (to be completed). For all site clearance works and excavation works suitably qualified,

experienced and licensed personnel will be required to undertake this specialist work in accordance with the 'measures for working with asbestos'. Any ACMs discovered in areas required for excavation, will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.

- The 'Asbestos Survey and Remediation Strategy' will be undertaken prior to construction. All mitigation measures/ recommendations from these surveys and the remediation strategy will be required to be implemented as part of the proposed development.
- Remediation Verification Report will be produced to demonstrate that all mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.
- 'Measures for working with asbestos' as detailed in Chapter 4 shall be implemented by contractors as appropriate as part of the construction phase.
- The specialist contractor will ensure secure containment and transport of all contaminated materials to the appropriate licenced waste disposal facility.
- Contractors shall be required to submit and adhere to a Construction Method Statement indicating the extent of areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works. All associated hazardous waste residuals will also be stored within temporary bunded storage areas prior to removal by an appropriate EPA approved waste management contractor for off-site treatment/recycling/disposal. Any other building waste will be disposed of within on-site skips for removal by a licensed waste management contractor. The contractor will be required to submit a Construction and Demolition Waste Management Plan to the Council for approval which will address all types of materials to be disposed and the location of the licenced waste disposal facilities that will be used, as appropriate.
- Imported good-quality granular soils materials and rock armour revetment will be imported from local sources where possible. The nearest suitable licensed quarries are outlined in the Section 4.4.10 of the Chapter 4.
- To minimise any impact on the underlying subsurface strata from material spillages, all fuels, oils, solvents and paints used during construction these will be stored within specially constructed temporary bunded areas or within dedicated bunded containers. Spill kits and hydrocarbon adsorbent packs will be stored on the site compound and operators will be fully trained in the use of this equipment. Fuel for vehicles will be stored in a mobile double skinned tank.

In order limit the risk to human health and the surrounding aquatic environment by exposure to contaminated material through excavation, it is proposed to retain the majority of the made ground in place. The current ground level across the entire site will be raised for the proposed development (1.5m raise on average), using imported good quality granular material. It is also proposed that the uppermost 250mm of this material will comprise of compacted clay with a low permeability of 1 x 10-7 ms-1 (refer to Chapter 9 for details) to limit infiltration to percolating water. A minor volume of excavated material planned to be excavated pertaining to the foul sewage pump-out station and any deep service trenches or chambers will be identified during detailed design. Temporary works design and monitoring will ensure that the there are no unacceptable ground movements and settlements of the adjacent ground. This material will be required to be tested for contaminants.

All buildings will rely on driven piles for foundations. This will minimise the need for the excavation and handling of the made ground layer and soft alluvial layers beneath it, as no in-situ ground needs to be displaced or handled during the execution of this type of piles. The alternative solution of bored piles was eliminated as it would produce contaminated soil arisings. Furthermore, transferring all loads on piles will avoid the settlements in the underlying strata (particularly in made ground and soft silts). The detailed design of driven piles will include a consideration of the allowable stresses in the bedrock so as to avoid fracturing the bedrock. The encapsulation of the contaminated ground will prevent contact between the contaminated ground and the environment and end-users in the operational phase.

It is noted that the due to the stringent requirements for the rock used in the revetments, not all quarries are able to produce such stone. Quarries in strong metamorphic and volcanic rocks typically tend to produce suitable stone for revetment. Two quarries in Co. Wexford, in Ballykelly (37km) and Gorey (41km), quarry should contain suitable type of stone.

The steel driven piles were selected as the foundation option in order to avoid the handling of the contaminated pile arisings and reduce the environmental impacts related to the arisings disposal.

Sheet piles forming the sea wall on the site perimeter and the option of either bored piles or tubular steel piles and screw piles (helical anchors) for the foundation of the marina and boardwalk elements (to be decided during detailed design) are also selected as their installation requires no excavation or dredging. A sheet-piled wall will provide a new sea wall for the site, raising the site level to meet flood requirements and providing a barrier to contain contaminated material within the site.

The mildly contaminated made ground soil retained by sheet piled wall will be buried below the surface and the flow path for the potential contaminants will be largely severed by the sheet pile wall. The sheet pile wall will also provide for additional coastal protection and flood defence. The rock armour revetment and the armour underlayer will be placed directly on in-situ riverbed silt, in order to avoid the need for the handling and removal of contaminated silt.

8.6 Residual Impacts

There are no likely significant residual soil or geological impacts associated with the Trinity Wharf development.

8.7 Difficulties Encountered

No significant difficulties were experienced in the completing this assessment. While adequate information is available from previous investigations, additional and more detailed ground investigations will take place at the development site prior to detailed design stage in order to further classify ground conditions for design and also to quantify the disposal options for excavated material which may be contaminated. It is not considered that this affects this impact assessment due to the design, construction methodology and the mitigation measures provided in this EIAR.

8.8 References

Institute of Geologists of Ireland (IGI) (2013) *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*

National Roads Authority (NRA 2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*

Environmental Protection Agency (EPA 2017) *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports*

Government of Ireland. Waste Management Act 1996 (as amended)

Kavanagh Mansfield and Partners (2008): *Report on a site investigation for a development at Trinity Wharf Wexford*

RPS (2018): *Trinity Wharf Marina Feasibility Study (project number IBE1115/D03*)

RSK (2018): *Preliminary Asbestos Walkover Survey*, Trinity Wharf, Wexford.

Appendix 8.1 Preliminary Asbestos Walkover Survey

ROUGHAN & O'DONOVAN

Wexford County Council

Preliminary Asbestos Walkover Survey

Trinity Wharf, Wexford

602393 (00)

OCTOBER 2018

RSK GENERAL NOTES

Project No.: 602393 (00)

Title: Preliminary Asbestos Walkover Survey – Trinity Wharf, Wexford

Client: Wexford County Council

Date: October 2018

Office: Dublin

Status: **FINAL**

Author	Bronagh O'Reilly	**Technical reviewer**	David O'Hagan
Signature	Bronagh O'Reilly.	Signature	D O'Hagan.
Date:	31st October 2018	Date:	31st October 2018

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1 INTRODUCTION

In October 2018, RSK Ireland Limited (RSK) was instructed by Wexford County Council to complete a preliminary walkover survey at the Trinity Wharf site, Wexford town. The survey was conducted on 19th October 2018. The aim of the assessment was to identify any potential Asbestos Containing Materials (ACMs) on the surface and near surface of the site following the discovery of suspected asbestos cement debris during a recent geotechnical investigation.

This report is subject to the RSK service constraints given in Appendix A and is not intended as a specification for any removal works. RSK can provide a detailed specification for works if required.

1.1 Site Location

The site is located on a c.10-acre parcel of reclaimed land adjacent to Wexford Harbour and is situated approximately 1.3km southeast of Wexford Town centre centred at Irish Grid reference T05541 21298. The site is located within an area of mixed commercial and residential land use. A site location plan is shown on Figure 1.

1.2 Site Description

The site is derelict and is located adjacent to Wexford Harbour. The former buildings were reported demolished between 2000 and 2005, with a number of stock piles containing construction and demolition waste remaining in various locations across the site and a number of the former floor slabs still in situ in the central portion of the site.

The site is bounded to the north, east and south by Wexford Harbour within an existing sea wall and the main Wexford to Rosslare railway line bounds the site to the south west.

The site lies at an elevation of approximately 5m above Ordnance Datum (mAOD) and is predominately flat. Access to the site can be gained via a gated entrance on Trinity Street to the north west of the site.

1.3 Scope of Work

The scope of the survey and layout of this report has been designed with consideration of the Health and Safety Executive guidance document 264 Asbestos: The Survey Guide and the CIRIA guidance document “Asbestos in soil and made ground: good practice site guide”.

The scope of works included:

- A preliminary walkover survey to identify any potential ACMs on the surface of the site;
- Limited representative sampling of any suspected ACMs on the surface of the site; and

- A factual and interpretative report with recommendations for further works (if required).

1.4 Proposed Development

It is our understanding that Wexford County Council plan to redevelop the 10-acre site to provide a high-quality business park which will include a mix of modern office space, hotel accommodation, multi-storey carparking, a landmark cultural and events multi-use building and 60 residential units. The proposed development will also include the provision of a 61-berth marina and a new boardwalk.

2 PRELIMINARY ASSESSMENT

2.1 Previous Asbestos Identification

From information provided by the councils appointed design consultants ROD, a fragment of cement suspected to contain asbestos was identified during the advancement of four trial pits in the northern portion of the site in October 2018. The TPs were undertaken as part of a geotechnical investigation by Priority Geotech. It is our understanding that all works were immediately stopped, and personnel and plant demobilised from site.

No laboratory results were provided to confirm the presence of asbestos in the cement fragment nor potential presence of asbestos in soils in any of the four TP locations completed.

No information has been provided with regards any asbestos surveys undertaken on the original buildings nor removal or disposal of asbestos during the subsequent demolition process.

2.2 Site History

A review of the historical maps of the site was undertaken to identify any potential sources of historic asbestos contamination. A review of the site history was undertaken by assessing the available historical maps on the Ordinance Survey of Ireland (OSI) map viewer http://map.geohive.ie/mapviewer.html.

The earliest available historical map of the area (1837-1842) shows the site to be undeveloped.

The development history of the site and surrounding area is detailed in Table 1 below. Map extracts are presented in Appendix B.

Table 1: Historical Map Review

Year	Site Description	Surrounding Land Uses
1837-1842	The site is partly developed reclaimed land. Docks occupy the north west potion of the site and a railway runs through a yard on the south west portion.	A railway line bounds the south western portion of the site. Trinity Street is location parallel to the southern site boundary. A barracks is located south west of the site. The surrounding area to the north west is developed docks. Wexford town centre is located c.1.3km to the north west of the subject site. The surrounding area to the south appears to be residential dwellings along the main road infrastructure with associated gardens.
1888-1913	The site has been further developed and an iron works occupy a central portion of the site. The south western portion of the subject site remains undeveloped reclaimed land.	The railway line on the southern boundary of the site is named Fishguard & Rosslare Section on the map. There are no significant changes to the surrounding land use.
1940s	The map shows the Clover Meats and Iron works. An Aerial view would indicate that the buildings	Further significant development in the surrounding area.

Year	Site Description	Surrounding Land Uses
	look like those typically constructed from AC cladding.	
1995	The map illustrates that the buildings were extended post iron works, for a car assembly plant. An Aerial view would confirm that the large building extending northeast to southwest would appear to be constructed of asbestos cement cladding. The remaining buildings appear to be corrugated metal.	The surrounding area is densely developed with mixed residential and commercial land use.
2000	No significant change onsite.	There are no significant changes to the surrounding land use.
2005	The existing buildings have been demolished and the footprint of the former buildings remains	There are no significant changes to the surrounding land use.
Present Day	The site is currently unoccupied. the former footprint of the buildings is still in situ. Stockpiles of construction and demolition waste in various locations across the site.	There are no significant changes to the surrounding land use.

2.3 Site Walkover

A preliminary walkover of the site was undertaken by an RSK P402 Qualified asbestos surveyor on 19th October 2018. The findings are summarised below and supported by the site photographs presented in Appendix D. The purpose of the walkover was to establish if any ACMs were present to the surface of the site.

The site is currently derelict however easily accessible and used by nearby residents / dog walkers. There were a number of stock piles containing construction and demolition waste remaining in various locations across the site which is extensively overgrown prohibiting access and detailed inspection.

An area of grassland occupies the western portion of the site; hardstanding area and retaining wall to the northern portion of the site and a gravel path along the shoreline on the eastern boundary. The central portion of the site is predominately covered with concrete floor slabs noted to be in varying states of disrepair.

Evidence of ground disturbance was noted in four locations in the northern portion of the site, presumed to be from the recent geotechnical investigation.

The RSK asbestos consultant walked the site noting the main areas where obvious suspected ACMs were noted. Suspected ACMs predominately comprised asbestos cement debris and floor tiles. A small number of samples were taken of suspect ACMs, these were appropriately labelled and securely double-bagged whilst on site, prior to return to the UKAS accredited laboratory for analysis. Results are presented in Appendix C.

3 WALKOVER RESULTS

3.1 Asbestos Containing Materials

Seven samples representative of suspected ACMs were taken and five were confirmed by laboratory analysis as containing asbestos. Three of the positive samples were confirmed as asbestos cement (AC) and two were confirmed as asbestos floor tiles including bitumen adhesive. A photolog of the identified ACMs is provided in Appendix C.

The AC were identified in numerous locations across the surface of the site and would be consistent with corrugated profile sheeting and rainwater goods. The asbestos floor tiles were identified in large pieces or in small badly damaged fragments across the majority of the site including stockpiles.

No other obvious suspected ACMs were noted in the grassed area in the eastern portion of the site.

The following table summarises the findings of the bulk sample analysis including a classification of the material type.

Table 2: Asbestos Containing Materials – Bulk Samples

Description		Analysis Results	Classification	Observations
S01	Beige Floor Tile	Chrysotile detected in tile and bitumen	Thermoplastic & bitumen	Within C&D waste in NW portion of the site and across the site
S04	AC Fragment	Chrysotile	Cement	AC sheeting adjacent to TP4. Similar debris noted adjacent all hard-standing areas and structures
S05	AC Fragment	Chrysotile	Cement	Small fragments noted throughout gravel area on eastern boundary
S06	Floor Tile Debris	Chrysotile detected in tile and bitumen	Thermoplastic & bitumen	Large area with floor tiles in situ, visible debris scattered throughout the area

Description		Analysis Results	Classification	Observations
S07	AC Debris (flat)	Chrysotile	Cement	Fragments noted on edge of floor slab along SW boundary

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Asbestos Containing Materials

Fragments of AC and floor tiles and / or floor tile debris were identified in numerous locations across the surface of the site.

The preliminary findings would indicate that ACMs are broadly concentrated along the retaining wall in the northern portion of the site; along the edges of floor slabs; adjacent to and within many of the demolition stockpiles and in the gravel track along the eastern boundary.

The AC identified would be consistent with fragments and broken sections of corrugated profile sheeting and rainwater goods and likely originate from the large linear building illustrated in Map 5, which is strongly suspected to be constructed from AC cladding.

The asbestos floor tiles were identified in-situ in two main areas and distributed in large pieces or in small badly damaged fragments across much of the site.

No suspect ACMs were identified within the grassed area or to surface of the stockpiles in the southern portion of the site.

Given the presence of ACMs adjacent to and on the surface of several of the remaining stockpiles, it must be assumed that further ACMs are likely to be present within the stockpile material. The investigation of such was outside the scope of the walkover survey and visual assessment was hindered due to extensive overgrowth.

The presence of asbestos to the surface and potentially within the stockpiles of C&D waste across the site would pose a significant risk during the construction phase of the development and therefore further investigation to fully identify and quantify the extent of surface and subsurface asbestos contamination and subsequent remedial measures are required. Given the historical development of the site and widespread impact of asbestos across the surface, it is highly likely that sub surface material will also be impacted with asbestos contamination and will require further investigation.

4.2 Recommendations

Based on the findings of the preliminary walkover the following is recommended to quantify the potential risks and liabilities associated with asbestos contamination at the site:

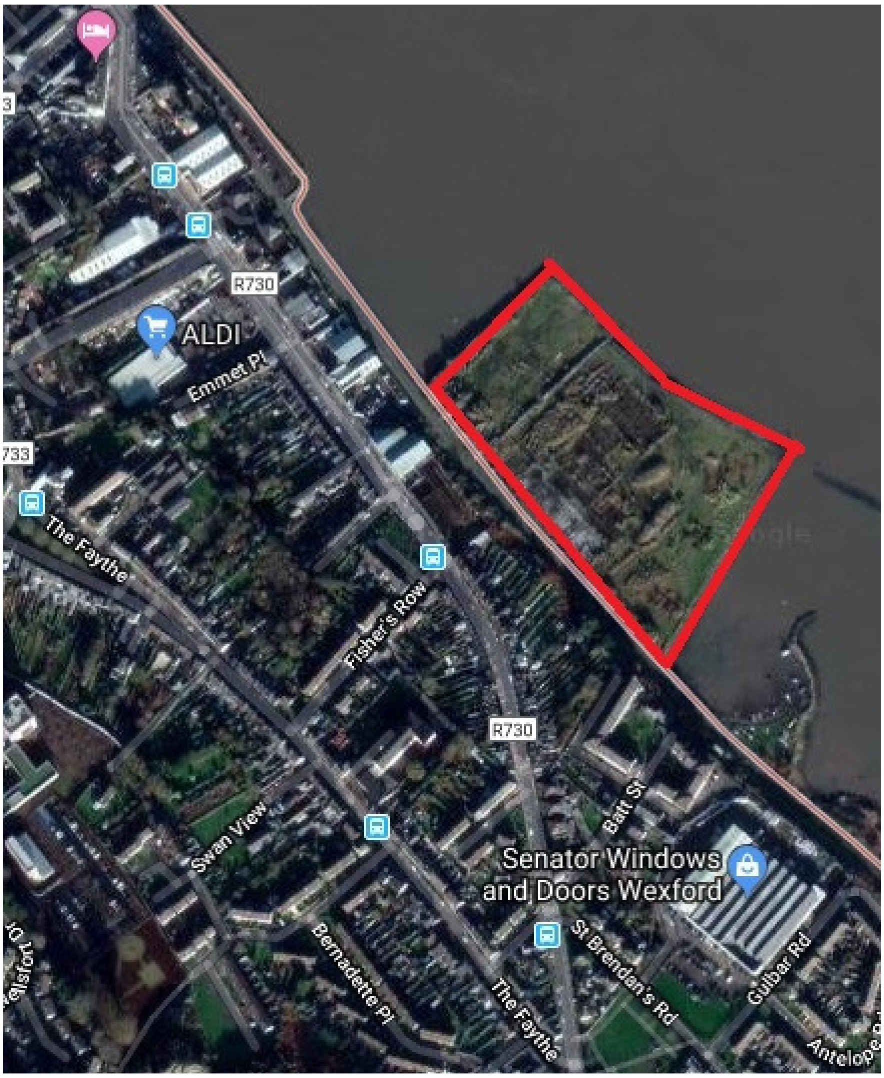
- Make safe or secure the site so that no further access is permitted to unauthorised personnel;
- Undertake a detailed asbestos survey of the surface of the site by a suitably qualified P402 asbestos surveyor(s) experienced in undertaking surveys on contaminated land sites. The aim of the survey should be to determine the full extent, type and location of all surface and near surface ACMs and should include representative sampling as appropriate.
- Undertake an intrusive investigation to identify any potential sub-surface asbestos contamination within the demolition material stockpiled in various locations across

the site. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on sites of this nature (including all plant operatives and engineers) and should include representative sampling as appropriate.

- Undertake a targeted intrusive investigation comprising trail pits and / or slit trenches to determine the extent of any possible asbestos in the fill material and below floor slabs across the site. The SI should be scoped to cause the minimal amount of disturbance to any surface ACMs identified and all suitable control measures implemented to prevent exposure to asbestos throughout the works. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on site of this nature and should include representative sampling for asbestos ID screening as appropriate.
- Develop a remedial strategy for the site upon completion of the investigations to outline works required to mitigate the risks associated with the asbestos contamination identified and to prevent the potential release of asbestos fibres during the proposed development works. It is advised that the contractor appointed to undertake the remedial programme is appropriately qualified and experienced to work with asbestos.
- Ensure all mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented are independently validated prior to proceeding with the redevelopment of the site.

It is also recommended that any further works to be completed as part of the geotechnical investigation are not permitted to proceed until remedial measures are instigated. This will ensure that the spread any potential exposure to the ACMs is minimised. All remedial works must be undertaken by a suitably qualified asbestos contractor and a method statement and evidence of competences provided in advance. Field staff should also ensure that they have received the appropriate accredited training for working with asbestos in soils prior to resuming the Geotech works and all entities involved in the works should hold appropriate PI insurance for working with asbestos.

FIGURES



Job Number: 602393 (00)
Job Title: Trinity Wharf, Wexford
Drawing Title: Figure 1 – Site Location Plan (Copyright googlemaps.co.uk)
Date: October 2018

SITE

Trinity Wharf
Wexford

LEGEND

▭	**Site boundary**
S01	**Sample Location**
▨	**Areas impacted by asbestos cement debris**
▨	**Main areas impacted by asbestos floor tiles**
▨	**Stockpiles of C&D rubble**

TITLE

SAMPLE LOCATIONS AND AREAS IMPACTED WITH ACMS

RSK

Drawn by:	Date drawn:	Scale
BOR	Oct 2018	NTS

Report No.	Page No.
602393 (00)	01 of 01

APPENDIX A
SERVICE CONSTRAINTS

RSK IRELAND LIMITED SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Ireland Limited (RSK) for Wexford County Council (the "client") in accordance with the terms of a contract between RSK and the "client", dated January 2018. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be** well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site.

APPENDIX B
HISTORICAL MAP REVIEW

Job Number: 602393 (00)

Job Title: Trinity Wharf, Wexford

Drawing Title: Map 1 – 1837-1842 (Copyright OSI)

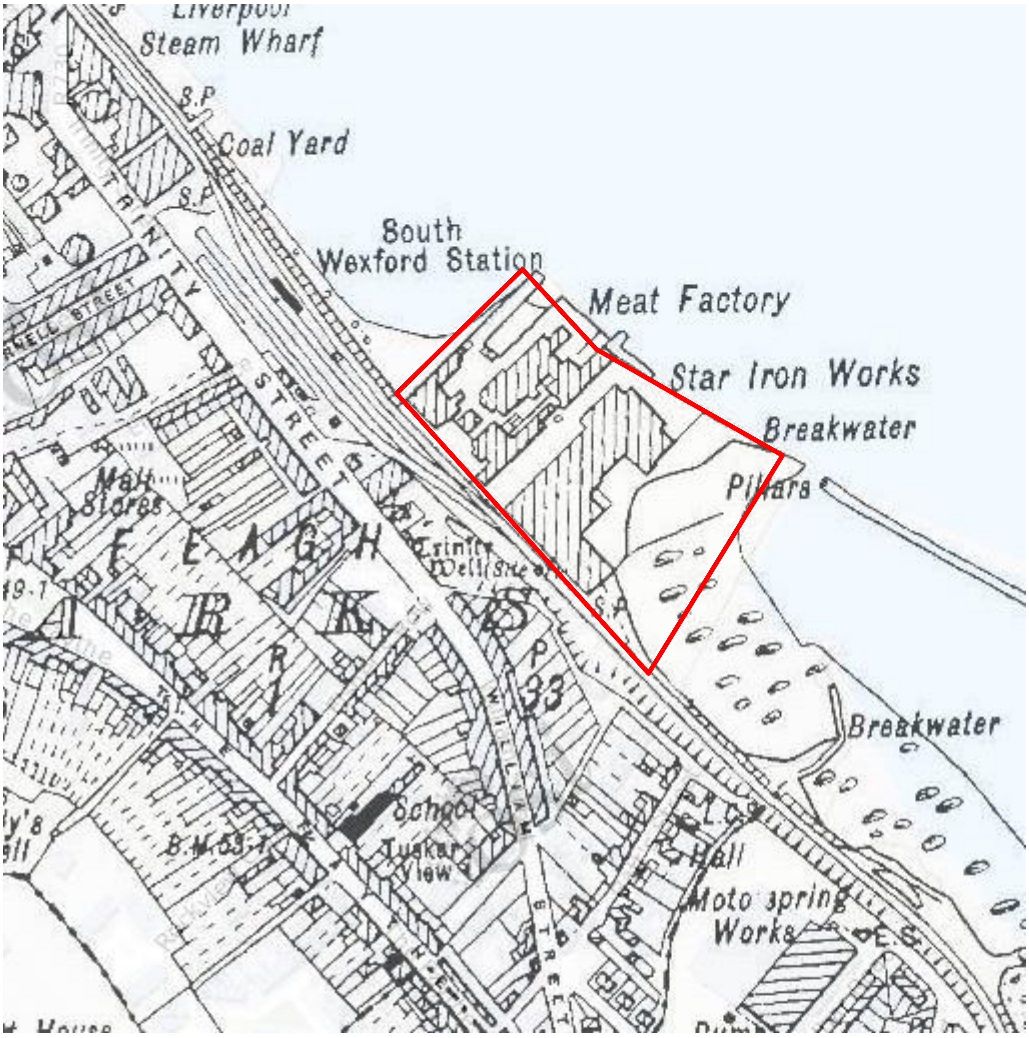
Date: October 2018

Job Number: 602393 (00)

Job Title: Trinity Wharf, Wexford

Drawing Title: Map 2 – 1888-1913 (Copyright OSI)

Date: October 2018



Job Number: 602393 (00)	
Job Title: Trinity Wharf, Wexford	
Drawing Title: Map 3 – Cassini c. 1940s (Copyright OSI)	
Date: October 2018	

Job Number: 602393 (00)
Job Title: Trinity Wharf, Wexford
Drawing Title: Map 4 – 1995 (Copyright OSI)
Date: October 2018

Job Number: 602393 (00)
Job Title: Trinity Wharf, Wexford
Drawing Title: Map 5 – 2000 (Copyright OSI)
Date: October 2018

Job Number: 602393 (00)

Job Title: Trinity Wharf, Wexford

Drawing Title: Map 6 – 2005 (Copyright OSI)

Date: October 2018

APPENDIX C
LABORATORY RESULTS

QC

QUALITY CONSULTANTS (NI) LTD

Asbestos in Bulk Materials Analysis Report

UKAS TESTING 2705

Unit B9, Inspire Business Park, 16 Carrowreagh Road, Dundonald, BT16 1QT | T: 028 90484905 | M: 07974 264204 | E: iharper@qcni.co.uk

Bulk sample analysis & asbestos identification by stereo microscopy and polarised light microscopy with dispersion staining as described in the current HSG248, Appendix 2 and in-house method SOP 01. Quality Consultants (NI) Ltd accepts responsibility only for results obtained from samples received. No responsibility is accepted for the information provided by the client or any errors that may have arisen during their sampling (such as origin or homogeneity) or transportation procedures. Opinions, interpretations and comments regarding density, appearance, material type and classification (or other) expressed herein are outside the scope of our UKAS accreditation. **NADIS** = No asbestos detected in sample. All samples will be retained for a minimum of six months unless the client requests alternative arrangements.

Client and Site Details

Client Details	RSK 48 Newforge Lane, Belfast, BT9 5NW
Site Details	Trinity Wharf

Job Details

Samples Submitted By	No of samples received	Report No	Issue No	Client Order/Ref No.
RSK	07	**BA9255**	1.0	602393
Date Samples Received	Date of Analysis	Analysed By	Authorised By	Date Authorised
23.10.18	24.10.18	Alan Mayes	Alan Mayes	24.10.18

Sample Details and Analysis Results

Client Sample No.	Laboratory Sample No.	Client Sample Details	Material Type	Asbestos Type(s) Identified
01	BA9255/01	Beige floor tile	Thermoplastic and bitumen	**Chrysotile detected in tile and bitumen**
02	BA9255/02	Cement roof tile	Cement	**NADIS**
03	BA9255/03	Grey floor tile	Thermoplastic	**NADIS**
04	BA9255/04	AC fragment	Cement	**Chrysotile**
05	BA9255/05	AC fragment	Cement	**Chrysotile**
06	BA9255/06	Floor tile debris	Thermoplastic and bitumen	**Chrysotile detected in tile and bitumen**
07	BA9255/07	AC debris (flat)	Cement	**Chrysotile**

Authorising Signature	Position	Date Issued
	Senior Analyst	24.10.18

APPENDIX D
SITE PHOTOLOG

PHOTOGRAPHIC LOG

Client Name: Wexford County Council	**Site Location:** Trinity Wharf, Wexford	**Preliminary Asbestos Walkover**

Photo No. **1**	**Date:** 19/10/18
Direction Photo taken: N/A	
Description: S01. Fragments of floor tiles within rubble	

Photo No. **2**	**Date:** 19/10/18
Direction Photo taken: SW	
Description: S04. AC debris adjacent TP-04	

Client Name: Wexford County Council	**Site Location:** Trinity Wharf, Wexford	**Preliminary Asbestos Walkover**

Photo No. 3	**Date:** 22/11/17

Direction Photo taken:

South

Description:

S05
Small scattered fragments of AC to gravel path

Photo No. 4	**Date:** 19/10/18

Direction Photo taken:

Description:

S06
Floor tiles in situ and damaged fragments scattered throughout area. Area also significantly contaminated with AC

PHOTOGRAPHIC LOG

Client Name: Wexford County Council	**Site Location:** Trinity Wharf, Wexford	**Preliminary Asbestos Walkover**

Photo No.	**Date:**
5	19/10/18

Direction Photo taken:

South

Description:

S07
Sporatic fragments of AC (flat profile) to edge of floor slab along SW boundary

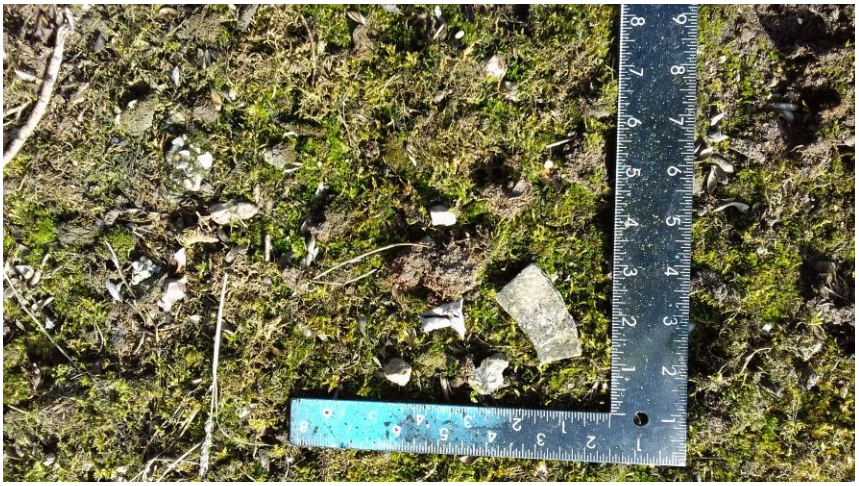


Photo No.	**Date:**
6	19/10/18

Direction Photo taken:
N/A

Description:

Badly damaged asbestos floor tiles

Photo No.	Date:
7	19/10/18

Direction Photo taken:

North

Description:

AC debris along edges of hardstanding / former floor slab

Photo No.	Date:
8	19/10/18

Direction Photo taken:

West

Description:

AC debris along edge of hardstanding / adjacent large stockpile on rear side of wall

Client Name: Wexford County Council	**Site Location:** Trinity Wharf, Wexford	**Preliminary Asbestos Walkover**

Photo No. **9**	**Date:** 19/10/18	
Direction Photo taken: East		
Description: AC debris to edge of large stockpile		

Photo No. **10**	**Date:** 19/10/18	
Direction Photo taken: NE		
Description: AC debris to stockpile in NW corner of the site		

Appendix 8.2 Kavanagh Mansfield and Partners Site Investigation

WEXFORD HARBOUR
TRINITY WHARF
DEVELOPMENT

Kavanagh Mansfield & Ptns
Consulting Engineers

CONTENTS

APPENDICES

FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Boring Procedures.

Unless otherwise stated, the 'Shell and Auger' technique of soft ground boring has been employed. All boring operations sampling and/or logging of soils and in-situ testing complies with the recommendations of the British Standard Code of Practice BS 5930 (1981), 'Site Investigation' and BS 1377:1990, 'Methods of test for soils for civil engineering purposes'.

Whilst the technique allows the maximum data to be obtained in soft ground, some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Where peat has been encountered during siteworks, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska-Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

Routine Sampling.
Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing.
Standard penetration tests, utilising either the standard split spoon sampler or solid cone and automatic trip-hammer are conducted unless otherwise where required by instruction. Subsequent to a seating drive of 150mm, a summation for the number of blows for 300mm penetration is recorded on the boring records together with the blow count for each 75mm penetration. In cases where incomplete penetration is obtained, the number of blows for the recorded value of penetration are noted. In coarse granular soils, a cone end is fitted to the sampler and a similar procedure adopted.

Groundwater.
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water
level.

Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage condition, tidal variation or other causes.

Retention of Samples.
After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

REPORT ON A SITE INVESTIGATION
FOR A DEVELOPMENT
AT TRINITY WHARF
WEXFORD

DEERLAND CONSTRUCTION LTD

KAVANAGH MANSFIELD AND PARTNERS
CONSULTING ENGINEERS

Report No. 13184 **JANUARY 2008**

1 Introduction

A major commercial development is being undertaken on a site at Trinity Wharf in Wexford. The site developers, Deerland Construction Limited, have ordered a comprehensive examination of sub-soil and bedrock conditions over the site area. This investigation was directed by Kavanagh Mansfield and Partners, Consulting Engineers, and carried out by IGSL in November/December 2007.

The proposed development includes reclamation of a large area of foreshore as well as the onshore development of the site formerly occupied by a motor assembly plant.

The programme of the investigation envisaged the construction of Cable Percussion Boreholes and Rotary Core Holes to establish geotechnical criteria on which to base foundation design. A number of scheduled exploratory locations were over tidal water and were to be constructed from a Jack Up drilling platform.

Delays have been experienced in obtaining foreshore licenses and the marine operations have been deferred. On land an area of the site was classified as "an area of natural habitat" and investigation here was also postponed pending receipt of permission from the appropriate authorities.

A programme of laboratory testing to establish geotechnical soil parameters was prepared by IGSL and laboratory testing was carried out at IGSL's Accredited laboratory immediately following site operations. A preliminary appraisal of environmental/contamination issues has also been carried out, with laboratory testing carried out by Alcontrol Geochem. Analysis was carried out to Murphy Suite requirements.

This report presents all factual data pertaining to the project and comments on the findings relative to construction of the land based segment of the development.

II Fieldwork

The site is located off Trinity Street in Wexford, comprising existing reclaimed land in Wexford harbour, formerly occupied by a major motor assembly operation. This reclaimed area is bounded on three sides by Wexford Harbour with an existing sea wall protecting the reclaimed lands. The main Wexford to Rosslare railway line forms part of the main land boundary. The site is reasonably level, ground level is taken as zero for the purposes of discussion in this report.

Demolition of the old industrial buildings has taken place, reinforced concrete ground floor slabs cover much of the site. Access to the site was secure and Deerland Construction Ltd. arranged for temporary access for drilling equipment, via a Railway Crossing, for the duration of the investigation.

A site location map and a detailed borehole and corehole layout is enclosed in Appendix V to this report. All exploratory locations were determined by Kavanagh Mansfield and Partners and marked out by site personnel for IGSL using the national grid co-ordinates provided. Access to some locations was not possible during this phase of works. Some additional boreholes were scheduled to provide in-fill data where it was indicated by the scheduled boreholes.

a. Boreholes

The exploratory holes were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig. A total of thirteen boreholes were constructed.

Detailed geotechnical records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement.

The boreholes typically encounter surface deposits of made ground overlying varying loose or soft strata of sand, clay or silt. Firm to stiff brown sandy clay or silt is then typically encountered, continuing to refusal on dense highly weathered rock (weathered to a dense coarse angular gravel consistency). Borehole refusal depths range from about 4.00 metres BGL at the south eastern end of the site (close to the railway line) to in excess of 17.00 metres in the centre of the site at BH 16.

Standpipes have been installed in three borehole locations to facilitate long term water observation. Ground water has been noted at about 2.00 metres in all locations. Tidal variation can be expected. Water strikes have also been observed in the lower dense gravel / weathered rock stratum.

Sections through the boreholes have been prepared and clearly identify the pattern of stratification across the site.

b. Coreholes

A Top-Drive rotary core drill was mobilised to drill and recover rock core at eight scheduled locations. An air mist flush was employed with standard triple tube technique. Open Hole Symmetrix Drilling was used in the overburden, with standard penetration tests carried out as instructed. Diamond core drilling was used in the bedrock, rock core was recovered at all locations.

Core was recovered and placed in timber boxes and returned to IGSL for detailed geotechnical logging. These records are contained in Appendix II to this report.

The bedrock is typically weak to moderately strong grey heavily weathered limestone / mudstone. The rock is typically thinly bedded with clay staining on many joints. In the weak weathered rock, standard penetration tests have been carried out to give an indication of in situ rock strength. The rock core findings can be summarised as follows:

Location	**Overburden**	**Weathered Rock**	**Solid Rock**
RC 02	0 – 10.20	10.20 – 11.50	11.50 – 17.00
RC 05	0 - 9.80	9.80 - 10.20	10.20 – 15.20
RC 07	0 – 11.50	11.50 – 22.00	
RC 09	0 – 10.90	10.90 – 11.50	11.50 – 16.50
RC 10	0 – 9.20	9.20 – 17.00	
RC 13	0 – 10.40	10.40 – 16.00	
RC 15	0 – 5.00	5.00 – 7.00	7.00 - 12.60
RC 17	0 – 15.40	15.40 – 16.00	16.00 – 21.00

Standpipes have been installed in RC 09, RC 13 and RC 15.

III Testing

(a) In-Situ :

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes to measure relative in-situ soil strength. SPT tests have also been carried out in the rotary core holes. N values are noted in the right hand column of the records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows.

Several limited penetration tests and refusals were recorded on cobbles or boulders in the overburden or on the weathered bedrock

The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	COMMENT
Made Ground	9 to 48	Variable (Loose to Dense)
Alluvial Silt/Sand	5 to 19	Loose to medium Dense
Grey Brown Clay	14 to 46	Firm to Stiff
Gravel	8 to 40	Loose to Dense
Weathered Rock	+ 50 to Refusal	Weak Rock

Numerous limited penetration tests were recorded in the base stratum presumed to be the highly weathered thinly bedded limestone.

(b) Laboratory :

All geotechnical samples from the boreholes have been returned to the IGSL laboratory for initial visual inspection, a schedule of testing was prepared and tests as scheduled carried out.

Samples of the made ground were selected for detailed environmental analysis and sent to Alcontrol Ltd. Testing was in accordance with "Murphy Suite" which determines the suitability of the soils for acceptance into licensed landfill facilities.

Geotechnical laboratory data is presented in Appendix III and environmental results in Appendix IV.

Geotechnical Testing

The geotechnical tests have been carried out in accordance with BS1377 Part 2: 1990 and consisted of the following:

a. Classification (Liquid and Plastic Limits)
b. Grading Analysis (Wet sieve/ Hydrometer)
c. Triaxial Compression
d. Consolidation
e. Sulphate and pH determination

Classification:

The liquid and plastic limits for samples of the cohesive soil from each borehole have determined. Results are tabulated and plotted on the standard Classification Chart. The tests in the main indicate that the gravelly clay stratum encountered in almost all locations if of low to intermediate (occasionally high) plasticity. In some instances plots below the "A" line suggest that the soil matrix be classified as silt.

Gradings:

The particle size distribution curves for the various strata have been established by wet sieve analysis for coarse material and by wet sieve and hydrometer for the finer material. Results are presented graphically. The gravelly clay stratum has typically evenly distributed straight line grading from the clay to the gravel fraction. The coarse base gravel/weathered rock is typically graded in the sand gravel fraction while the alluvial material underlying the fill typically grades as a fine slightly gravelly (shelly) sand.

Triaxial:

The cohesive strength and behavioural characteristics of undisturbed samples has been determined by consolidated un-drained triaxial compression test, with pore water pressure measurement.

Consolidation:

The consolidation characteristics of the four samples (above) have also been established by long term analysis under a pressure range from 12.5 to 200 kN/sq.m. The results indicate the anticipated rate and extent of settlement under load.

Sulphate and pH:

Chemical analysis has been carried out on several selected samples to establish soluble sulphate concentration and acidity in soil. While sulphate concentrations generally fell into Class I, high values were noted particularly in samples from BH 4 and BH 11.

Environmental Testing:

The results of Murphy Suite testing are contained in Appendix IV. This preliminary testing regime was carried out by Alcontrol Ltd. on seven samples selected at random from the made ground deposits.

These results reflect some elevated levels, particularly for PAHs and for Sulphates. In general low to moderate levels of contamination have been noted.

Additional sampling and analysis will be scheduled following detailed assessment of the current data.

IV: Discussion:

The proposed commercial/retail development at Wexford will involve construction over basement on the old motor assembly site located on reclaimed ground east of the main Dublin Rosslare Railway Line at Trinity Street, Wexford.

Reclamation of part of the foreshore of Wexford Harbour adjoining the above area is also proposed. Access to the development will be via a new bridge over the railway from Trinity Street.

A detailed investigation of ground conditions on the site has been carried out for Deerland Construction Ltd. This investigation was directed by Kavanagh Mansfield and Partners, Consulting Engineers for the project.

Conventional cable percussion methods were used to bore in overburden and rotary core drilling was carried out in the bedrock. Geotechnical and environmental laboratory analysis was also carried out to confirm design parameters.

The investigation has confirmed the following pattern of stratification:

MADE GROUND
ALLUVIUM
Gravely CLAY
Dense GRAVEL
Weathered ROCK

The made ground varies in thickness from 1.50 to 4.00 metres and overlies loose organic sand or clay (alluvial deposits). The deepest area of alluvium is noted at BH 14 where it extends to almost 5.00 metres.

Firm to stiff gravelly clay (boulder clay) is then encountered. This stratum varies in thickness but extends to a maximum depth of about 17.00 metres at BH 16.

Dense gravel/weathered mudstone or limestone is finally encountered, the horizon of the weathered rock is relatively close to the surface at the southern end close to the railway at about 3.00 metres BGL deepening to in excess of 17 metres eastwards towards the estuary.

The rock quality across the site area is extremely variable. Triple tube rotary core drilling has been employed with good quality core of Limestone/Mudstone recovered in several boreholes. Highly weathered (residual) mudstone has however been encountered in a number of locations with very low solid recovery recorded. The particular locations showing deep weathering are RC 07, RC 10 and RC 13.

Several sections through the various boreholes have been provided, clearly indicating the variations in stratification and rock profile. Further variations are possible between the borehole positions.

The development is understood to incorporate basement construction over much of the footprint with an assumed formation 3.00 metres below existing ground level. Piling techniques are to be adopted to support structural and floor loads.

The basement excavation will be mainly in made ground deposits, with alluvium present over at least part of the site where fill is shallowest. Ground water ingress has been recorded at about 2.00 metres,however with tidal variation a design water level at or close to ground level should be adopted.

PILING

High column loads are envisaged for this development. The presence of weathered shaley limestone or mudstone underlying the site suggests that this would be the preferred medium for pile formation.

Rock at the southern corner of the site is at or about 4.00 to 5.00 metres and consideration could be given to direct excavation for column bases in this area, given that 3.00 metres may be excavated for the basement.

Over the remainder of the site rock head ranges from about 10.00 to 17.00 metres BGL. The quality of the rock varies as indicated on the detailed core logs and in some locations highly weathered mudstone extends to depths in excess of 17 metres.

We would suggest that where large diameter bored piles are used a penetration of 2.00 to 3.00 metres of sound rock should be achieved. In the highly weathered rock penetration of the order of 5.00 to 6.00 metres would be expected to ensure uniformity. A 900mm diameter bored pile could support about 300 tonnes.

Where pre-cast concrete piles are proposed, these should incorporate a rock shoe and be driven to refusal in the weathered rock material. Maximum pile loading for driven concrete piles will be about 150 tonnes.

Specialist piling contractors should be consulted to provide detailed design proposals based on the data contained in this report.

Basement Excavation and Ground Water

Basement construction to a depth of 3.00 metres or so is proposed for at least part of the site area. Ground water (tidally related) is anticipated. Consideration can be given to cofferdam construction (probably in segments) using the stiff gravelly clay as a seal for either traditional steel sheet piles or secant piles. This should effectively provide a sufficient seal against ground water to permit basement construction.

A final standing water level at or about ground level should be assumed (assuming flood or high spring tides) in design against uplift. Resistance to up-lift can be accommodated by the base slab and by utilising the bearing piles as anchors. The use of rock anchors may be also appropriate.

Disposal of Excavated Material

A preliminary assessment of environmental issues relating to the made ground and to earlier site usage has been carried out. Elevated levels of PAHs and Sulphates were noted and these may raise difficulties in disposal of excavated material to landfill.

The use of the excavated material in reclamation of part of the foreshore will be subject to Department of Marine regulations. These regulations are considerably more stringent that normal, testing to the Department's requirements involves samples being shipped to a specialist UK laboratory.

Specialist environmental experts should be consulted for advice on the issues outlined above.

Additional Works

Further borehole and corehole investigation is to be carried out in the special conservation area in the south-east of the site. During this site visit additional environmental sampling using trial pit excavation can be scheduled.

The low core recovery in some locations using traditional triple tube techniques has been noted. More sophisticated core drilling using GEOBORE "S" technology with MUD flush will ensure recovery of the weak bedrock and would be of use in assessing requirements for pile lengths.

Additional environmental laboratory analysis will be required to satisfy both landfill requirements and foreshore reclamation. Ground water sampling if required can be carried out from existing standpipes.

IGSL LTD/JC
JANUARY 2008

Appendix I – Cable Tool Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH3
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	109,000.00 E 112,500.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	9.80
CASING DEPTH (m)	9.80
DATE STARTED	16/11/2007
DATE COMPLETED	17/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)		
0	MADE GROUND (comprised of gravel, rubble, clay, ash)				3737	B	0.50	N = 15 (2, 3, 6, 4, 2, 3)	
1					3738	B	1.50	N = 9 (1, 2, 2, 3, 2, 2)	
2	Soft brown sandy CLAY/SILT			2.20	3739	U	2.50	12 blows	
3	Loose grey silty SAND			3.00	3740	D	3.05		
	Stiff brown very gravelly CLAY (Possibly claybound gravel)			3.30	3741	B	3.50		
4					3742	B	4.50	N = 24 (2, 4, 4, 8, 5, 7)	
5					3743	B	5.50	N = 40 (3, 4, 11, 14, 9, 6)	
6	Medium dense to dense dark brown silty/clayey GRAVEL with cobbles (Possibly very gravelly clay)			5.80	3744	B	6.50	N = 23 (2, 4, 4, 7, 7, 5)	
7					3745	B	7.50	N = 38 (3, 8, 10, 12, 9, 7)	
8					3746	B	8.50	N = 29 (4, 6, 7, 6, 7, 9)	
9	Angular cobbles and boulders			9.20	3747	B	9.50	N = 50/20 mm (17, 8, 50)	
	End of Borehole at 9.80 m			9.80					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1	1.3	0.75	
8.2	8.4	0.5	
9.5	9.8	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.20	2.20		1.90		Moderate
9.20	9.20		3.60		Rapid

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17-11-07	9.80	0.00	3.10	End of boring

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH4
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	1,060.00 E 1,080.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	9.80
CASING DEPTH (m)	9.80
DATE STARTED	14/11/2007
DATE COMPLETED	15/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of concrete, rubble, clay, ash)								
1					3717	B	1.00	N = 11 (2, 3, 2, 3, 4, 2)	
	Soft grey slightly sandy SILT (with some fill in the upper horizons)			1.40					
2					3718	B	2.00	N = 9 (1, 2, 3, 2, 2, 2)	
3					3719	B	3.00	N = 8 (1, 1, 2, 1, 2, 3)	
	Firm light brown sandy CLAY with some gravel			3.20					
4					3720	B	4.00	N = 16 (2, 3, 4, 3, 4, 5)	
	Firm orangish brown CLAY			4.60					
5					3721	U	5.00	45 blows	
					3722	U	5.50	40 blows	
6	Very stiff brown very gravelly CLAY with frequent cobbles			6.20	3723	B	6.50	N = 34 (4, 5, 6, 9, 10, 9)	
7					3724	B	7.50	N = 46 (3, 8, 10, 10, 12, 14)	
8					3725	B	8.50	N = 37 (4, 6, 9, 10, 11, 7)	
9	Angular cobbles and boulders			9.20					
	End of Borehole at 9.80 m			9.80					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.3	0.5	0.5	
3.8	3.9	0.25	
7.9	8	0.25	
9.4	9.8	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.40	2.40	4.80	2.00		Moderate
9.20	9.20		3.30		Rapid

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
14-11-07	5.00	5.00	Dry	End of day
15-11-07	9.80	0.00	2.80	End of boring

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH6
SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,150.00 E 1,100.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	9.90
CASING DEPTH (m)	9.90
DATE STARTED	15/11/2007
DATE COMPLETED	16/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of stone, gravel, rubble, clay)				3726	B	0.50	N = 18 (2, 4, 4, 3, 6, 5)	
1					3727	B	1.50	N = 13 (2, 3, 3, 4, 3, 3)	
2					3728	B	2.50	N = 33 (1, 4, 9, 13, 7, 4)	
3					3729	B	3.50	N = 8 (2, 2, 3, 2, 1, 2)	
4	Soft grey/black SILT			4.10	3730	U	4.50	20 blows	
5					3731	D	5.05		
	Stiff orangish brown CLAY/SILT			5.30	3732	B	5.50	N = 37 (4, 7, 8, 8, 10, 11)	
6	Very stiff light brown very gravelly CLAY with occasional cobbles			6.40	3733	B	6.50	N = 37 (3, 5, 6, 12, 9, 10)	
7					3734	B	7.50	N = 33 (4, 4, 6, 7, 8, 12)	
8					3735	B	8.50	N = 39 (3, 6, 8, 10, 10, 11)	
9	Angular cobbles and boulders			9.40	3736	B	9.50	N = 50/235 mm (5, 8, 6, 10, 19, 15)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.1	2.3	0.5	
7.9	8.1	0.5	
9.1	9.2	0.25	
9.6	9.9	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.40	2.40		2.00		Moderate
9.40	9.40		3.90		Rapid

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
16-11-07	9.90	0.00	3.40	End of boring

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
16-11-07	9.90	6.90	9.90	50mm SP

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH6
SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,150.00 E 1,100.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	9.90
CASING DEPTH (m)	9.90
DATE STARTED	15/11/2007
DATE COMPLETED	16/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
10				9.90					
11									
12									
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.1	2.3	0.5	
7.9	8.1	0.5	
9.1	9.2	0.25	
9.6	9.9	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
16-11-07	9.90	6.90	9.90	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH8
SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,115.00 E 1,050.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	10.00
CASING DEPTH (m)	10.00
DATE STARTED	17/11/2007
DATE COMPLETED	18/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of re-inforced concrete, stone, gravel, ash, clay)				3749	B	0.50	N = 12 (2, 3, 2, 3, 4, 3)	
1	Soft brown sandy CLAY/SILT with occasional gravel			1.20	3750	B	1.50	N = 10 (1, 2, 2, 3, 2, 3)	
2					3751	B	2.50	N = 17 (2, 2, 1, 2, 3, 11)	
3	Stiff to very stiff brown gravelly CLAY with occasional cobbles			3.00	3752	B	3.50	N = 30 (3, 4, 6, 7, 7, 10)	
4					3753	B	4.50	N = 19 (3, 3, 4, 4, 6, 5)	
5					3754	B	5.50	N = 27 (2, 3, 5, 6, 8, 8)	
6					3755	B	6.50	N = 28 (3, 5, 6, 7, 6, 9)	
7					3756	B	7.50	N = 35 (4, 7, 7, 9, 9, 10)	
8					3757	B	8.50	N = 37 (3, 4, 5, 8, 11, 13)	
9	Dense angular grey silty GRAVEL			9.40	3758	B	9.50	N = 50/235 mm (2, 2, 3, 5, 17, 25)	
	Angular cobbles and boulders			9.80					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0	0.2	1	
2.9	3	0.5	
8.2	8.3	1.25	
9.8	10	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.20	2.20		1.80		Moderate
9.80	9.80		3.40		Rapid

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-11-07	4.00	1.00	4.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17-11-07	3.00	3.00	1.80	End of day
18-11-07	10.00	0.00	2.70	End of boring

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH8
SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,115.00 E 1,050.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	10.00
CASING DEPTH (m)	10.00
DATE STARTED	17/11/2007
DATE COMPLETED	18/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
10	End of Borehole at 10.00 m			10.00					
11									
12									
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0	0.2	1	
2.9	3	0.5	
8.2	8.3	1.25	
9.8	10	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-11-07	4.00	1.00	4.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH9
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	1,160.00 E 1,050.00 N
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	10.10
CASING DEPTH (m)	10.10
DATE STARTED	24/11/2007
DATE COMPLETED	29/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of clay,rubble,stone,ash)	▨			7713	B	0.50	N = 11 (2, 3, 2, 2, 3, 4)	
1					7714	B	1.50	N = 14 (3, 3, 4, 4, 3, 3)	
2	Firm grey brown sandy gravelly SILT	✕		2.10	7715	B	2.50	N = 10 (1, 2, 3, 2, 2, 3)	
3					7716 NR	B U	3.00		
					7717	B	3.50	N = 11 (2, 2, 2, 3, 3, 3)	
4	Firm to stiff brown sandy gravelly CLAY	✕		4.00	7718	B	4.50	N = 14 (1, 3, 3, 4, 4, 3)	
5					7719	B	5.50	N = 19 (2, 4, 6, 5, 4, 4)	
6					7720	B	6.50	N = 21 (3, 4, 4, 4, 5, 8)	
7					7721	B	7.50	N = 18 (2, 4, 3, 4, 6, 5)	
8					7722	B	8.50	N = 18 (3, 3, 4, 5, 5, 4)	
9	Dense grey brown angular GRAVEL with cobbles and boulders	○		9.00	7723	B	9.50	N = 50/115 mm (5, 11, 19, 31)	
10	End of Borehole at 10.10 m			10.10					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1	1.3	0.75	
6.9	7.1	0.5	
8.2	8.4	0.5	
9.6	10.1	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.00	2.00		1.80		Slow
9.00	9.00		3.70		Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
24-11-07	9.00	9.00	7.40	End of Day

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH11
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	1,030.00 E 0,990.00 N	**DATE STARTED**	02/12/2007
GROUND LEVEL (m)		**DATE COMPLETED**	02/12/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	10.10	**PROCESSED BY**	F.C
CASING DEPTH (m)	10.10		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Field Test Results	Standpipe Details
MADE GROUND (comprised of tarmac over hardcore fill)				7745	B	0.50	N = 13 (3, 3, 4, 3, 4, 2)	
Firm to stiff grey/brown CLAY with some boulders			1.20	7746	B	1.50	N = 10 (1, 2, 2, 3, 2, 3)	
				7747	B	2.50	N = 17 (2, 3, 3, 6, 4, 4)	
				7748	B	3.00		
				7749	B	3.50	N = 18 (3, 4, 4, 5, 4, 5)	
				7750	B	4.50	N = 35 (2, 5, 9, 12, 8, 6)	
				7751	B	5.50	N = 35 (3, 4, 4, 10, 13, 8)	
				NR	U	6.00		
				7752	B	6.50	N = 28 (4, 7, 9, 6, 6, 7)	
Medium dense brown clayey fine to coarse GRAVEL			6.90	7753	B	7.50	N = 24 (3, 5, 6, 5, 7, 6)	
Dense grey brown angular GRAVEL with cobbles and boulders			8.10	7754	B	8.50	N = 32 (4, 5, 7, 7, 8, 10)	
							N = 50/115 mm (6, 10, 17, 33)	
End of Borehole at 10.10 m			10.10					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
5.8	5.9	0.25	
7.2	7.4	0.5	
9.7	10.1	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
6.90	6.90		5.80		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH12
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,070.00 E 1,000.00 N	**DATE STARTED**	29/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	30/11/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	13.90	**PROCESSED BY**	F.C
CASING DEPTH (m)	13.90		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Field Test Results	Standpipe Details
MADE GROUND (comprised of concrete,rubble,hardcore)				7723	B	0.50	N = 32 (3, 4, 8, 11, 7, 6)	
						1.50	N = 50/115 mm (19, 6, 18, 32)	
Soft grey slightly sandy SILT			2.40	7724	B	2.50	N = 14 (2, 3, 3, 4, 3, 4)	
Medium dense orange/brown silty SAND with some gravel			2.90	7725	B	3.50	N = 14 (1, 3, 4, 4, 3, 3)	
Firm to stiff orange/brown CLAY/SILT			4.50	7726	B	4.50	N = 11 (2, 2, 3, 2, 3, 3)	
				7727	B	5.50	N = 29 (3, 5, 6, 7, 7, 9)	
				7728	B	6.50	N = 37 (4, 7, 8, 8, 10, 11)	
Stiff black SILT/CLAY			7.40	7729	B	7.50	N = 24 (3, 4, 6, 5, 6, 7)	
				NR	U	8.00		
				7730	B	8.50	N = 27 (2, 4, 5, 7, 8, 7)	
				7731	B	9.50	N = 36 (4, 6, 7, 9, 10, 10)	
				7732	B	10.50	N = 29 (2, 4, 6, 6, 8, 9)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.3	2.1	2.5	
13.4	13.9	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.60	2.60		2.20		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH12
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,070.00 E 1,000.00 N	**GROUND LEVEL (m)**	
BOREHOLE DIAMETER (mm)	200	**DATE STARTED**	29/11/2007
BOREHOLE DEPTH (m)	13.90	**DATE COMPLETED**	30/11/2007
CASING DEPTH (m)	13.90	**BORED BY**	T.McCarthy
CLIENT	Deerland Properties	**PROCESSED BY**	F.C
ENGINEER	Kavanagh Mansfield		

Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
				Ref. Number	Sample Type	Depth (m)		
Stiff black SILT/CLAY *(continued)*				7733	B	11.50	N = 28 (3, 5, 5, 7, 8, 8)	
Stiff brown/white CLAY/SILT			11.80	7734	B	12.50	N = 23 (3, 4, 4, 6, 6, 7)	
Dense grey brown angular GRAVEL with cobbles and boulders			12.80	7735	B	13.50	N = 50/95 mm (8, 16, 32, 18)	
End of Borehole at 13.90 m			13.90					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.3	2.1	2.5	
13.4	13.9	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
13.10	13.10		7.30		Rapid

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH14
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,170.00 E 10,000.00 N	**GROUND LEVEL (m)**	
BOREHOLE DIAMETER (mm)	200	**DATE STARTED**	18/11/2007
BOREHOLE DEPTH (m)	12.30	**DATE COMPLETED**	19/11/2007
CASING DEPTH (m)	12.30	**BORED BY**	T.McCarthy
CLIENT	Deerland Properties	**PROCESSED BY**	Taras
ENGINEER	Kavanagh Mansfield		

Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
				Ref. Number	Sample Type	Depth (m)		
MADE GROUND (comprised of re-infornced concrete, stone, rubble, clay)				3759	B	0.50	N = 9 (1, 1, 2, 2, 2, 3)	
Loose grey silty SAND			1.40	3760	B	1.50	N = 13 (2, 2, 3, 3, 3, 4)	
Soft greyish black ~~sandy SILT~~			2.60	3761	B	2.50	N = 12 (2, 3, 4, 3, 2, 3)	
				3762	U	3.00	18 blows	
				3763	D	3.55		
				3764	B	4.00	N = 5 (1, 0, 1, 1, 2, 1)	
Loose grey sandy GRAVEL with fragments of shells			4.40					
Loose brown clayey sandy GRAVEL			4.80	3765	B	5.00	N = 8 (1, 2, 1, 2, 3, 2)	
Medium dense brown fine to medium sandy GRAVEL			6.10	3766	B	6.00	N = 11 (2, 2, 3, 3, 2, 3)	
				3767	B	7.00	N = 15 (2, 3, 4, 3, 4, 4)	
				3768	B	8.00	N = 19 (3, 3, 4, 4, 5, 6)	
Stiff brown gravelly CLAY with occasional cobbles			8.60	3769	B	9.00	N = 21 (2, 4, 5, 4, 5, 7)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0	0.2	1.25	
9.7	9.9	0.5	
10.5	10.6	0.5	
11.8	12.3	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.00	2.00		1.80		Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
18-11-07	2.00	2.00	1.80	End of day
19-11-07	2.00	2.00	1.80	Start of day

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH14
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,170.00 E 10,000.00 N	**DATE STARTED**	18/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	19/11/2007
BOREHOLE DIAMETER (mm)	200		
CLIENT	Deerland Properties	**BOREHOLE DEPTH (m)**	12.30
ENGINEER	Kavanagh Mansfield	**CASING DEPTH (m)**	12.30
BORED BY	T.McCarthy	**PROCESSED BY**	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
10	Stiff brown gravelly CLAY with occasional cobbles *(continued)*				3770	B	10.00	N = 23 (3, 4, 4, 5, 5, 9)	
11					3771	B	11.00	N = 26 (4, 5, 6, 5, 7, 8)	
12	Angular cobbles and boulders			11.60	3772	B	12.00	N = 50/20 mm (21, 4, 50)	
	End of Borehole at 12.30 m			12.30					
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0	0.2	1.25	
9.7	9.9	0.5	
10.5	10.6	0.5	
11.8	12.3	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.60	11.60		7.80		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH16
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,135.00 E 0,950.00 N	**DATE STARTED**	20/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	22/11/2007
BOREHOLE DIAMETER (mm)	200		
CLIENT	Deerland Properties	**BOREHOLE DEPTH (m)**	17.30
ENGINEER	Kavanagh Mansfield	**CASING DEPTH (m)**	17.30
BORED BY	T.McCarthy	**PROCESSED BY**	Taras

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of oil, ash, slag, rubble)				3777	B	0.50	N = 16 (2, 3, 4, 3, 5, 4)	
1					3778	B	1.50	N = 24 (3, 6, 9, 7, 5, 3)	
2	Soft grey SILT			2.40	3779	B	2.50	N = 5 (1, 0, 1, 1, 1, 2)	
3	Loose grey silty SAND			3.00	3780	U	3.00	30 blows	
	Stiff to very stiff brown very gravelly CLAY			3.50	3781	D	3.55		
4					3782	B	4.00	N = 18 (2, 4, 4, 5, 4, 5)	
5					3783	B	5.00	N = 32 (3, 4, 5, 7, 11, 9)	
6					3784	B	6.00	N = 22 (2, 3, 4, 4, 8, 6)	
7					3785	B	7.00	N = 38 (3, 9, 10, 12, 9, 7)	
	Stiff grey CLAY/SILT			7.60					
8					3786	B	8.00	N = 28 (4, 6, 7, 8, 6, 7)	
	Stiff brown gravelly CLAY with occasional cobbles			8.30					
9					3787	B	9.00	N = 27 (4, 5, 6, 6, 7, 8)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.2	1.4	0.5	
4.7	4.9	0.5	
5.3	5.4	0.25	
10.5	10.7	0.5	
16.9	17.3	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.40	2.40		1.90		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
20-11-07	3.00	3.00	1.70	Start of day

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22-11-07	5.00	1.00	5.00	50mm SP
22-11-07	17.00	14.00	17.00	50mm SP

REMARKS Seals from 5.50-14.00m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	**BH16**
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,135.00 E 0,950.00 N	**DATE STARTED**	20/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	22/11/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	17.30	**PROCESSED BY**	Taras
CASING DEPTH (m)	17.30		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe
10	Stiff brown gravelly CLAY with occasional cobbles *(continued)*				3788	B	10.00	N = 35 (3, 6, 7, 9, 9, 10)	
11					3789	B	11.00	N = 24 (4, 4, 5, 6, 5, 8)	
12					3790	B	12.00	N = 25 (3, 4, 5, 5, 7, 8)	
13					3791	B	13.00	N = 33 (4, 6, 7, 7, 9, 10)	
14					3792	B	14.00	N = 29 (3, 4, 6, 6, 8, 9)	
15					3793	B	15.00	N = 24 (4, 5, 5, 6, 6, 7)	
16					3794	B	16.00	N = 22 (3, 4, 4, 5, 7, 6)	
	Angular cobbles and boulders			16.60					
17					3795	B	17.00	N = 75/40 mm (25, 50)	
	End of Borehole at 17.30 m			17.30					
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.2	1.4	0.5	
4.7	4.9	0.5	
5.3	5.4	0.25	
10.5	10.7	0.5	
16.9	17.3	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
16.60	16.60		12.90		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22-11-07	5.00	1.00	5.00	50mm SP
22-11-07	17.00	14.00	17.00	50mm SP

REMARKS Seals from 5.50-14.00m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 13184.GPJ IGSL.GDT 7/12/07

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184

CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	**BH17**
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	1,180.00 E 0,950.00 N	**DATE STARTED**	22/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	23/11/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	12.50	**PROCESSED BY**	F.C
CASING DEPTH (m)	12.50		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of iron slag)				7701	B	0.50	N = 48 (3, 4, 4, 11, 14, 19)	
1					7702	B	1.50	N = 50/160 mm (9, 14, 18, 24, 8)	
2					7703	B	2.50	N = 12 (3, 5, 4, 3, 2, 3)	
	Medium dense grey slightly silty SAND			2.80					
3					7704	B	3.50	N = 16 (2, 3, 4, 3, 4, 5)	
	Firm brown gravelly CLAY/SILT			4.10					
4					7705	B	4.50	N = 15 (2, 3, 4, 4, 3, 4)	
5					7706	B	5.50	N = 14 (2, 2, 3, 3, 4, 4)	
	Medium dense brown gravelly SAND			5.80					
6					7707	B	6.50	N = 19 (3, 4, 4, 5, 4, 6)	
7					7708	B	7.50	N = 23 (2, 4, 4, 5, 7, 7)	
	Stiff to very stiff brown gravelly CLAY with occasional cobbles			7.60					
8					7709	B	8.50	N = 19 (3, 3, 4, 4, 5, 6)	
9					7710	B	9.50	N = 27 (2, 5, 4, 8, 9, 6)	
10					7711	B	10.50	N = 38 (3, 4, 6, 7, 11, 14)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.8	1.7	2.25	
10.8	11	0.5	
12.1	12.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80		2.30		Slow
5.80	5.80		3.40		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
23-11-07	4.00	4.00	2.40	Start of Day

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 13184.GPJ IGSL.GDT 10/12/07

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH17
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)	1,180.00 E 0,950.00 N	**DATE STARTED**	22/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	23/11/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	12.50	**PROCESSED BY**	F.C
CASING DEPTH (m)	12.50		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
11	Stiff to very stiff brown gravelly CLAY with occasional cobbles *(continued)*				7712	B	11.50	N = 31 (2, 4, 5, 8, 9, 9)	
12	Dense grey brown angular GRAVEL with cobbles and boulders			11.80					
	End of Borehole at 12.50 m			12.50				N = 50/75 mm (25, 50)	
13									
14									
15									
16									
17									
18									
19									
20									
21									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.8	1.7	2.25	
10.8	11	0.5	
12.1	12.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 13184.GPJ IGSL.GDT 10/12/07

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	**BOREHOLE NO.**	BH18
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	1,180.00 E 0,950.00 N	**DATE STARTED**	20/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	20/11/2007
BOREHOLE DIAMETER (mm)	200	**BORED BY**	T.McCarthy
BOREHOLE DEPTH (m)	4.50	**PROCESSED BY**	Taras
CASING DEPTH (m)	4.50		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND (comprised of hardcore, clay, rubble)				3773	B	0.50	N = 19 (2, 3, 5, 4, 4, 6)	
1					3774	B	1.50	N = 13 (2, 4, 3, 3, 4, 3)	
2	Medium dense light brown silty sandy GRAVEL			1.90					
	Firm brownish reddish grey CLAY/SILT			2.50	3775	B	2.50	N = 21 (3, 4, 5, 5, 6, 5)	
3	Dense broken angular gravel,cobbles and boulders			3.20	3776	B	3.50	N = 33 (3, 4, 6, 7, 10, 10)	
4	End of Borehole at 4.50 m			4.50				N = 75/20 mm (25, 50)	
5									
6									
7									
8									
9									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4.1	4.3	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.00	2.00		1.60		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 13184.GPJ IGSL.GDT 7/12/07

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH21
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	4.80
CASING DEPTH (m)	4.80
DATE STARTED	01/12/2007
DATE COMPLETED	01/12/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	F.C

Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
				Ref. Number	Sample Type	Depth (m)		
MADE GROUND (comprised of clay,rubble,stone,ash)				7736	B	0.50	N = 13 (3, 3, 4, 3, 4, 2)	
Firm brown sandy gravelly CLAY			0.95	7737	B	1.50	N = 14 (2, 2, 3, 3, 3, 5)	
				7738	B	2.50	N = 15 (2, 3, 4, 3, 4, 4)	
Dense, grey, angular GRAVEL with many angular cobbles and boulders.			3.20	7739	B	3.50	N = 33 (3, 5, 7, 7, 9, 10)	
				7740	B	4.50	N = 50/75 mm (25, 50)	
End of Borehole at 4.80 m			4.80					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.9 4.2	2.1 4.8	0.5 2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.30	2.30		1.90		Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 13184.GPJ IGSL.GDT 10/12/07

GEOTECHNICAL BORING RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
BOREHOLE NO.	BH22
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	3.90
CASING DEPTH (m)	3.90
DATE STARTED	01/12/2007
DATE COMPLETED	01/12/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
BORED BY	T.McCarthy
PROCESSED BY	F.C

Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
				Ref. Number	Sample Type	Depth (m)		
MADE GROUND (comprised of hardcore, clay, rubble)				7741	B	0.50	N = 20 (3, 5, 8, 6, 3, 3)	
				7742	B	1.50	N = 12 (2, 3, 2, 3, 3, 4)	
Medium dense brown fine to coarse gravelly SAND			1.70	7743	B	2.50	N = 19 (3, 4, 5, 5, 4, 5)	
Dense grey brown angular GRAVEL with cobbles and boulders			2.80	7744	B	3.50	N = 50/70 mm (9, 16, 50)	
End of Borehole at 3.90 m			3.90					

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.4	3.9	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.70	1.70		1.50		Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 13184.GPJ IGSL.GDT 10/12/07

Appendix II – Rotary Coring Records

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**DRILLHOLE NO**	RC02
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)		**DATE STARTED**	30/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	01/12/2007
CORE DIAMETER (mm)	84	**DRILLED BY**	Millennium
INCLINATION	-90	**LOGGED BY**	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of concrete, gravel and cobbles.	1.20				
1								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of black silty sand.	5.70				
2													
3													
4													
5													
6								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown clay.	8.70				N = 50/80 mm (4, 7, 19, 21, 10)
7													N = 50/75 mm (3, 6, 22, 28)
8													
9								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly (fine) clay.	10.00				

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

IGSL

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC02

SHEET Sheet 2 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)

CORE DIAMETER (mm) 84

INCLINATION -90

FLUSH Air/Mist

DATE STARTED 30/11/2007

DATE COMPLETED 01/12/2007

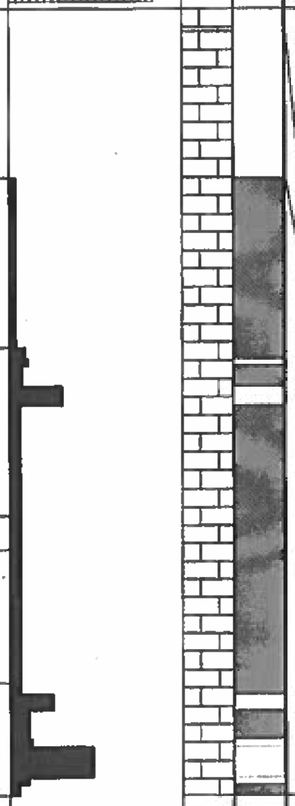
CLIENT Deerland Properties

ENGINEER Kavanagh Mansfield

DRILLED BY Millennium

LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10	10.00				SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of highly weathered limestone (possible bedrock).	10.20				
11	11.50	100	0	0	Rotary drilling. No recovery. Observed by driller as very weathered rock.	11.50	Discontinuities are rough and undulose. Apertures are open with slightly iron oxide stained and clay and fine gravel smeared surfaces. Irregular breaks throughout.			
12					Moderately weak to locally moderately strong, thin to medium bedded, grey, fine grained, slightly cherty LIMESTONE. Moderately to highly weathered.					
13	13.00	87	14	11						
14	14.50	100	0	0						
	14.80	50	0	0						
15										
16	16.00	100	41	18		17.00				
17	17.00				End of Corehole at 17 (m)					
18										
19										



REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

IGSL

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC05

SHEET Sheet 1 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)

CORE DIAMETER (mm) 84

INCLINATION -90

FLUSH Air/Mist

DATE STARTED 26/11/2007

DATE COMPLETED 26/11/2007

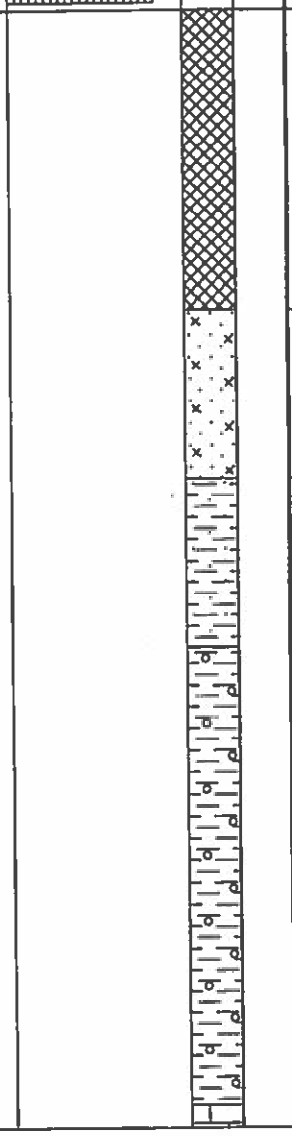
CLIENT Deerland Properties

ENGINEER Kavanagh Mansfield

DRILLED BY Millennium

LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0					SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of concrete and silty gravel fill.	2.70				
1										
2										
3					SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of grey silty sand.	4.20				
4					SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silty clay.	5.70				
5										
6					SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay	9.80				
7										
8										
9										



REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

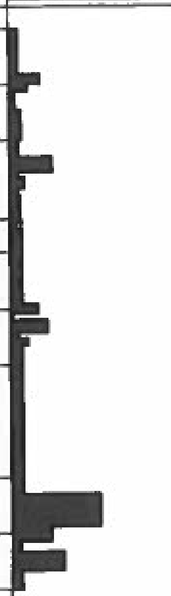
Date	Tip Depth	RZ Top	RZ Base	Type

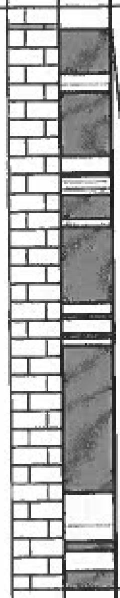
GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
DRILLHOLE NO	RC05
SHEET	Sheet 2 of 2
CO-ORDINATES(_)	
GROUND LEVEL (m)	
CORE DIAMETER (mm)	84
INCLINATION	-90
FLUSH	Air/Mist
DATE STARTED	26/11/2007
DATE COMPLETED	26/11/2007
DRILLED BY	Millennium
LOGGED BY	IGSL
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%
10.20			
	100	0	0
10.70			
	100	10	0
11.20			
	100	20	0
11.90	100	23	0
12.20	100	24	24
12.70	100	40	26
13.20			
	100	0	0
14.20	100	58	58
14.70	100	58	58
15.20			

Fracture Spacing (mm)





Strata description	Depth (m)	Discontinuities
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of variably weathered limestone (possible bedrock). *(continued)*	10.20	
Moderately strong to moderately weak, thinly bedded, grey to dark grey, fine grained, slightly cherty LIMESTONE. Moderately to highly weathered.	15.20	Discontinuities are rough to locally smooth and undulose to irregular and locally planar. Apertures are open with clay smeared and slightly iron oxide stained surfaces. Dips are sub-10° with predominantly variable breaks throughout.
End of Corehole at 15.2 (m)		

Elevation | Standpipe Details | SPT (N Value)

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

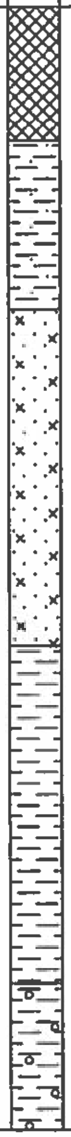
INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
DRILLHOLE NO	RC07
SHEET	Sheet 1 of 3
CO-ORDINATES(_)	
GROUND LEVEL (m)	
CORE DIAMETER (mm)	84
INCLINATION	-90
FLUSH	Air/Mist
DATE STARTED	27/11/2007
DATE COMPLETED	28/11/2007
DRILLED BY	Millennium
LOGGED BY	IGSL
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield

Downhole Depth (m) | Core Run Depth (m) | T.C.R.% | S.C.R.% | R.Q.D.% | Fracture Spacing (mm) 0 250 500 | Legend | Non-intact zones (shaded)



Strata description	Depth (m)	Discontinuities
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of concrete and cobbly gravelly fill.	1.20	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of sandy clay	2.70	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of black silty sand.	5.70	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown clay	8.70	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay		

Elevation | Standpipe Details | SPT (N Value)

REMARKS

1 Core box.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**DRILLHOLE NO**	RC07
		SHEET	Sheet 2 of 3
CO-ORDINATES(_)		**DATE STARTED**	27/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	28/11/2007
CORE DIAMETER (mm)	84	**DRILLED BY**	Millennium
INCLINATION	-90	**LOGGED BY**	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay *(continued)*	11.30				
11	11.50	7	0	0				SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of highly weathered limestone (possible bedrock). Brown grey clayey angular GRAVEL and COBBLES (possible highly weathered limestone bedrock)	11.50				
13	13.00	7	0	0									N = 50/105 mm (3, 5, 12, 12, 26)
14	14.50	10	0	0									N = 50/95 mm (4, 4, 10, 15, 25)
16	16.00	7	0	0									N = 50/80 mm (3, 6, 15, 25, 10)
17	17.50	20	0	0									N = 50/85 mm (3, 4, 5, 20, 25)
19	19.00	20	0	0									N = 50/75 mm (4, 4, 19, 31)

REMARKS

1 Core box.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**DRILLHOLE NO**	RC07
		SHEET	Sheet 3 of 3
CO-ORDINATES(_)		**DATE STARTED**	27/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	28/11/2007
CORE DIAMETER (mm)	84	**DRILLED BY**	Millennium
INCLINATION	-90	**LOGGED BY**	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
20								Brown grey clayey angular GRAVEL and COBBLES (possible highly weathered limestone bedrock) *(continued)*					
	20.50	80	0	0									N = 50/75 mm (5, 7, 30, 20)
21	21.00	30	0	0					22.00				
22	22.00							End of Corehole at 22 (m)					
23													
24													
25													
26													
27													
28													
29													

REMARKS

1 Core box.

INSTALLATION REMARKS

GROUNDWATER DETAILS

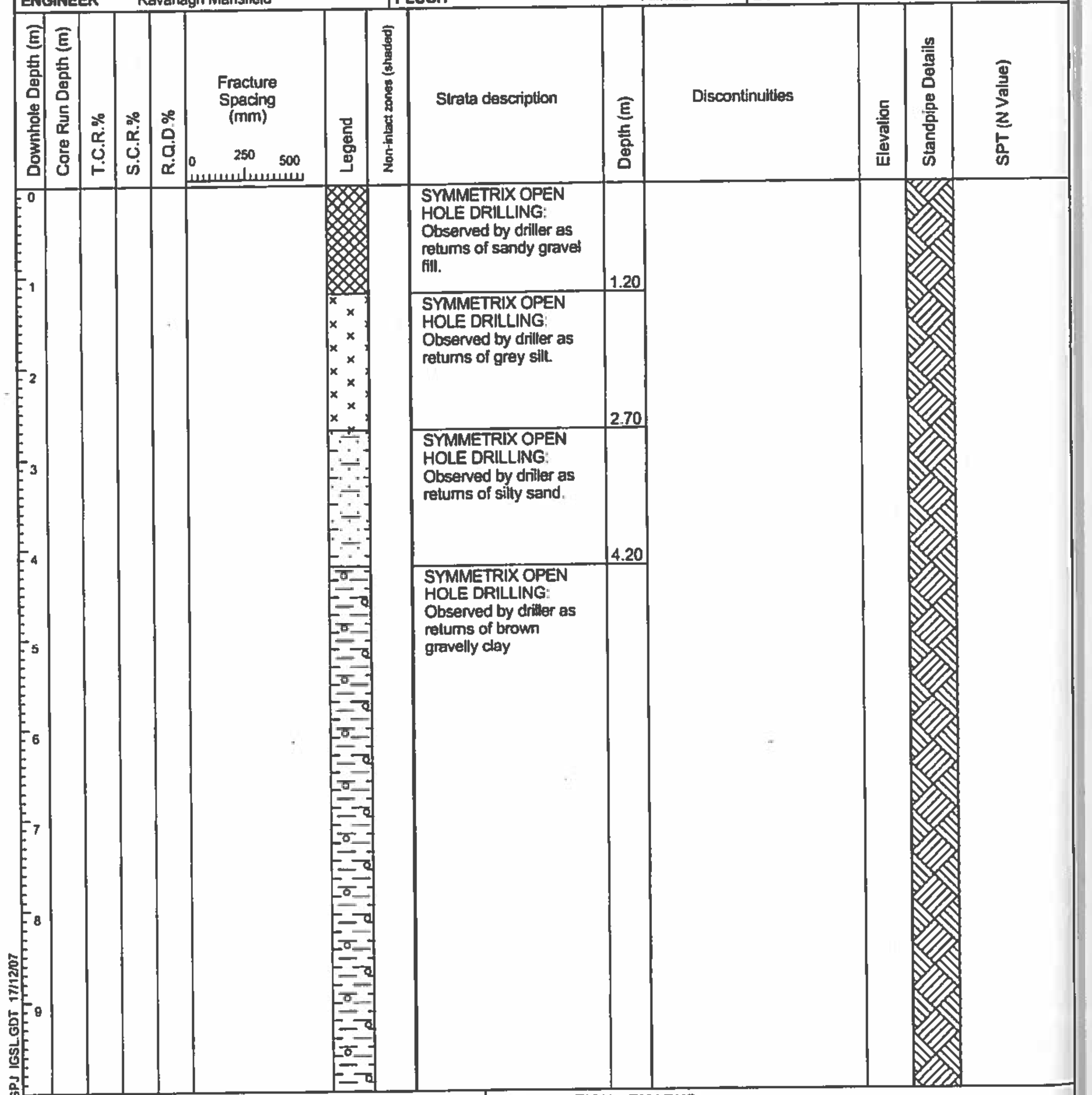
Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	DRILLHOLE NO	RC09
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)		DATE STARTED	26/11/2007
GROUND LEVEL (m)		DATE COMPLETED	27/11/2007
CORE DIAMETER (mm)	84	DRILLED BY	Millennium
INCLINATION	-90	LOGGED BY	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		



Strata description	Depth (m)	Discontinuities
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of sandy gravel fill.	1.20	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of grey silt.	2.70	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silty sand.	4.20	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay		

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

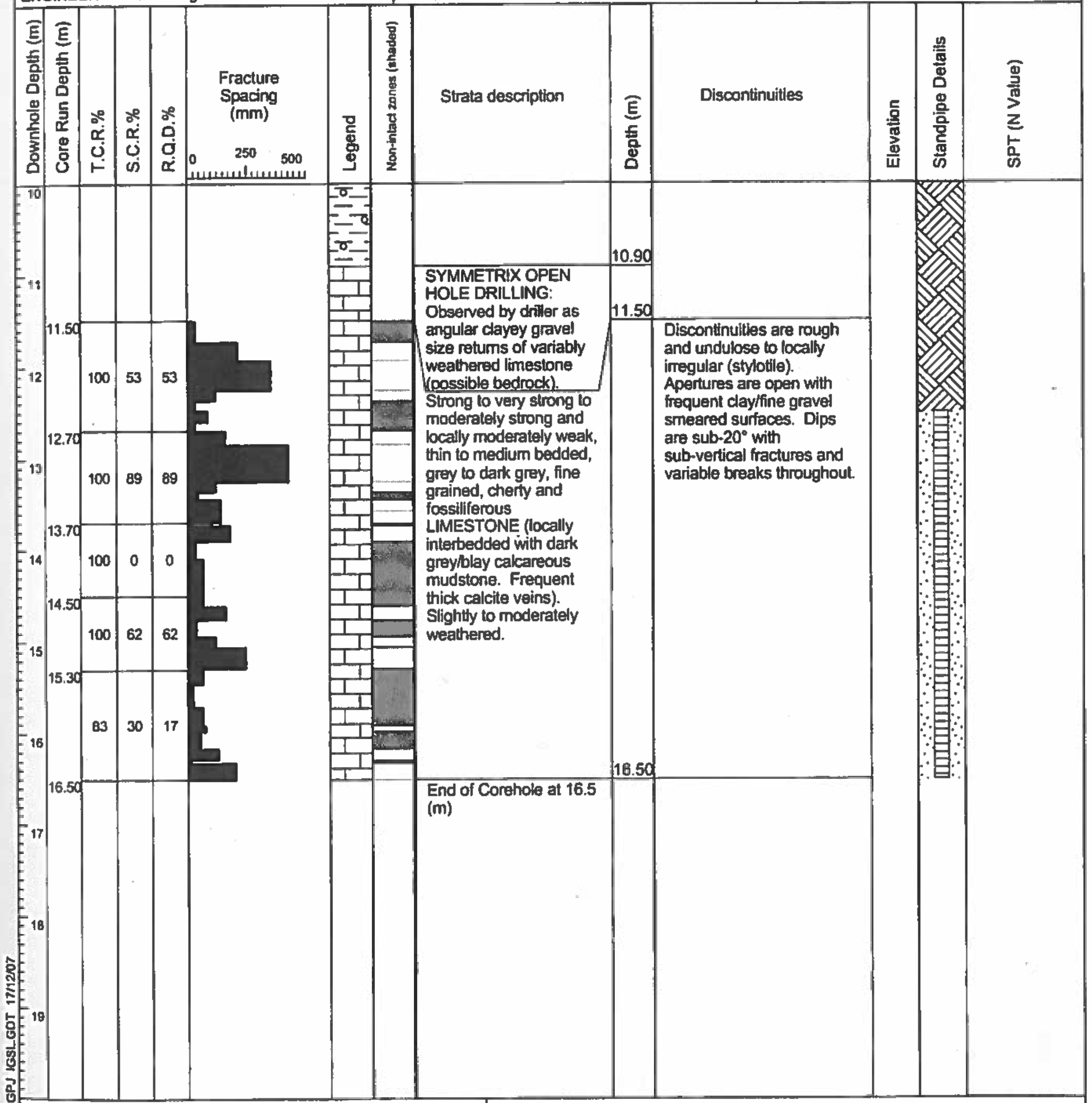
Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-11-07	16.50	12.50	16.50	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184		
CONTRACT	Trinity Wharf, Wexford	DRILLHOLE NO	RC09
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)		DATE STARTED	26/11/2007
GROUND LEVEL (m)		DATE COMPLETED	27/11/2007
CORE DIAMETER (mm)	84	DRILLED BY	Millennium
INCLINATION	-90	LOGGED BY	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		



Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%
11.50			
	100	53	53
12.70			
	100	89	89
13.70			
	100	0	0
14.50			
	100	62	62
15.30			
	83	30	17
16.50			

Strata description	Depth (m)	Discontinuities
	10.90	
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of variably weathered limestone (possible bedrock).	11.50	
Strong to very strong to moderately strong and locally moderately weak, thin to medium bedded, grey to dark grey, fine grained, cherty and fossiliferous LIMESTONE (locally interbedded with dark grey/blay calcareous mudstone. Frequent thick calcite veins). Slightly to moderately weathered.	16.50	Discontinuities are rough and undulose to locally irregular (stylotile). Apertures are open with frequent clay/fine gravel smeared surfaces. Dips are sub-20° with sub-vertical fractures and variable breaks throughout.
End of Corehole at 16.5 (m)		

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-11-07	16.50	12.50	16.50	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC10
SHEET Sheet 1 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)
CORE DIAMETER (mm) 84
INCLINATION -90
FLUSH Air/Mist

DATE STARTED 01/12/2007
DATE COMPLETED 01/12/2007

CLIENT Deerland Properties
ENGINEER Kavanagh Mansfield

DRILLED BY Millennium
LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0						▩		SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of tar and fill.	1.20				
1 2 3 4 5								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of black sand.	5.70				
6 7								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of black silty sand.	7.20				
8								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of sand grading into brown clay.	8.70				
9								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown clay.	9.20				
								SYMMETRIX OPEN HOLE DRILLING:	10.00				

REMARKS
1 Core box. Rock falling in on core barrell.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC10
SHEET Sheet 2 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)
CORE DIAMETER (mm) 84
INCLINATION -90
FLUSH Air/Mist

DATE STARTED 01/12/2007
DATE COMPLETED 01/12/2007

CLIENT Deerland Properties
ENGINEER Kavanagh Mansfield

DRILLED BY Millennium
LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10 11	10.00	7	0	0				Observed by driller as angular clayey gravel size returns of rock (possible bedrock). Angular red/white/brown mottled, slightly sandy coarse GRAVEL and COBBLES (predominantly sandstone) with local boulders, iron oxide stained, probable highly weathered rock.					
12	11.50	7	0	0									N = 40/85 mm (3, 4, 10, 15, 15)
13	13.00	50	0	0									N = 50/75 mm (4, 10, 20, 30)
14	14.00	60	20	20									
15	15.00	60	0	0									
16	16.00	50	0	0					17.00				
17 18 19	17.00							End of Corehole at 17 (m)					

REMARKS
1 Core box. Rock falling in on core barrell.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
DRILLHOLE NO	RC13
SHEET	Sheet 1 of 2
CO-ORDINATES(_)	
GROUND LEVEL (m)	
CORE DIAMETER (mm)	84
INCLINATION	-90
FLUSH	Air/Mist
DATE STARTED	25/11/2007
DATE COMPLETED	30/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
DRILLED BY	Millennium
LOGGED BY	IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of concrete & gravel fill.	2.70				
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of grey sandy silt.	5.70				
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown sandy clay	7.20				
9								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay					

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
30-11-07	16.00	12.00	16.00	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER	13184
CONTRACT	Trinity Wharf, Wexford
DRILLHOLE NO	RC13
SHEET	Sheet 2 of 2
CO-ORDINATES(_)	
GROUND LEVEL (m)	
CORE DIAMETER (mm)	84
INCLINATION	-90
FLUSH	Air/Mist
DATE STARTED	25/11/2007
DATE COMPLETED	30/11/2007
CLIENT	Deerland Properties
ENGINEER	Kavanagh Mansfield
DRILLED BY	Millennium
LOGGED BY	IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10									10.40				
	10.90	91	56	40				SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of highly weathered limestone (possible bedrock). Clayey sub-angular gravel and cobble size returns of limestone with occasional boulders (possible highly weathered rock)	10.90				
	12.00	93	21	21									
	13.40	64	0	0									
	14.50	71	0	0									
	15.20	62	0	0					16.00				
16	16.00							End of Corehole at 16 (m)					

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
30-11-07	16.00	12.00	16.00	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC15

SHEET Sheet 1 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)

CORE DIAMETER (mm) 84

INCLINATION -90

FLUSH Air/Mist

DATE STARTED 30/11/2007

DATE COMPLETED 30/11/2007

CLIENT Deerland Properties

ENGINEER Kavanagh Mansfield

DRILLED BY Millennium

LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0						▨		SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravelly fill.	2.70			▨	
3								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silty sandy gravel.	4.50				
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown sandy gravel (fine).	5.00				
5	5.00	0	0	0				Rotary drilling. No recovery. Observed by driller as very weathered rock.	7.00				N = 50/80 mm (4, 7, 19, 21, 10)
7	7.00	100	19	12				Moderately weak to moderately strong, thinly bedded, white slightly grey & purple (slighly green 11.6m-12.6m), fine grained SANDSTONE/SILTSTONE. Slightly to moderately weathered.		Discontinuities are rough and undulose and locally irregular. Apertures are open and incipient with iron oxide stained (pervasive 7.0m-9.8m) and commonly silt and fine gravel smeared surfaces. Dips are sub-20° with vertical fractures throughout.			N = 50/75 mm (3, 6, 22, 28)
8	8.00	100	0	0									
	8.70	100	28	8									

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
30-11-07	12.60	8.60	12.60	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT Trinity Wharf, Wexford

DRILLHOLE NO RC15

SHEET Sheet 2 of 2

CO-ORDINATES(_)

GROUND LEVEL (m)

CORE DIAMETER (mm) 84

INCLINATION -90

FLUSH Air/Mist

DATE STARTED 30/11/2007

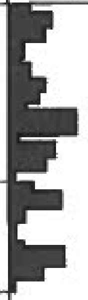
DATE COMPLETED 30/11/2007

CLIENT Deerland Properties

ENGINEER Kavanagh Mansfield

DRILLED BY Millennium

LOGGED BY IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10	10.00	100	62	43				Moderately weak to moderately strong, thinly bedded, white slightly grey & purple (slighly green 11.6m-12.6m), fine grained SANDSTONE/SILTSTONE. Slightly to moderately weathered. *(continued)*	12.60	Discontinuities are rough and undulose and locally irregular. Apertures are open and incipient with iron oxide stained (pervasive 7.0m-9.8m) and commonly silt and fine gravel smeared surfaces. Dips are sub-20° with vertical fractures throughout. *(continued)*			
12	11.60	100	59	43									
13	12.60							End of Corehole at 12.6 (m)					

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
30-11-07	12.60	8.60	12.60	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**DRILLHOLE NO**	RC17
		SHEET	Sheet 1 of 3
CO-ORDINATES(_)		**DATE STARTED**	28/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	29/11/2007
CORE DIAMETER (mm)	84	**DRILLED BY**	Millennium
INCLINATION	-90	**LOGGED BY**	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of cobbly gravelly fill.	1.20				
1								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silty sandy clay	2.70				
3								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silty clay	4.20				
4								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of black silty clay	5.70				
6								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay					
9													

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC NEWLOG 10M PER PG 13184RC.GPJ IGSL.GDT 17/12/07

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 13184

CONTRACT	Trinity Wharf, Wexford	**DRILLHOLE NO**	RC17
		SHEET	Sheet 2 of 3
CO-ORDINATES(_)		**DATE STARTED**	28/11/2007
GROUND LEVEL (m)		**DATE COMPLETED**	29/11/2007
CORE DIAMETER (mm)	84	**DRILLED BY**	Millennium
INCLINATION	-90	**LOGGED BY**	IGSL
FLUSH	Air/Mist		
CLIENT	Deerland Properties		
ENGINEER	Kavanagh Mansfield		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
10								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of brown gravelly clay *(continued)*	15.40				
15								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular clayey gravel size returns of variably weathered limestone (possible bedrock).	16.00				
16	16.00	100	25	19				Moderately weak to moderately strong, grey/dark grey, medium grained LIMESTONE (heavily solution weathered - vuggy and leached). Moderately to highly weathered.		Discontinuities are rough and undulose to irregular. Apertures are open with sand and clay smeared/infilled surfaces. Dips are sub-10° with sub-vertical fractures throughout.			
17	17.50	93	0	0									
19	19.00	100	0	0									
	19.10	100	29	29									
	19.80												

REMARKS

2 Core boxes.

INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC NEWLOG 10M PER PG 13184RC.GPJ IGSL.GDT 17/12/07

IGSL	**GEOTECHNICAL CORE LOG RECORD**	**REPORT NUMBER** 13184

CONTRACT	Trinity Wharf, Wexford			**DRILLHOLE NO** **SHEET**	**RC17** Sheet 3 of 3
CO-ORDINATES(_)		**GROUND LEVEL (m)** **CORE DIAMETER (mm)**	 84	**DATE STARTED** **DATE COMPLETED**	28/11/2007 29/11/2007
CLIENT **ENGINEER**	Deerland Properties Kavanagh Mansfield	**INCLINATION** **FLUSH**	-90 Air/Mist	**DRILLED BY** **LOGGED BY**	Millennium IGSL

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	Legend	Non-intact zones (shaded)	Strata description	Depth (m)	Discontinuities	Elevation	Standpipe Details	SPT (N Value)
20		100	87	67		▦							
	20.10	33	0	0		▦	▨		21.00				
21	21.00							End of Corehole at 21 (m)					
22													
23													
24													
25													
26													
27													
28													
29													

REMARKS

2 Core boxes

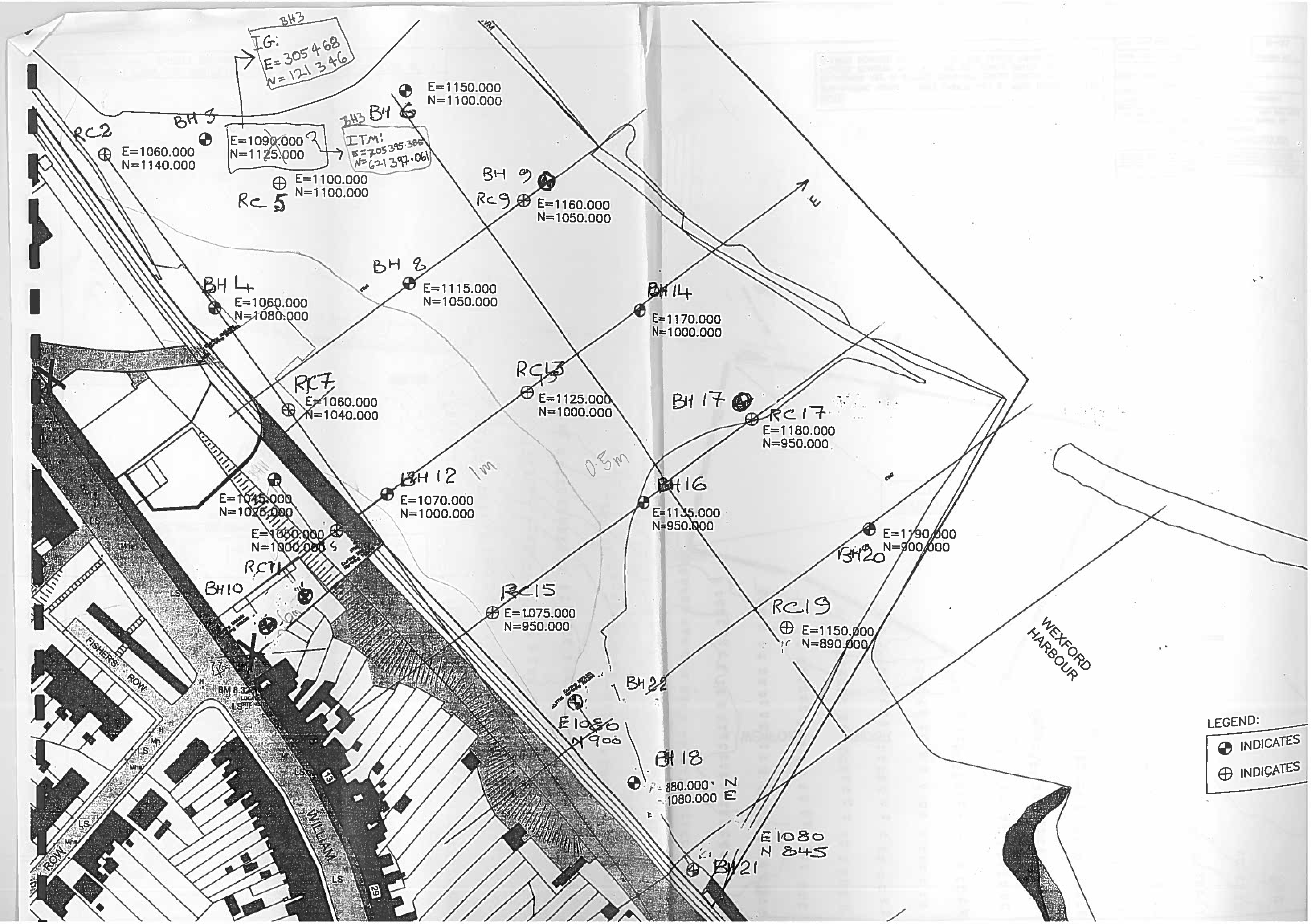
INSTALLATION REMARKS

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type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IG:
E=305468
N=121346
BH 3
E=1090.000
N=1125.000
?
BH3 BH 6
ITM:
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N=621397.061
E=1150.000
N=1100.000
RC2
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BH 9
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E
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BH 4
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N=1000.000
RC7
E=1060.000
N=1040.000
BH 17
RC17
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N=950.000
BH 12
1m
0.5m
E=1070.000
N=1000.000
E=1045.000
N=1025.000
BH16
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N=950.000
E=1050.000
N=1000.000
E=1190.000
N=900.000
BH20
RC11
BH10
RC15
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N=950.000
RC19
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WEXFORD HARBOUR
FISHER'S ROW
BM 8.32
BH22
E 1050
N 900
BH 18
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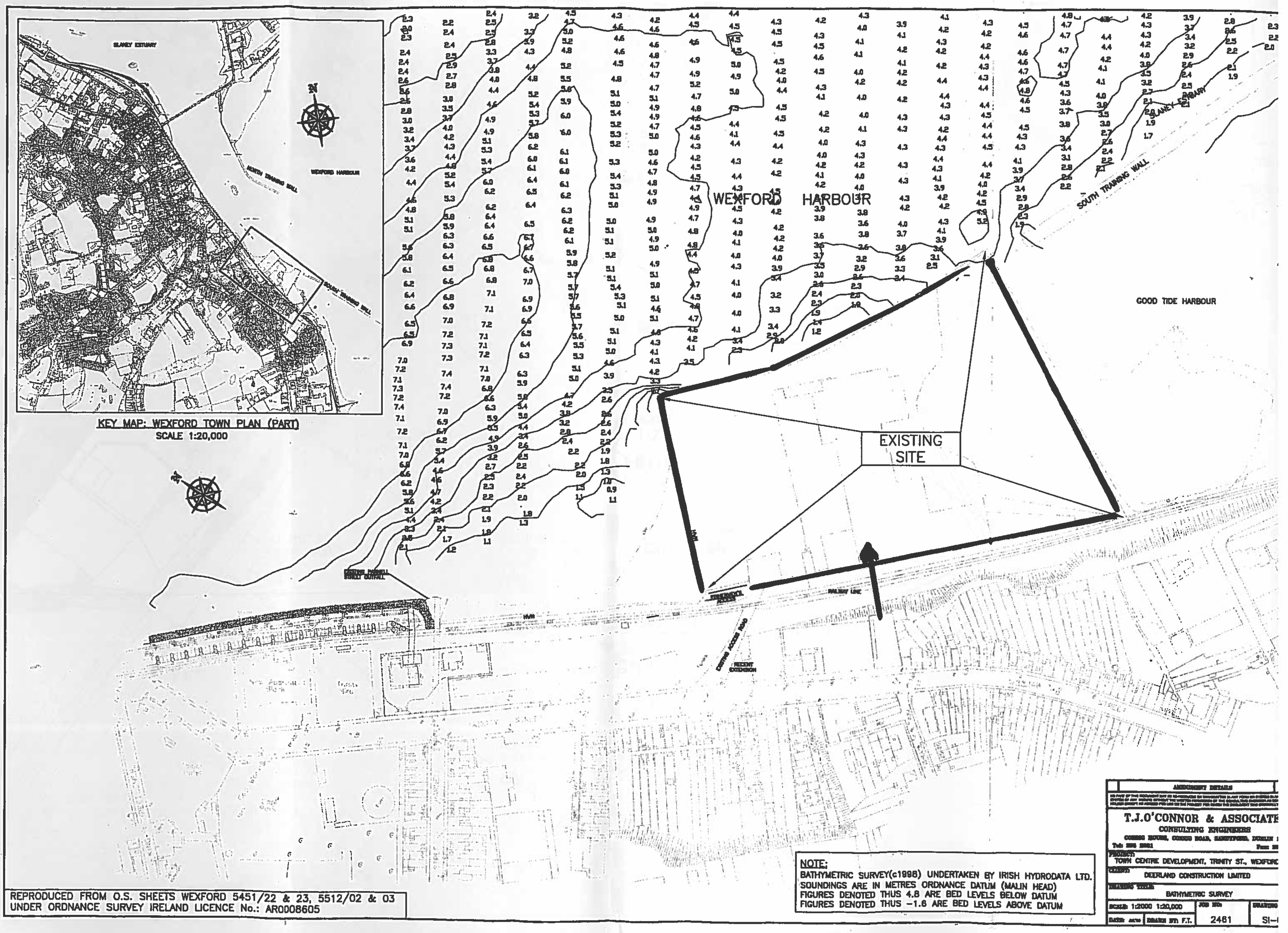
1080.000 E
E 1080
N 845
BH 21
WILLIAM
ROW
LS
13
29
LEGEND:
INDICATES
INDICATES



REPRODUCED FROM O.S. SHEETS WEXFORD 5451/22 & 23, 5512/02 & 03
UNDER ORDNANCE SURVEY IRELAND LICENCE No.: AR0008605

NOTE:
BATHYMETRIC SURVEY(c1998) UNDERTAKEN BY IRISH HYDRODATA LTD.
SOUNDINGS ARE IN METRES ORDNANCE DATUM (MALIN HEAD)
FIGURES DENOTED THUS 4.8 ARE BED LEVELS BELOW DATUM
FIGURES DENOTED THUS −1.6 ARE BED LEVELS ABOVE DATUM

AMENDMENT DETAILS

T.J.O'CONNOR & ASSOCIATE
CONSULTING ENGINEERS

PROJECT:
TOWN CENTRE DEVELOPMENT, TRINITY ST., WEXFORD

CLIENT:
DEERLAND CONSTRUCTION LIMITED

DRAWING TITLE
BATHYMETRIC SURVEY

SCALE: 1:2000 1:20,000
JOB No.: 2461
DRAWN BY: F.T.
DRAWING No.: SI–

Appendix III – Geotechnical Laboratory Records

Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425µm %	Preparation	Description	Classification
BH 4	3718	2.00	D	28.7	49	32	17	50	WS	Black slightly organic slightly sandy slightly gravelly SILT	M I
BH 4	3721	5.00	U				0	#DIV/0!	WS	Mottled orange brown sandy gravelly CLAY	
BH 4	3724	7.50	D	25	42	21	21	57	WS	Brown slightly sandy gravelly CLAY	C I
BH 5	3739	2.5	D	21.1	22	14	8	82	WS	Mottled orange grey brown slightly sandy slightly gravelly CLAY	C L
BH 5	3741	3.50	D	6.3	19	NP		19	WS	Orange brown silty very sandy GRAVEL with many cobbles	M L
BH 6	3732	5.50	D	22.6	47	23	24	81	WS	Orange brownslightly sandy slightly gravelly CLAY	C I
BH 6	3733	6.50	D	16.7	49	24	25	59	WS	Grey brown slightly sandy slightly gravelly CLAY with many cob	C I
BH 6	3735	8.50	D	22.4	43	22	21	54	WS	Light brown slightly sandy slightly gravelly CLAY	C I
BH 8	3750	1.50	D	12.7	26	14	12	47	WS	Brown slightly sandy gravelly CLAY	C L
BH 8	3752	3.5	D	10.6	28	14	14	59	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 8	3756	7.5	D	14.8	48	24	24	66	WS	Orange brown slightly sandy slightly gravelly CLAY	C I
BH 9	7716	3.00	D	19.9	27	15	12	77	WS	Grey brown slightly organic sandy gravelly CLAY	C L
BH 9	7719	5.50	D	28.5	34	17	17	54	WS	Grey brown slightly sandy slightly gravelly CLAY with some cobbles	C L
BH 11	7747	2.50	D	21.1	32	19	13	65	WS	Grey brown slightly organic sandy gravelly CLAY	C L
BH 11	7751	5.50	D	15.4	40	19	21	48	WS	Grey brown slightly sandy gravelly CLAY with some cobbles	C I

Notes: NAT - tested as received WS - Wet sieved (425µm) NP - Non Plastic

IGSL	Contract TRINITY WHARF WEXFORD	Contract No. 13184	
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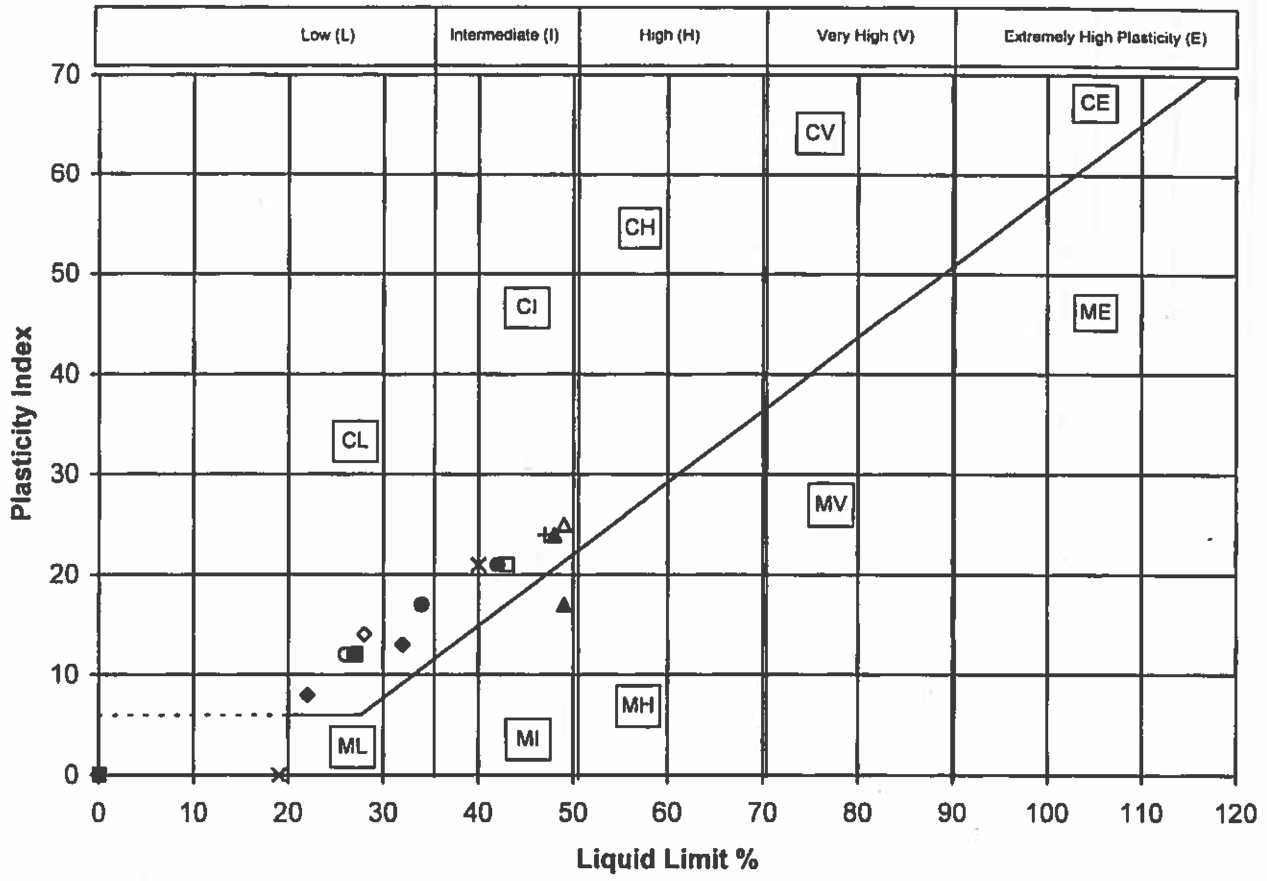
Plasticity Chart - Summary of Liquid & Plastic Limit Tests

BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18

Contract No. 13184 Contract: TRINITY WHARF WEXFORD



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425µm	Description
▲	BH 4	3718	2.00	28.7	49	32	17	50	Black slightly organic slightly sandy slightly gravelly SILT
■	BH 4	3721	5.00	0	0	0	0	#DIV/0!	Mottled orange brown sandy gravelly CLAY
●	BH 4	3724	7.50	25	42	21	21	57	Brown slightly sandy gravelly CLAY
◆	BH 5	3739	2.50	21.1	22	14	8	82	Mottled orange grey brown slightly sandy slightly gravelly CLAY
×	BH 5	3741	3.50	6.3	19	NP	0	19	Orange brown silty very sandy GRAVEL with many cbbles
+	BH 6	3732	5.50	22.6	47	23	24	81	Orange brownslightly sandy slightly gravelly CLAY
△	BH 6	3733	6.50	16.7	49	24	25	59	Grey brown slightly sandy slightly gravelly CLAY with many cobbles
□	BH 6	3735	8.50	22.4	43	22	21	54	Light brown slightly sandy slightly gravelly CLAY
○	BH 8	3750	1.50	12.7	26	14	12	47	Brown slightly sandy gravelly CLAY
◇	BH 8	3752	3.50	10.6	28	14	14	59	Grey brown slightly sandy slightly gravelly CLAY
▲	BH 8	3756	7.50	14.8	48	24	24	66	Orange brown slightly sandy slightly gravelly CLAY
■	BH 9	7716	3.00	19.9	27	15	12	77	Grey brown slightly organic sandy gravelly CLAY
●	BH 9	7719	5.50	28.5	34	17	17	54	Grey brown slightly sandy slightly gravelly CLAY with some cobbles
◆	BH 11	7747	2.50	21.1	32	19	13	65	Grey brown slightly organic sandy gravelly CLAY
×	BH 11	7751	5.50	15.4	40	19	21	48	Grey brown slightly sandy gravelly CLAY with some cobbles
+									
△									

NP denotes specimen is non-plastic.

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Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425µm %	Preparation	Description	Classification
BH 12	7727	5.50	D	18.9	46	24	22	98	WS	Orange brown slightly sandy CLAY	C I
BH 12	7729	7.50	D	25.5	34	19	15	77	WS	Black slightly sandy slightly gravelly CLAY	C L
BH 12	7732	10.50	D	27.3	37	21	16	96	WS	Orange brown slightly sandy slightly gravelly CLAY	C I
BH 12	7734	12.50	D	18.4	38	20	18	50	WS	Yellow very sandy gravelly CLAY	C I
BH 14	3762	3.00	D	30.6	31	NP		81	WS	Grey silty SAND with shell fragments	M L
BH 14	3770	10.00	D	19.9	45	25	20	30	WS	Brown slightly sandy gravelly CLAY with broken rock	C I
BH 16	3780	3.00	D	24	27	NP		76	WS	Grey silty slightly organic SAND	M L
BH 16	3782	4.00	D	22	39	22	17	64	WS	Orange brown slightly sandy slightly gravelly CLAY	C I
BH 16	3786	8.00	D	28.5	45	26	19	80	WS	Mottled orange black brown sandy gravelly CLAY	C I
BH 16	3789	11.00	D	32	49	27	22	92	WS	Orange brown slightly sandy slightly gravelly CLAY	C I
BH 16	3793	15.00	D	38.6	56	29	27	60	WS	Dark brown slightly sandy slightly gravelly CLAY	C H
BH 17	7705	4.50	D	20.5	30	14	16	80	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 17	7709	8.50	D	36.3	52	27	25	92	WS	Brown slightly sandy slightly gravelly CLAY	C H
BH 18	3375	2.50	D	19.9	37	24	13	55	WS	Orange yellow sandy gravelly CLAY(weathered rock)	C I
BH 21	7737	1.50	D	19.7	41	NP		52	WS	Yellow brown silty very sandy GRAVEL(poss weathered rock)	M I
BH 21	7738	2.50	D	21.2	48	NP		30	WS	Yellow brown silty very sandy GRAVEL(poss weathered rock)	M I

Notes: NAT - tested as received WS - Wet sieved (425µm) NP - Non Plastic

IGSL	Contract TRINITY WHARF WEXFORD	Contract No. 13184	
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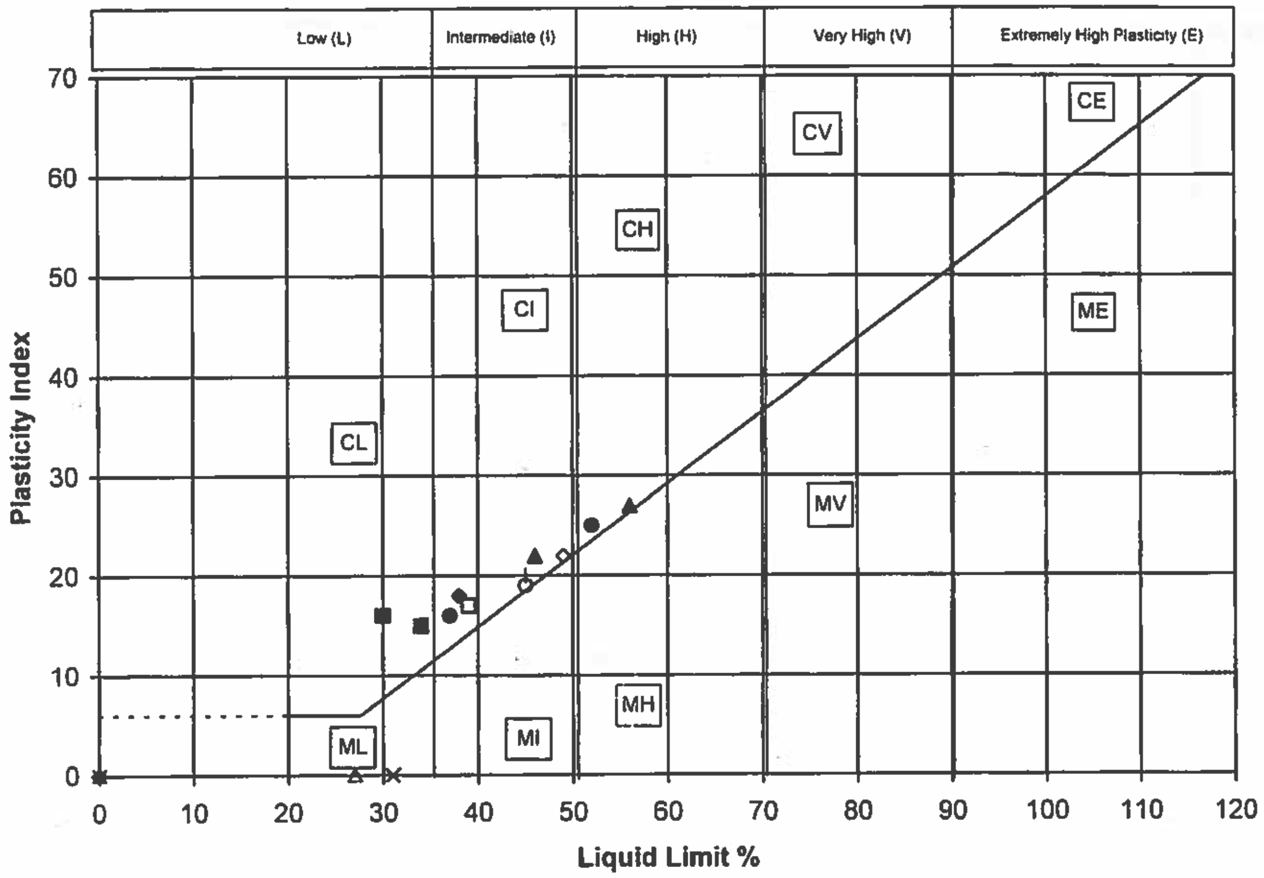
Plasticity Chart - Summary of Liquid & Plastic Limit Tests

BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18

Contract No. 13184 Contract: TRINITY WHARF WEXFORD



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425µm	Description
▲	BH 12	7727	5.50	18.9	46	24	22	98	Orange brown slightly sandy CLAY
■	BH 12	7729	7.50	25.5	34	19	15	77	Black slightly sandy slightly gravelly CLAY
●	BH 12	7732	10.50	27.3	37	21	16	96	Orange brown slightly sandy slightly gravelly CLAY
◆	BH 12	7734	12.50	18.4	38	20	18	50	Yellow very sandy gravelly CLAY
×	BH 14	3762	3.00	30.6	31	NP	0	81	Grey silty SAND with shell fragments
+	BH 14	3770	10.00	19.9	45	25	20	30	Brown slightly sandy gravelly CLAY with broken rock
△	BH 16	3780	3.00	24	27	NP	0	76	Grey silty slightly organic SAND
□	BH 16	3782	4.00	22	39	22	17	64	Orange brown slightly sandy slightly gravelly CLAY
○	BH 16	3786	8.00	28.5	45	26	19	80	Mottled orange black brown sandy gravelly CLAY
◇	BH 16	3789	11.00	32	49	27	22	92	Orange brown slightly sandy slightly gravelly CLAY
▲	BH 16	3793	15.00	38.6	56	29	27	60	Dark brown slightly sandy slightly gravelly CLAY
■	BH 17	7705	4.50	20.5	30	14	16	80	Grey brown slightly sandy slightly gravelly CLAY
●	BH 17	7709	8.50	36.3	52	27	25	92	Brown slightly sandy slightly gravelly CLAY
◆									
×									
+									
△									

NP denotes specimen is non-plastic.

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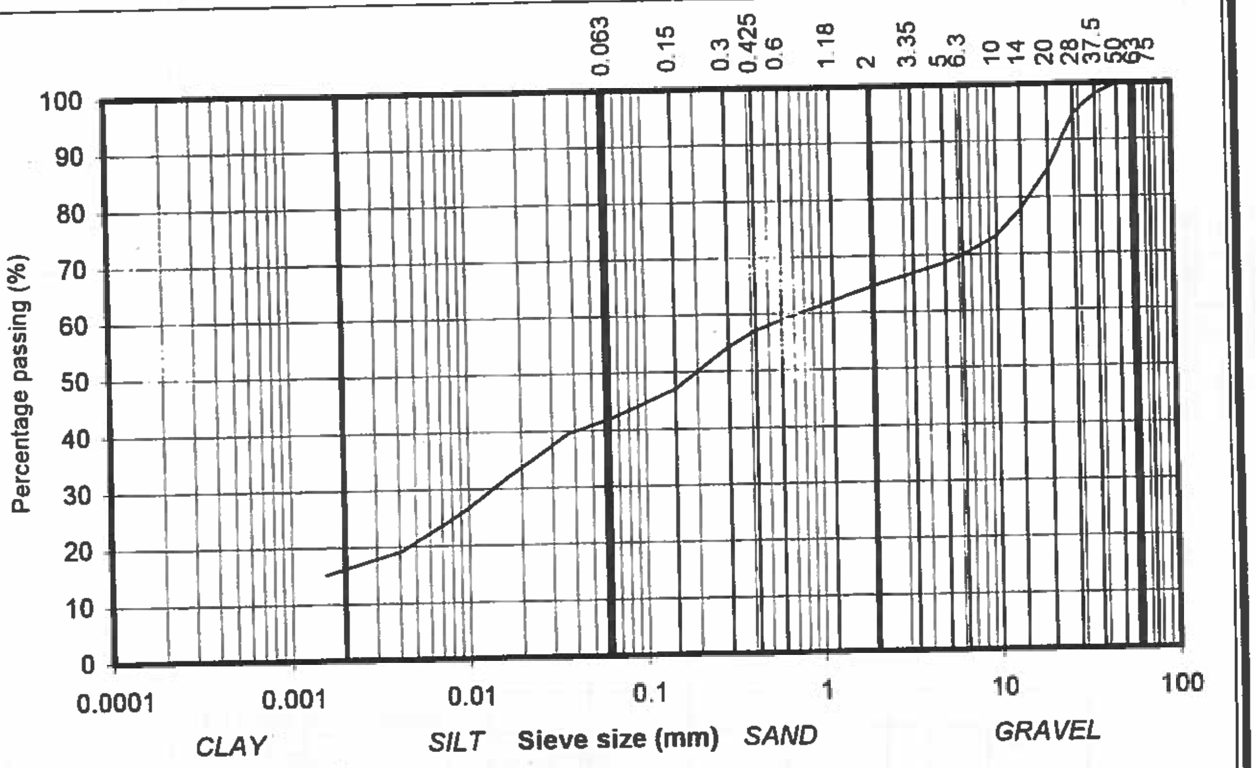
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 4
SAMPLE No.: 3724
DEPTH (m): 7.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Brown slightly sandy, gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	98	
28	95	
20	85	
14	78	
10	73	
6.3	70	
5	69	
3.35	67	
2	65	SAND
1.18	62	
0.6	59	
0.425	57	
0.3	54	
0.15	47	
0.063	42	SILT/CLAY
0.037	39	
0.026	36	
0.017	32	
0.010	27	
0.007	24	
0.004	19	
0.002	15	



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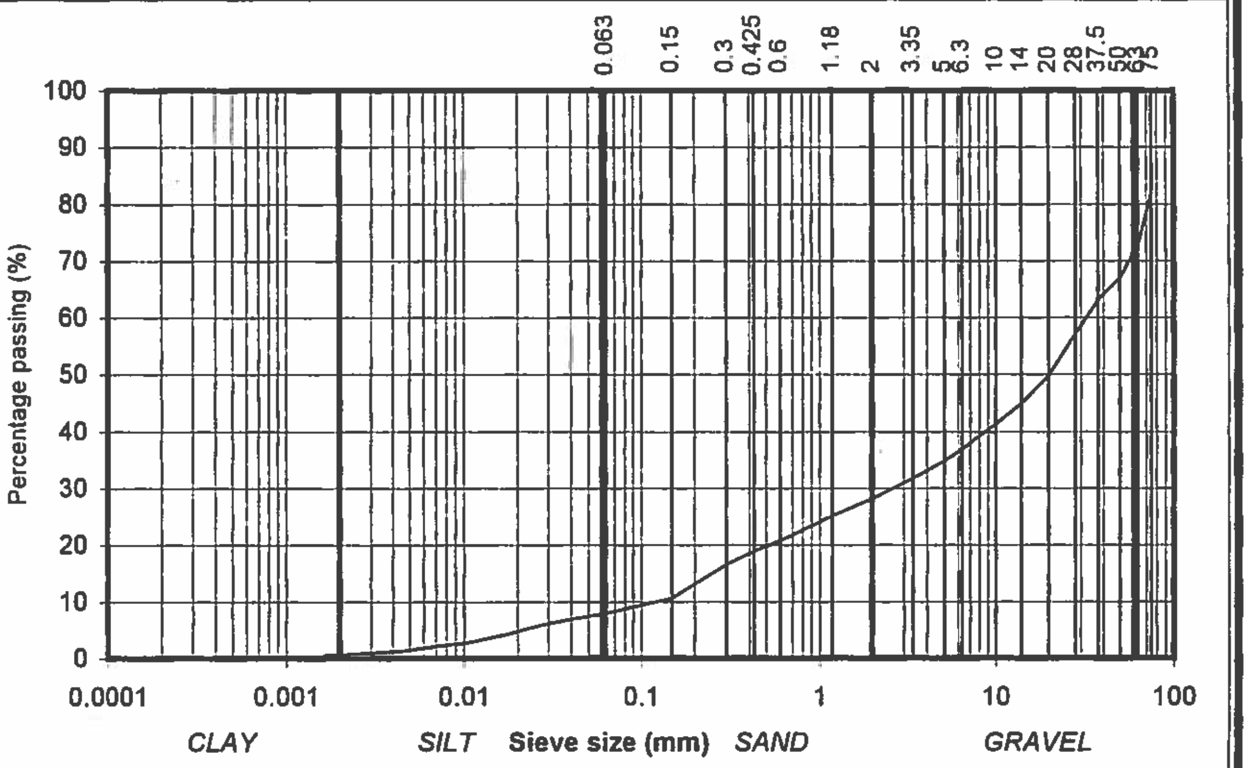
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 5
SAMPLE No.: 3741
DEPTH (m): 3.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Orange brown silty, very sandy, GRAVEL with many cobbles

particle size	% passing	
75	82	COBBLES
63	73	GRAVEL
50	67	
37.5	63	
28	57	
20	50	
14	45	
10	41	
6.3	37	
5	35	
3.35	32	
2	28	SAND
1.18	25	
0.6	21	
0.425	19	
0.3	17	
0.15	11	
0.063	8	SILT/CLAY
0.038	7	
0.027	6	
0.018	4	
0.010	3	
0.007	2	
0.004	1	
0.002	1	



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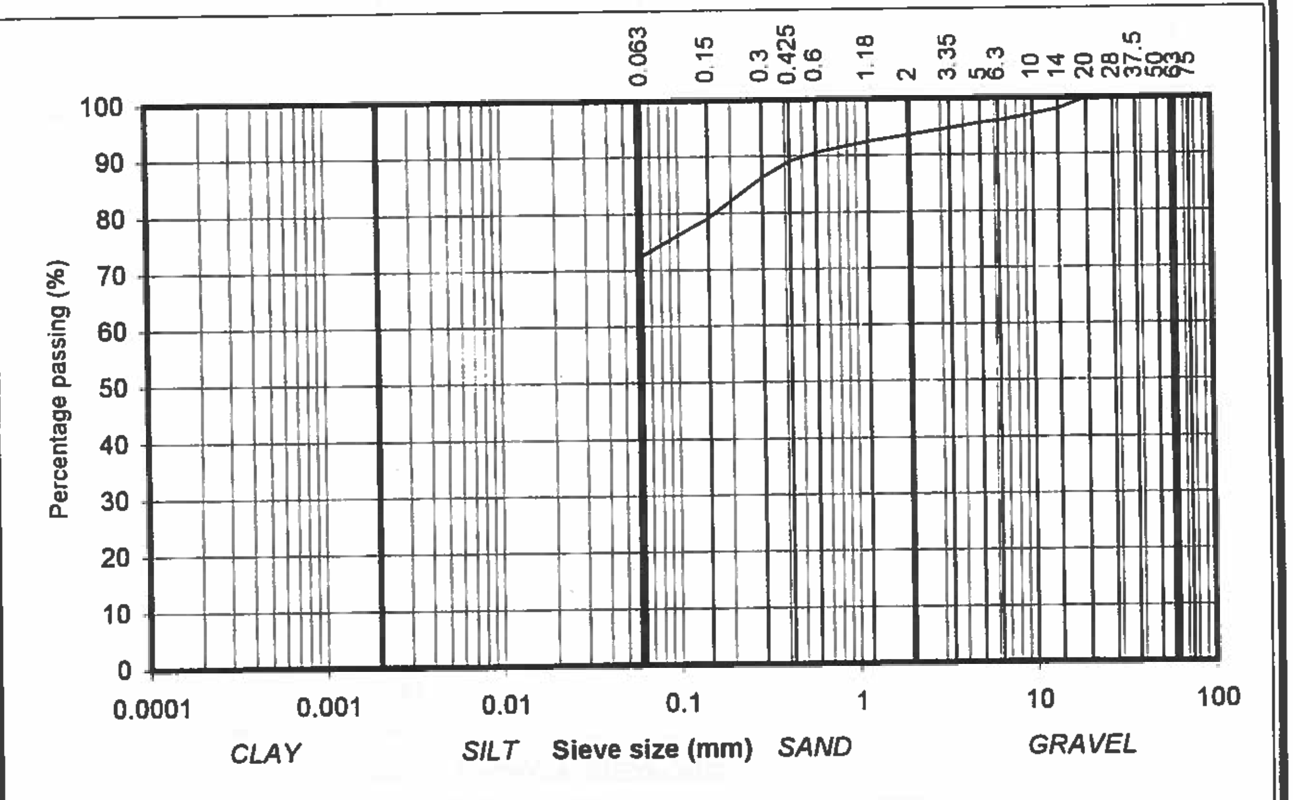
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 5
SAMPLE No.: 3744
DEPTH (m): 6.50
TEST METHOD: Wet sieve
DESCRIPTION: Brown slightly sandy, slightly gravelly, SILT/CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	98	
10	97	
6.3	96	
5	96	
3.35	95	
2	94	SAND
1.18	93	
0.6	91	
0.425	89	
0.3	86	
0.15	79	
0.063	73	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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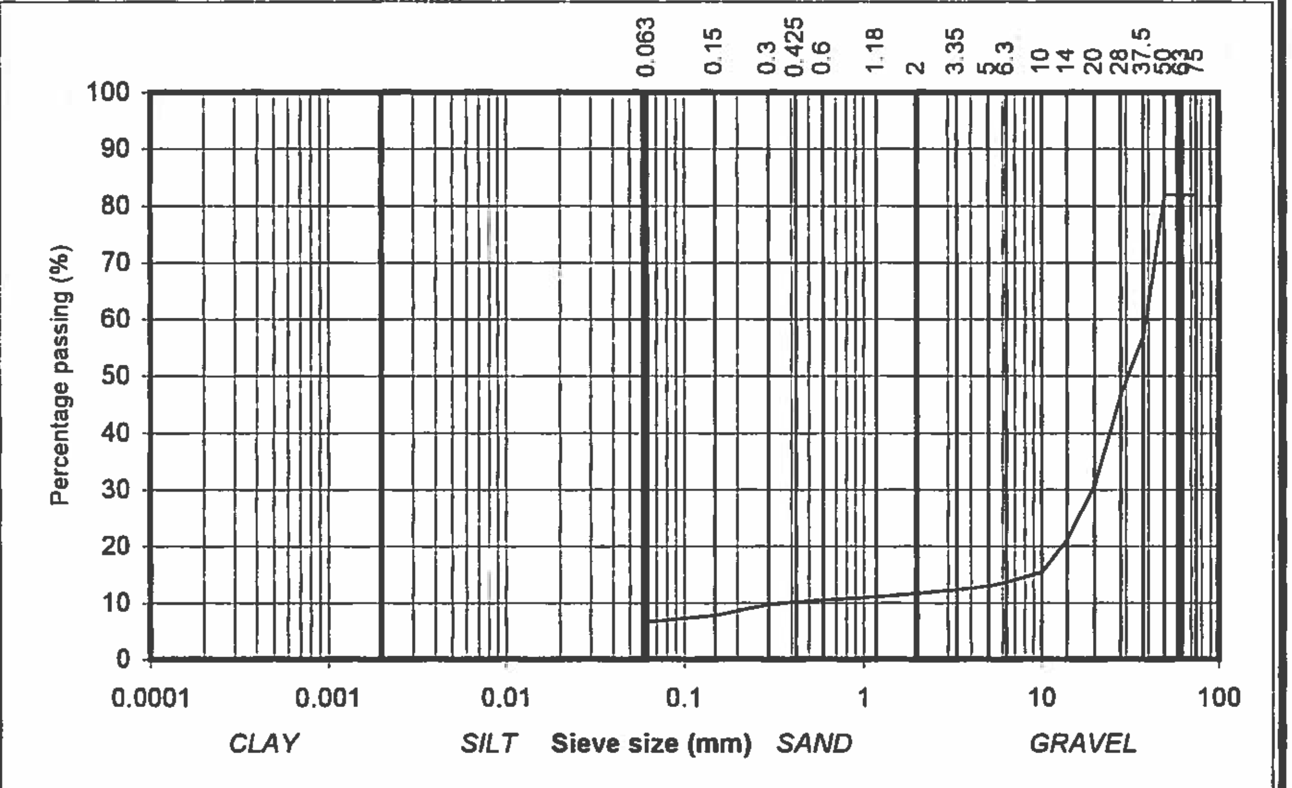
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 5
SAMPLE No.: 3746
DEPTH (m): 8.50
TEST METHOD: Wet sieve
DESCRIPTION: Brown clayey/silty, slightly sandy, GRAVEL with some cobbles

particle size	% passing	
75	82	COBBLES
63	82	GRAVEL
50	82	
37.5	57	
28	47	
20	31	
14	21	
10	15	
6.3	14	
5	13	
3.35	12	
2	12	SAND
1.18	11	
0.6	10	
0.425	10	
0.3	10	
0.15	8	
0.063	7	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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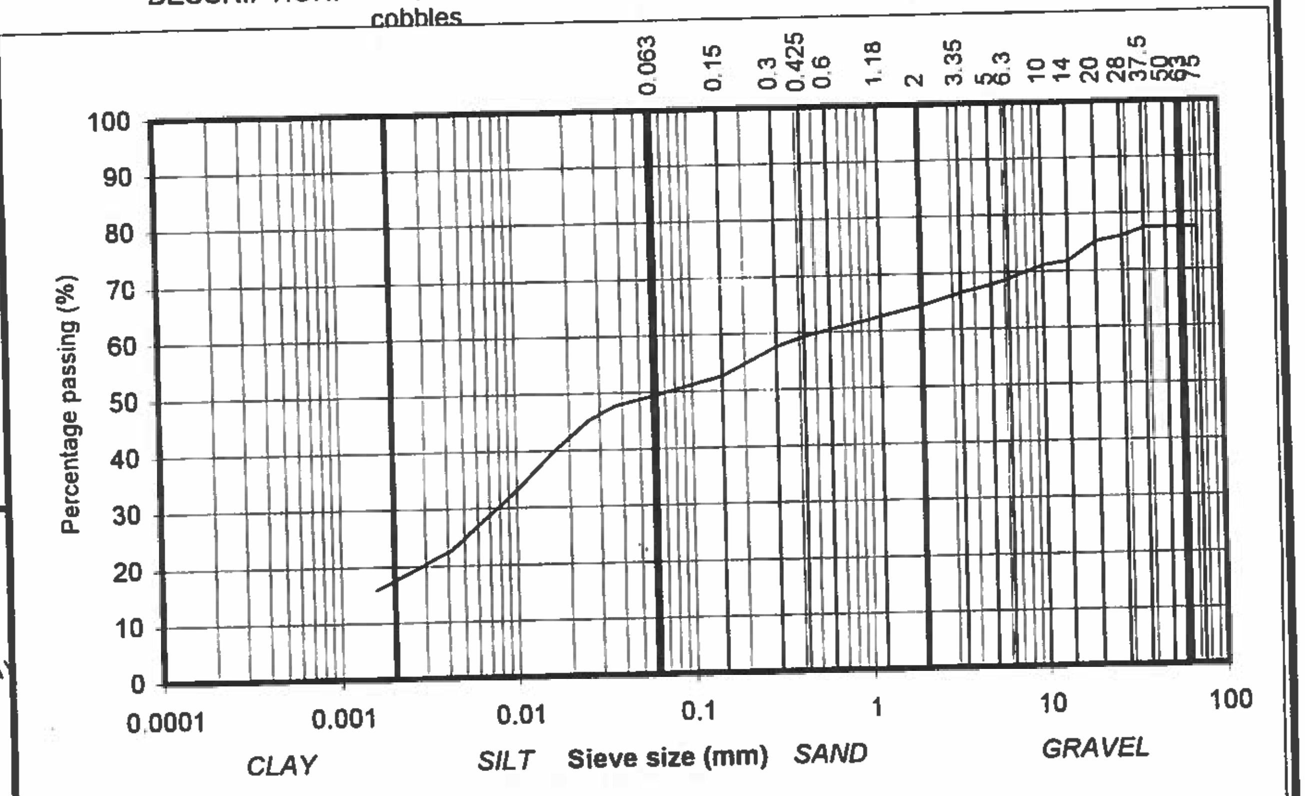
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 6
SAMPLE No.: 3733
DEPTH (m): 6.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Grey brown slightly sandy, slightly gravelly, CLAY with many cobbles

particle size	% passing	
75	77	COBBLES
63	77	GRAVEL
50	77	
37.5	77	
28	76	
20	75	
14	72	
10	71	
6.3	69	
5	68	
3.35	67	
2	64	SAND
1.18	63	
0.6	60	
0.425	59	
0.3	58	
0.15	53	
0.063	50	SILT/CLAY
0.037	48	
0.026	45	
0.017	40	
0.010	33	
0.007	29	
0.004	23	
0.002	16	



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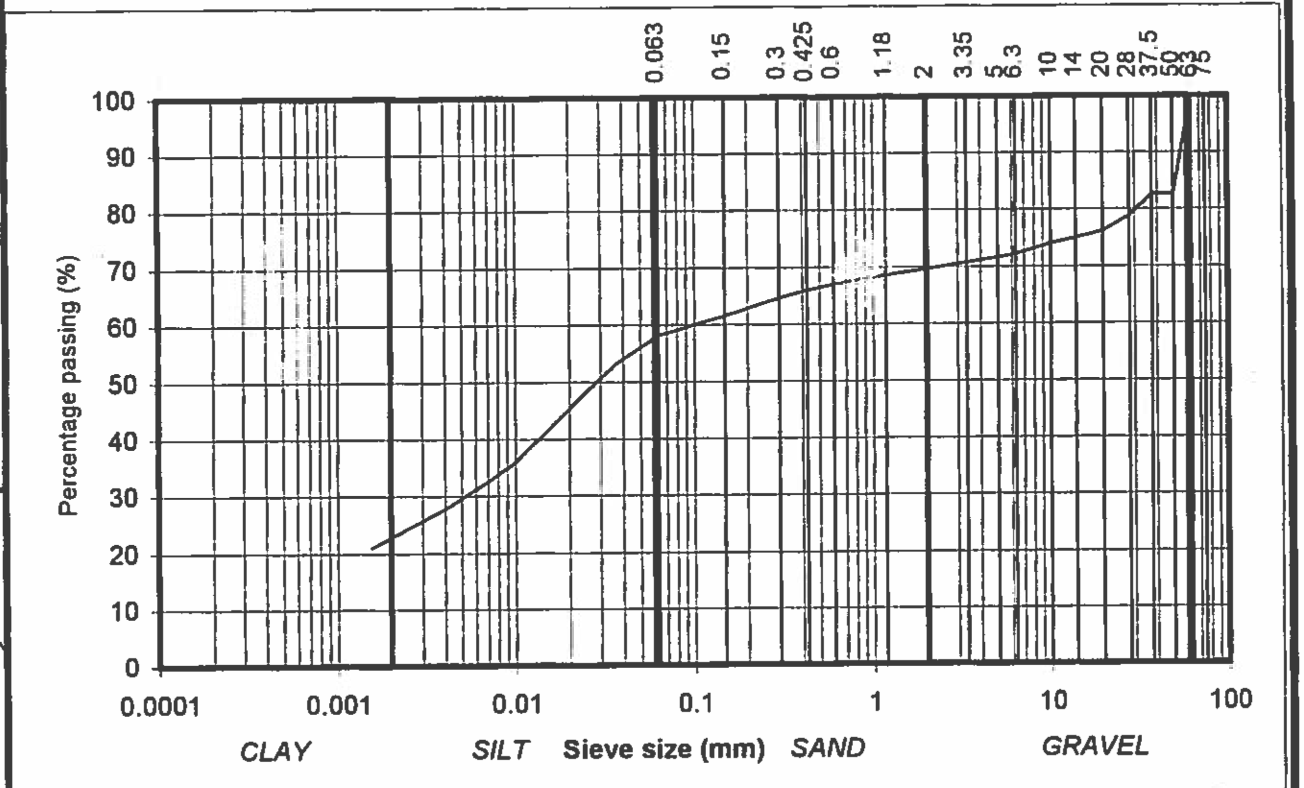
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 8
SAMPLE No.: 3756
DEPTH (m): 7.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Orange brown slightly sandy, slightly gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	83	
37.5	83	
28	79	
20	76	
14	75	
10	74	
6.3	72	
5	72	
3.35	71	
2	70	SAND
1.18	69	
0.6	67	
0.425	66	
0.3	65	
0.15	62	
0.063	58	SILT/CLAY
0.037	53	
0.026	49	
0.017	43	
0.010	36	
0.007	33	
0.004	28	
0.002	21	



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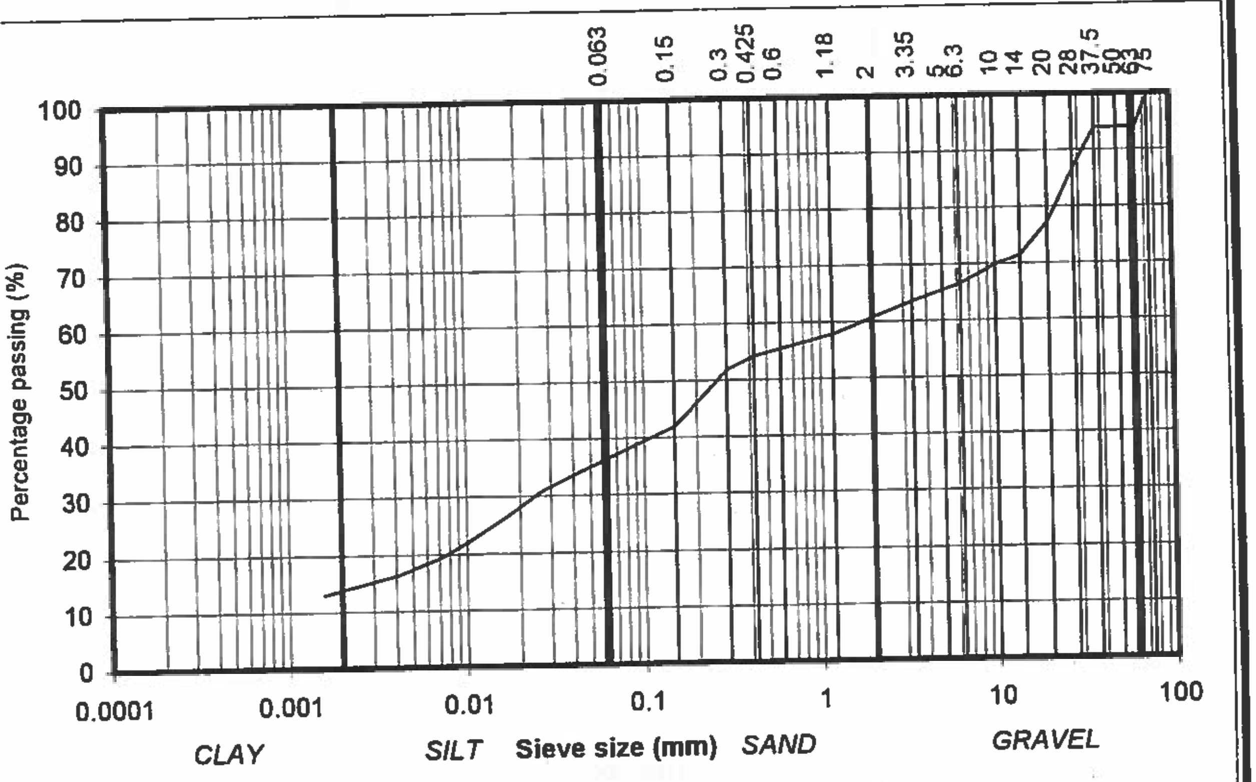
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 9
SAMPLE No.: 7719
DEPTH (m): 5.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Grey brown slightly sandy, gravelly, CLAY with some cobbles

particle size	% passing	
75	100	COBBLES
63	94	GRAVEL
50	94	
37.5	94	
28	87	
20	77	
14	72	
10	70	
6.3	67	
5	65	
3.35	63	
2	61	SAND
1.18	58	
0.6	55	
0.425	54	
0.3	52	
0.15	42	
0.063	37	SILT/CLAY
0.037	33	
0.027	31	
0.017	27	
0.010	22	
0.007	19	
0.004	16	
0.002	13	



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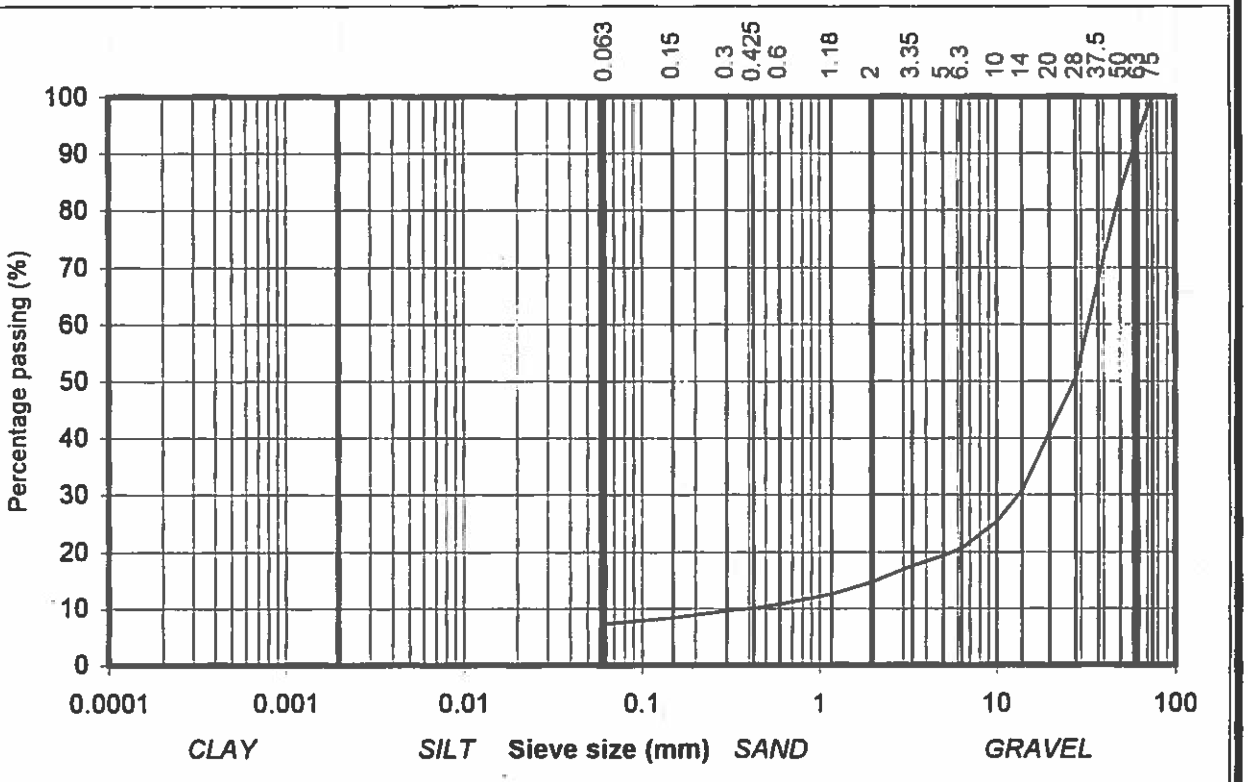
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 9
SAMPLE No.: 7723
DEPTH (m): 9.50
TEST METHOD: Wet sieve
DESCRIPTION: Grey brown clayey/silty, sandy, GRAVEL with some cobbles

particle size	% passing	
75	100	COBBLES
63	93	GRAVEL
50	84	
37.5	68	
28	51	
20	41	
14	31	
10	25	
6.3	21	
5	19	
3.35	18	
2	15	SAND
1.18	13	
0.6	11	
0.425	10	
0.3	10	
0.15	8	
0.063	7	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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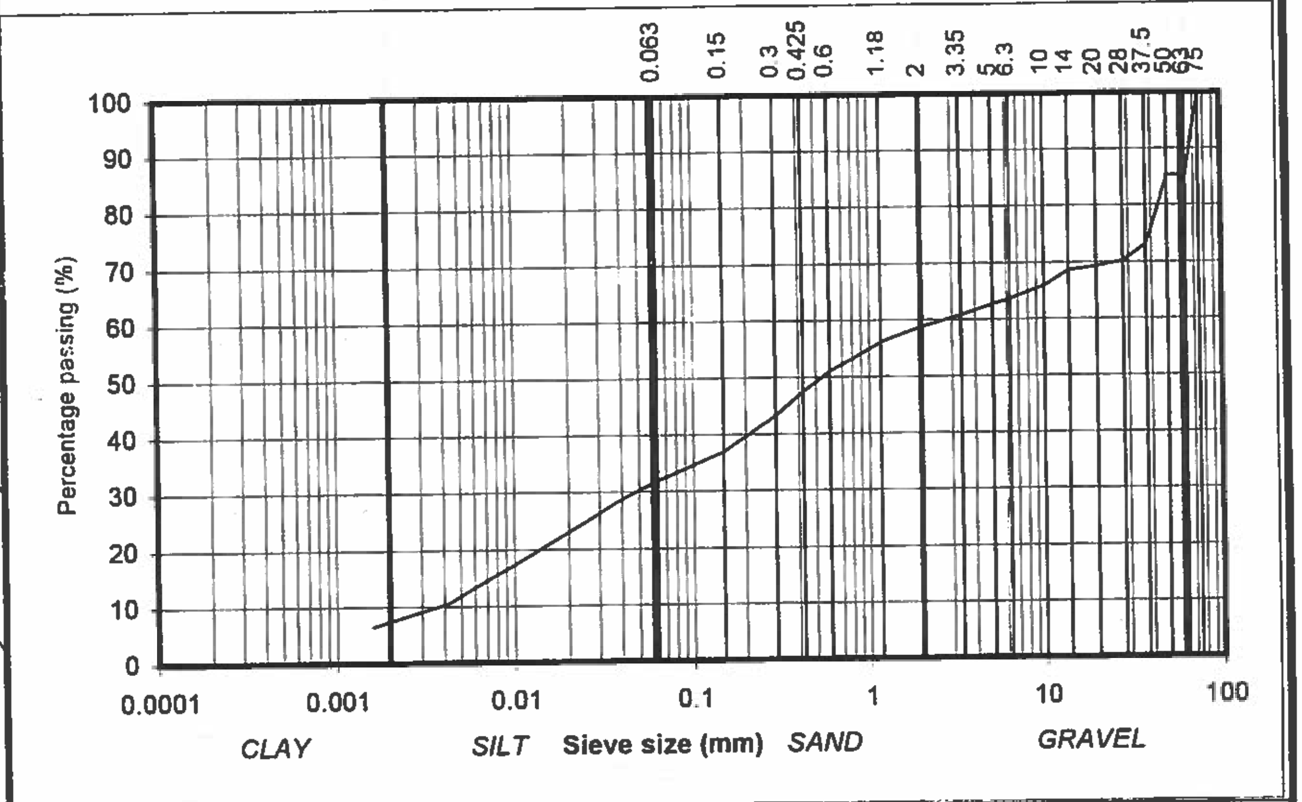
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	85	GRAVEL
50	85	
37.5	73	
28	70	
20	69	
14	69	
10	66	
6.3	64	
5	63	
3.35	61	
2	59	SAND
1.18	56	
0.6	51	
0.425	48	
0.3	43	
0.15	37	
0.063	32	SILT/CLA
0.037	28	
0.027	25	
0.017	22	
0.010	17	
0.007	15	
0.004	11	
0.002	6	

Contract No:	13184
Contract:	TRINITY WHARF WEXFORD
BH/TP No:	BH 11
SAMPLE No.:	7751
DEPTH (m):	5.50
TEST METHOD:	Wet sieve and hydrometer
DESCRIPTION:	Grey brown slightly sandy, gravelly, CLAY with some cobbles



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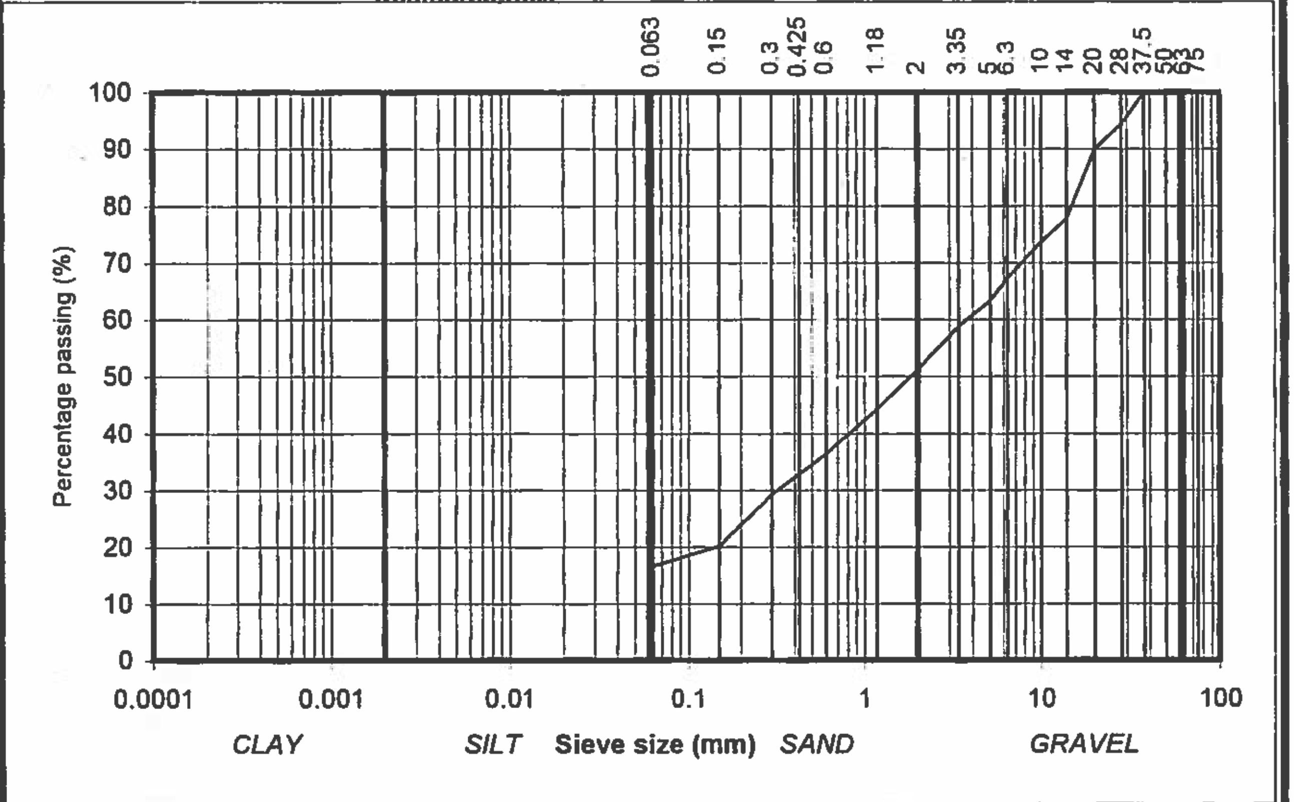
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	94	
20	90	
14	78	
10	74	
6.3	67	
5	63	
3.35	59	
2	51	SAND
1.18	44	
0.6	37	
0.425	33	
0.3	29	
0.15	20	
0.063	17	SILT/CLA
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No:	13184
Contract:	TRINITY WHARF WEXFORD
BH/TP No:	BH 11
SAMPLE No.:	7753
DEPTH (m):	7.50
TEST METHOD:	Wet sieve
DESCRIPTION:	Yellow brown clayey/silty, very sandy, GRAVEL possible weathered rock



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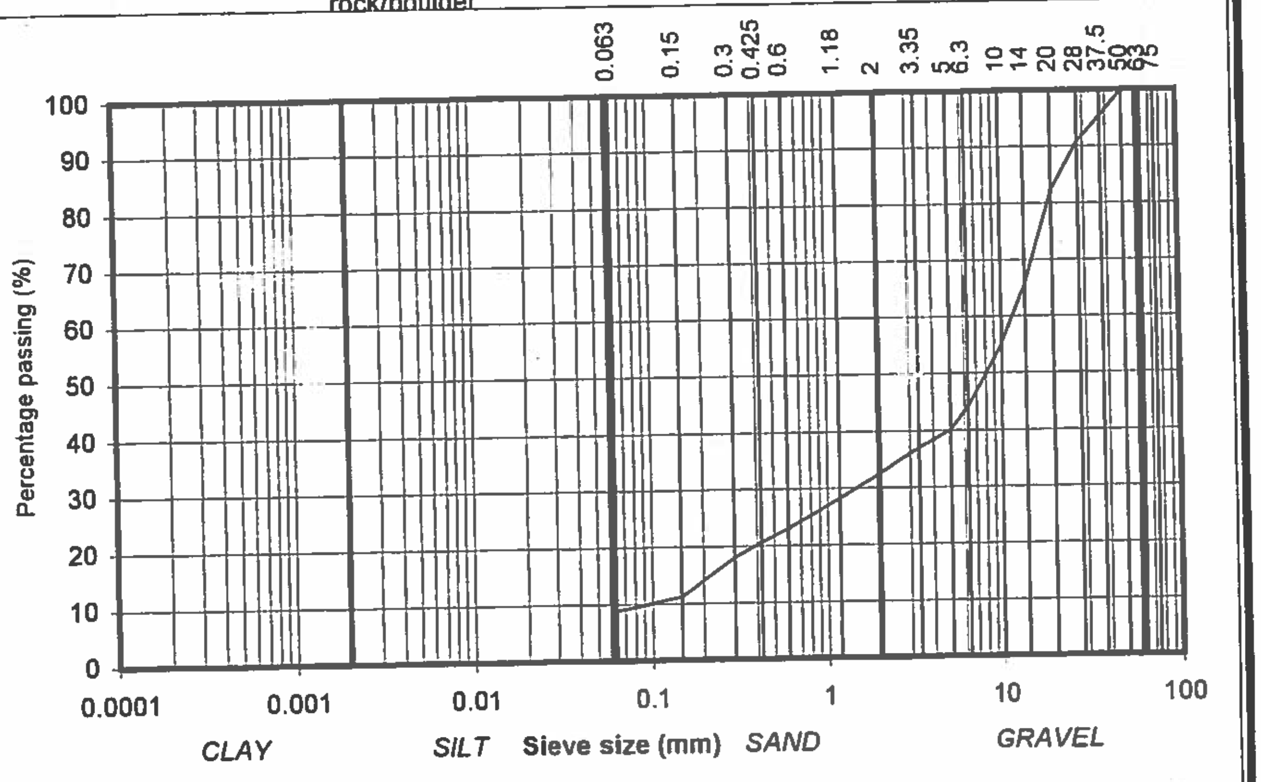
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 11
SAMPLE No.: 7754
DEPTH (m): 8.50
TEST METHOD: Wet sieve
DESCRIPTION: Brown clayey/silty, very sandy, GRAVEL with broken rock/boulder

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	95	
28	91	
20	82	
14	66	
10	55	
6.3	44	
5	40	
3.35	37	
2	32	SAND
1.18	28	
0.6	23	
0.425	21	
0.3	18	
0.15	11	
0.063	9	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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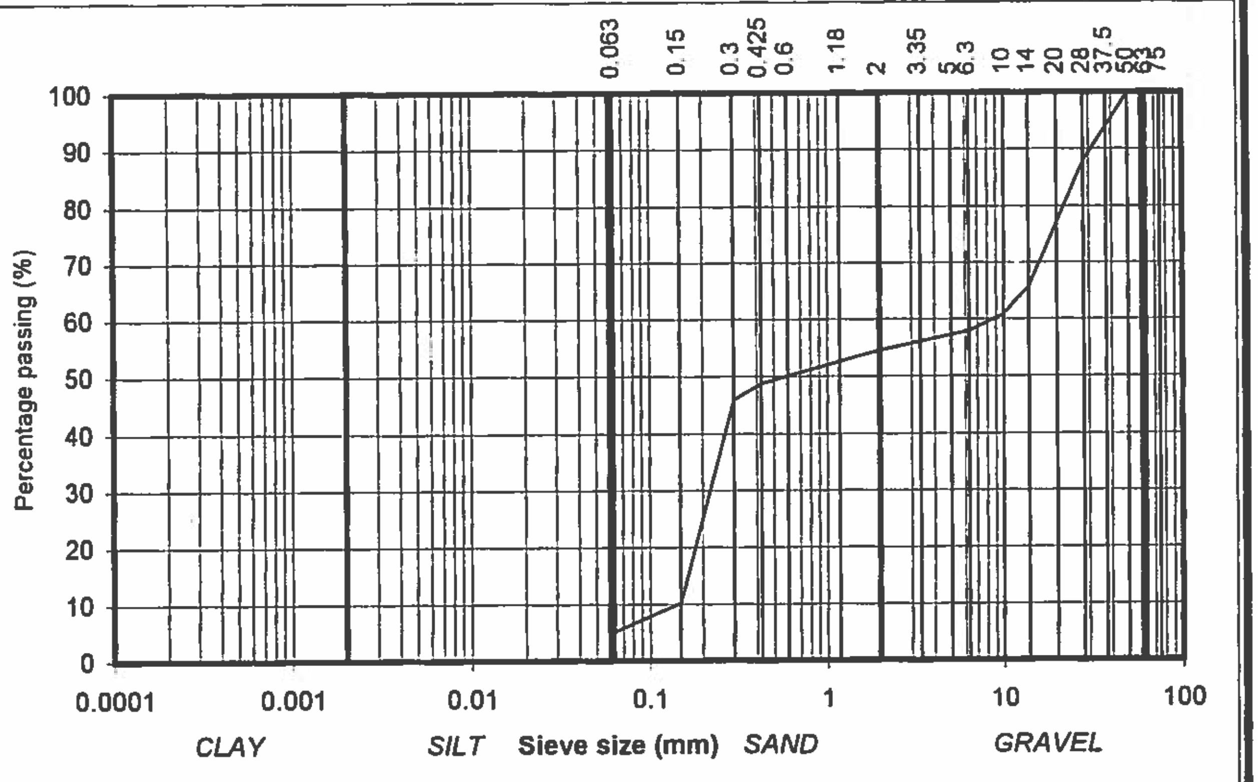
IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 12
SAMPLE No.: 7725
DEPTH (m): 3.50
TEST METHOD: Wet sieve
DESCRIPTION: Orange brown clayey, very gravelly, SAND

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	94	
28	88	
20	77	
14	66	
10	61	
6.3	58	
5	57	
3.35	56	
2	55	SAND
1.18	53	
0.6	50	
0.425	49	
0.3	46	
0.15	10	
0.063	5	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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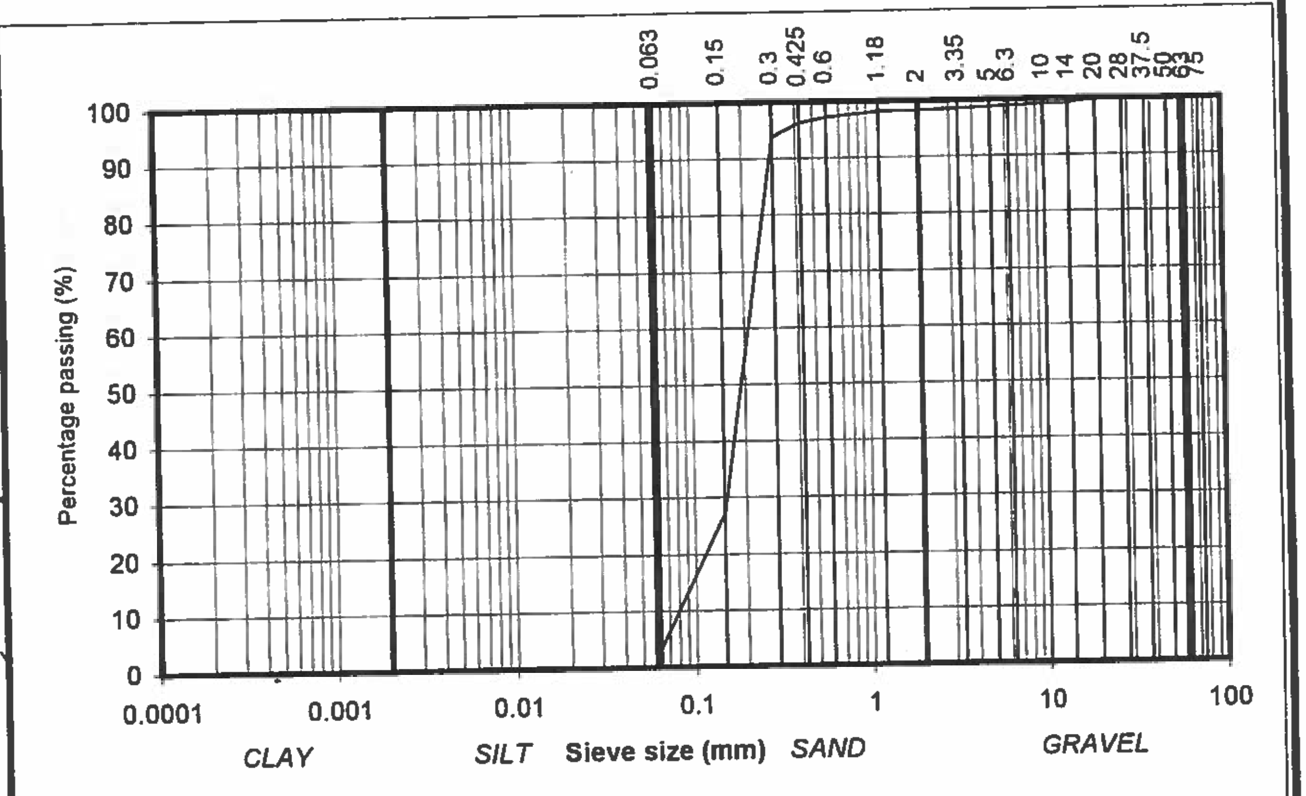
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	99	
10	99	
6.3	99	
5	99	
3.35	99	
2	98	SAND
1.18	98	
0.6	97	
0.425	96	
0.3	94	
0.15	27	
0.063	4	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 14
SAMPLE No.: 3760
DEPTH (m): 1.50
TEST METHOD: Wet sieve
DESCRIPTION: Grey brown slightly clayey/silty, slightly gravelly, SAND



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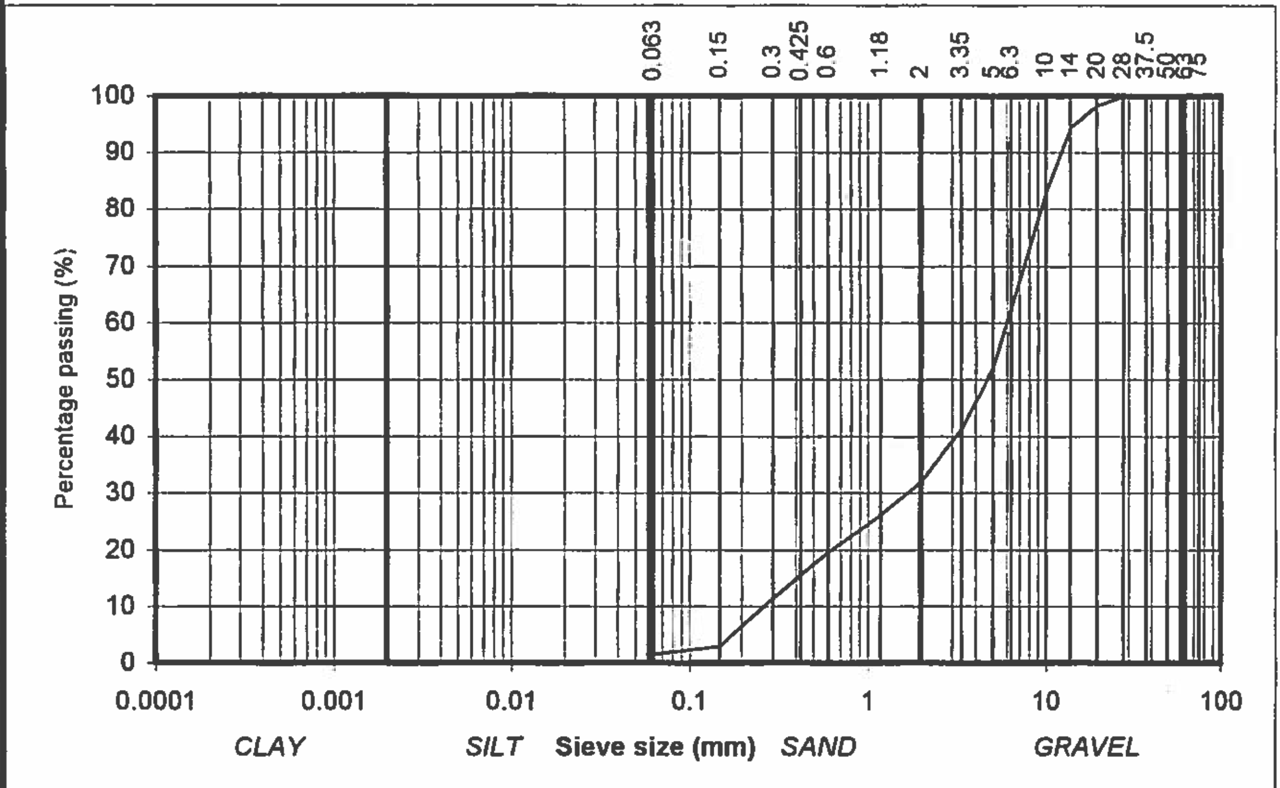
PSD V3.1 12.01

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	98	
14	94	
10	83	
6.3	63	
5	52	
3.35	41	
2	32	SAND
1.18	26	
0.6	20	
0.425	16	
0.3	11	
0.15	3	
0.063	2	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 14
SAMPLE No.: 3767
DEPTH (m): 7.00
TEST METHOD: Wet sieve
DESCRIPTION: Brown slightly clayey/silty, very sandy, GRAVEL



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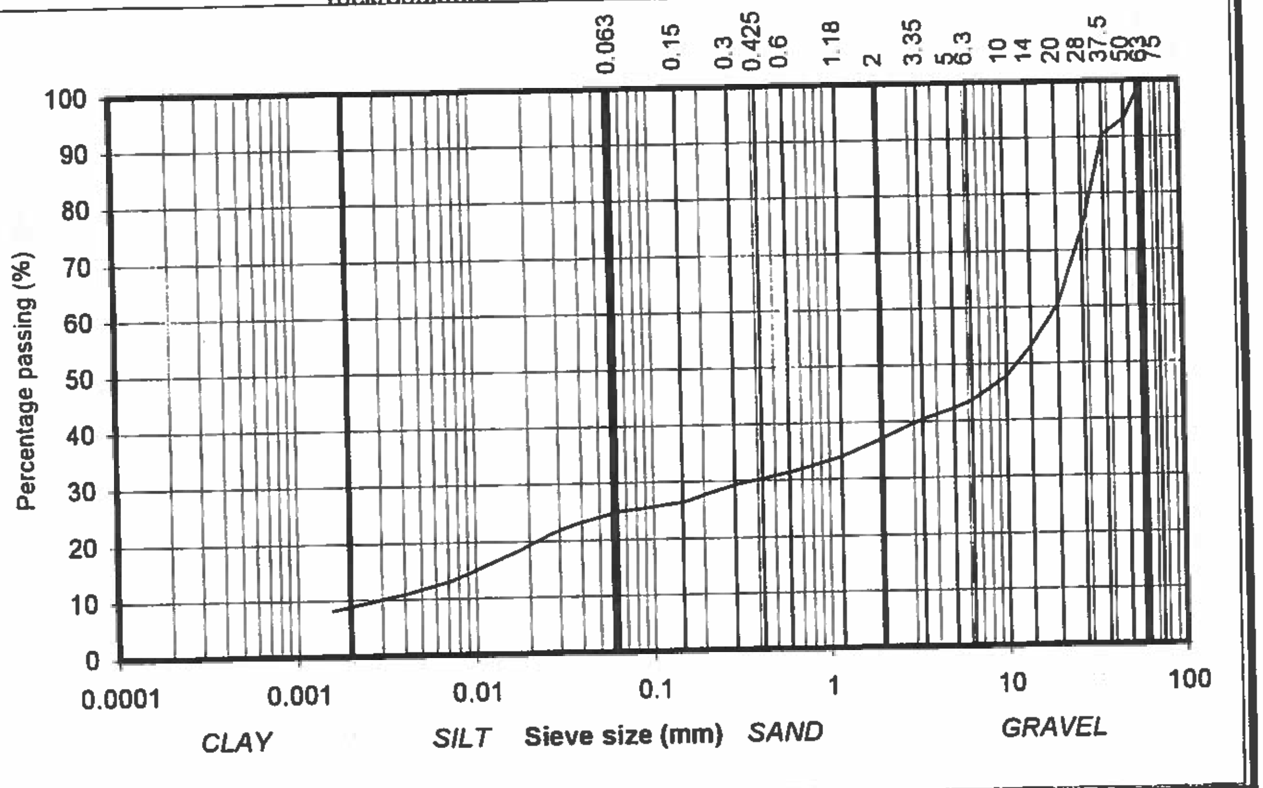
PSD V3.1 12.01

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 14
SAMPLE No.: 3770
DEPTH (m): 10.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Brown slightly sandy, gravelly, CLAY with broken rock/boulders

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	93	
37.5	90	
28	74	
20	60	
14	53	
10	48	
6.3	44	
5	42	
3.35	41	
2	37	SAND
1.18	34	
0.6	31	
0.425	30	
0.3	29	
0.15	26	
0.063	25	SILT/CLAY
0.037	23	
0.027	21	
0.017	18	
0.010	15	
0.007	13	
0.004	11	
0.002	8	



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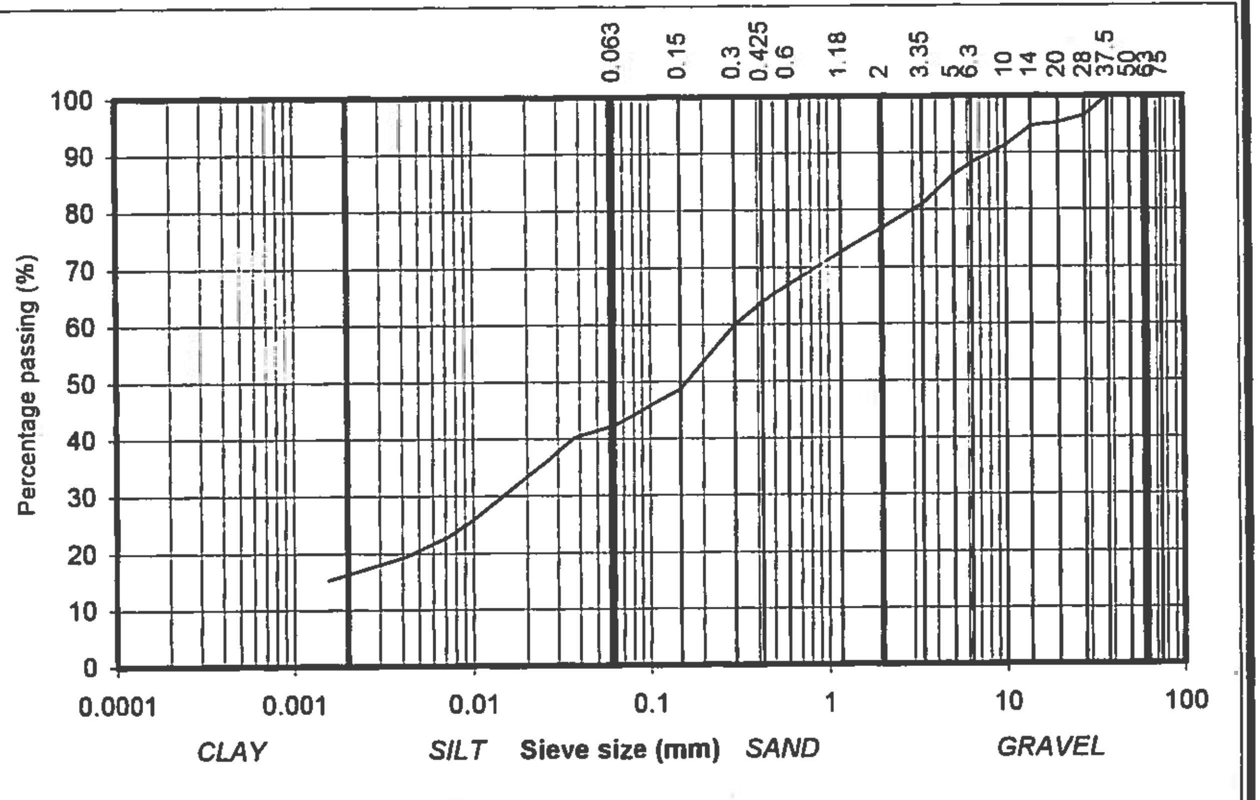
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 16
SAMPLE No.: 3782
DEPTH (m): 4.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Orange brown slightly sandy, slightly gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	97	
20	95	
14	95	
10	91	
6.3	88	
5	86	
3.35	81	
2	77	SAND
1.18	73	
0.6	67	
0.425	64	
0.3	60	
0.15	49	
0.063	42	SILT/CLAY
0.037	40	
0.027	36	
0.017	32	
0.010	26	
0.007	23	
0.004	19	
0.002	15	



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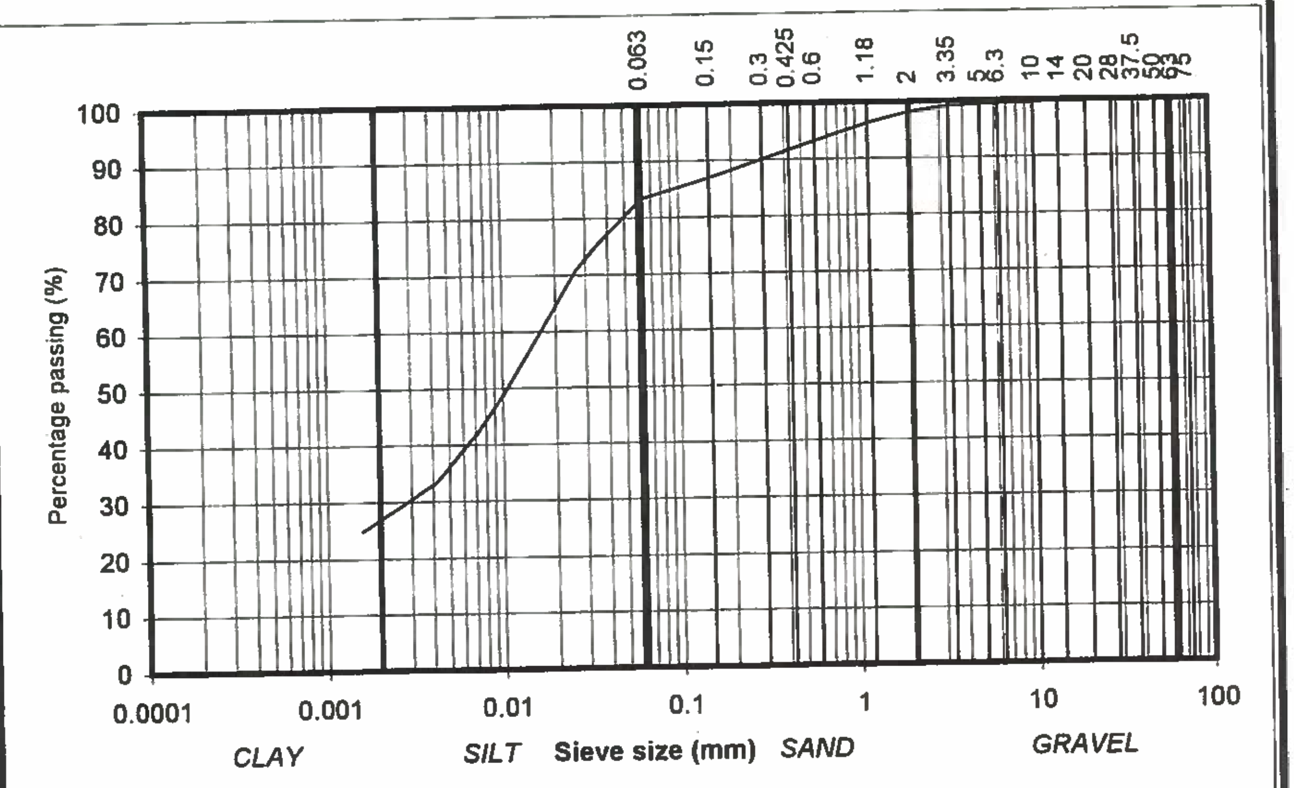
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 16
SAMPLE No.: 3789
DEPTH (m): 11.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Orange brown slightly sandy, slightly gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	100	
10	100	
6.3	100	
5	99	
3.35	99	
2	98	SAND
1.18	96	
0.6	93	
0.425	92	
0.3	90	
0.15	87	
0.063	83	SILT/CLAY
0.037	76	
0.027	71	
0.017	61	
0.010	49	
0.007	42	
0.004	33	
0.002	25	



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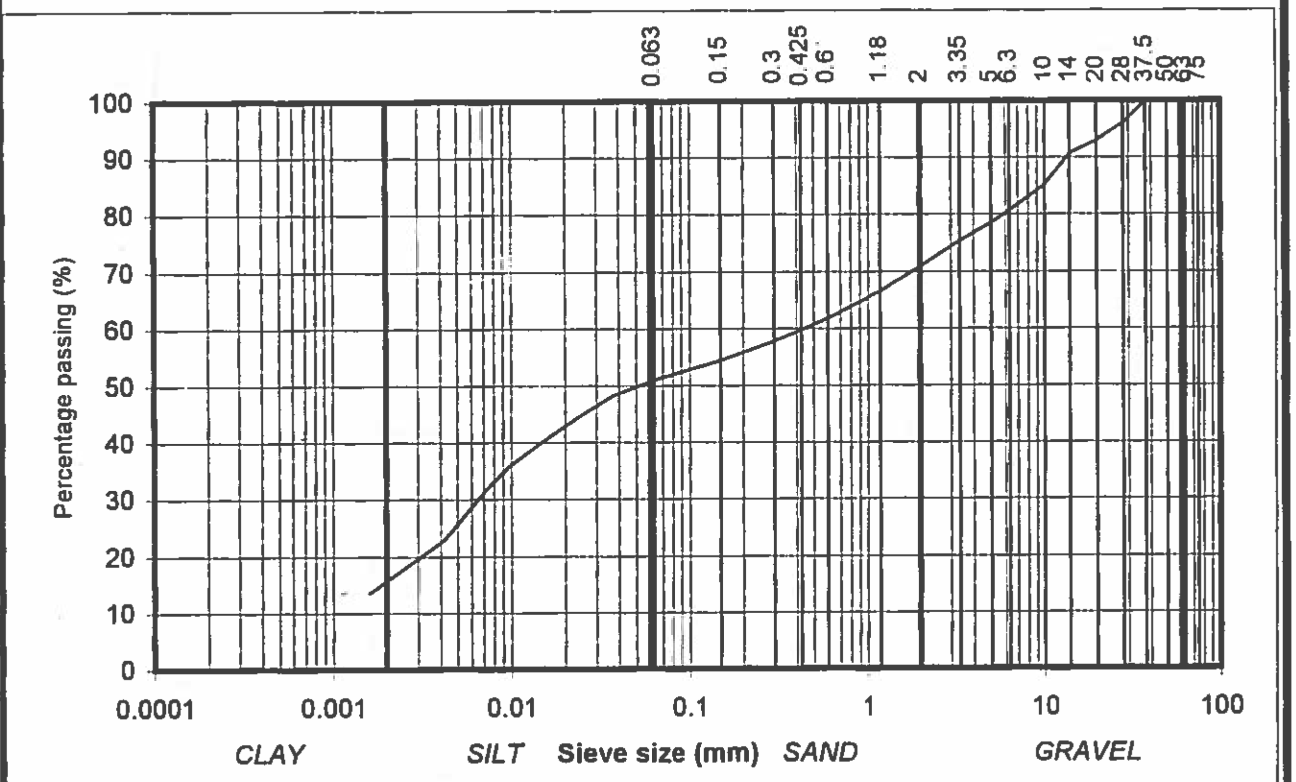
PSD V3.1 12.01

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 16
SAMPLE No.: 3793
DEPTH (m): 15.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Dark brown slightly sandy, slightly gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	96	
20	93	
14	91	
10	85	
6.3	81	
5	79	
3.35	75	
2	71	SAND
1.18	67	
0.6	62	
0.425	60	
0.3	58	
0.15	54	
0.063	51	SILT/CLAY
0.037	48	
0.026	45	
0.017	41	
0.010	36	
0.007	32	
0.004	23	
0.002	14	



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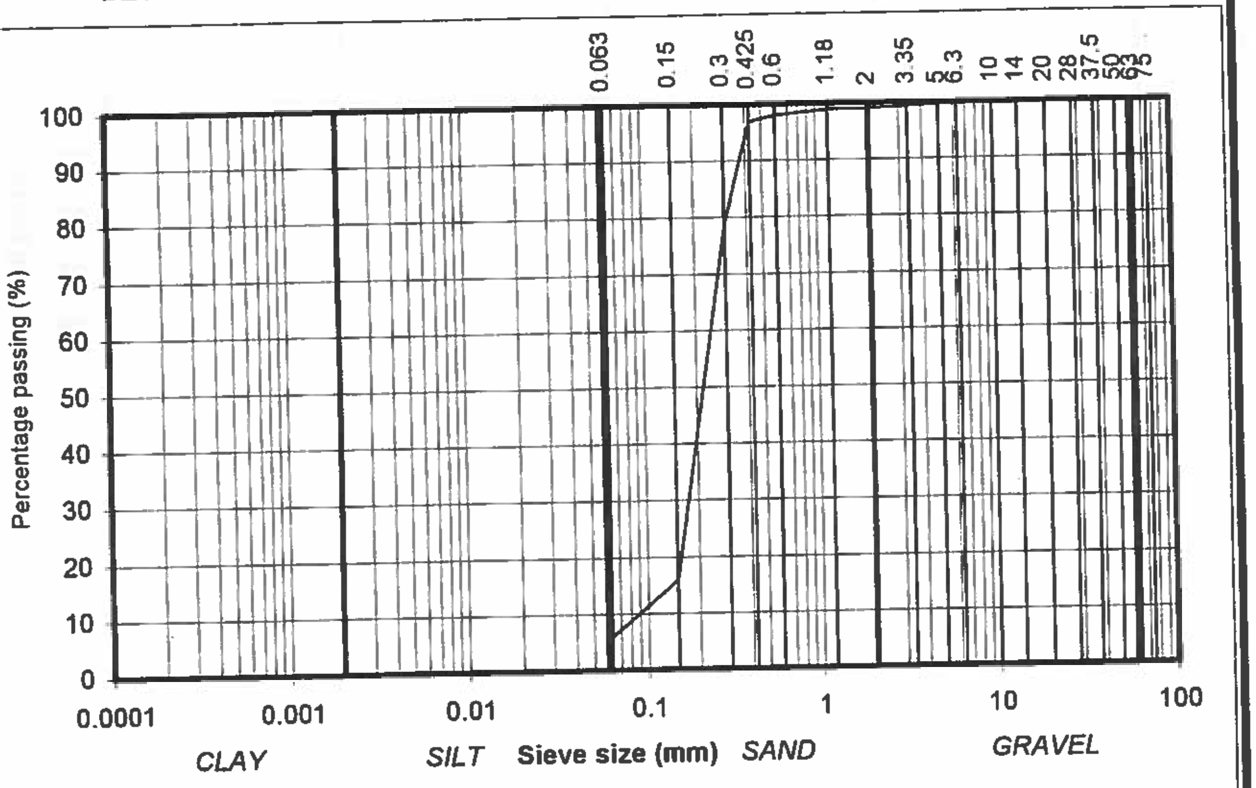
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	100	
10	100	
6.3	100	
5	100	
3.35	99	
2	99	SAND
1.18	99	
0.6	98	
0.425	97	
0.3	79	
0.15	16	
0.063	6	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 17
SAMPLE No.: 7704
DEPTH (m): 3.50
TEST METHOD: Wet sieve
DESCRIPTION: Grey brown clayey/silty, slightly gravelly, SAND



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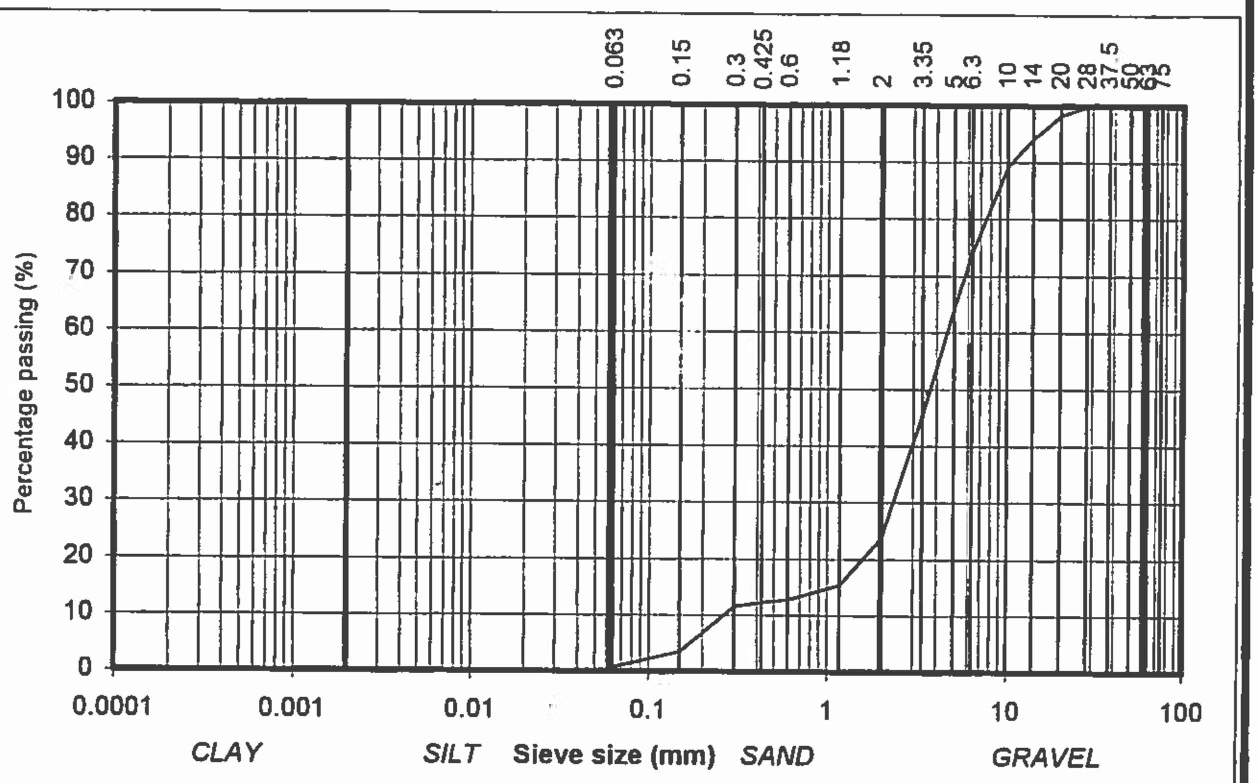
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	98	
14	94	
10	89	
6.3	74	
5	64	
3.35	46	
2	24	SAND
1.18	15	
0.6	13	
0.425	12	
0.3	12	
0.15	4	
0.063	1	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 17
SAMPLE No.: 7707
DEPTH (m): 6.50
TEST METHOD: Wet sieve
DESCRIPTION: Brown slightly clayey/silty, very sandy, GRAVEL



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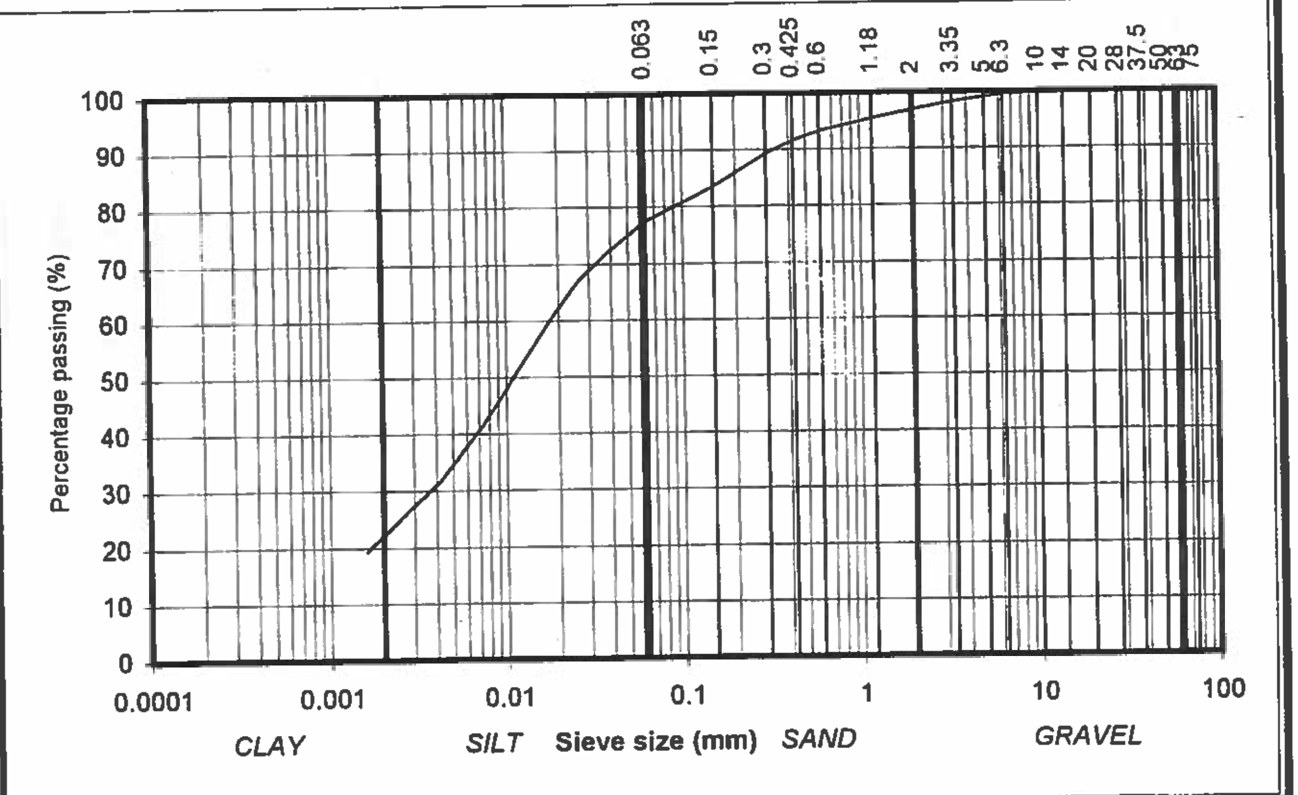
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 17
SAMPLE No.: 7709
DEPTH (m): 8.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Brown slightly sandy, slightly gravelly, CLAY

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	100	
10	100	
6.3	100	
5	99	
3.35	98	
2	97	SAND
1.18	95	
0.6	93	
0.425	92	
0.3	89	
0.15	84	
0.063	78	SILT/CLAY
0.037	72	
0.026	67	
0.017	59	
0.010	48	
0.007	41	
0.004	32	
0.002	19	



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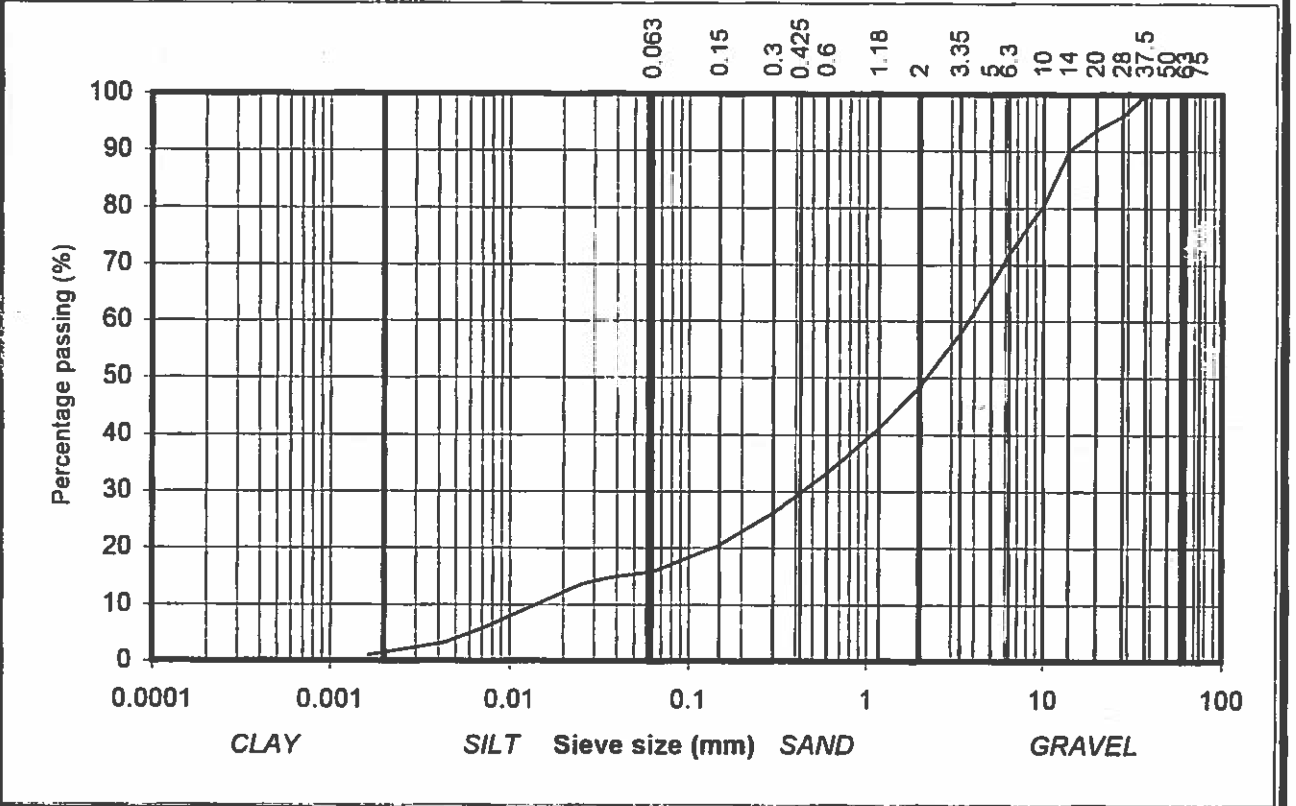
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 21
SAMPLE No.: 7738
DEPTH (m): 2.50
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Yellow brown silty, very sandy, GRAVEL possible weathered rock

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	96	
20	94	
14	90	
10	81	
6.3	72	
5	66	
3.35	58	
2	49	SAND
1.18	41	
0.6	33	
0.425	30	
0.3	26	
0.15	21	
0.063	16	SILT/CLAY
0.037	15	
0.026	14	
0.017	11	
0.010	8	
0.007	6	
0.004	3	
0.002	1	



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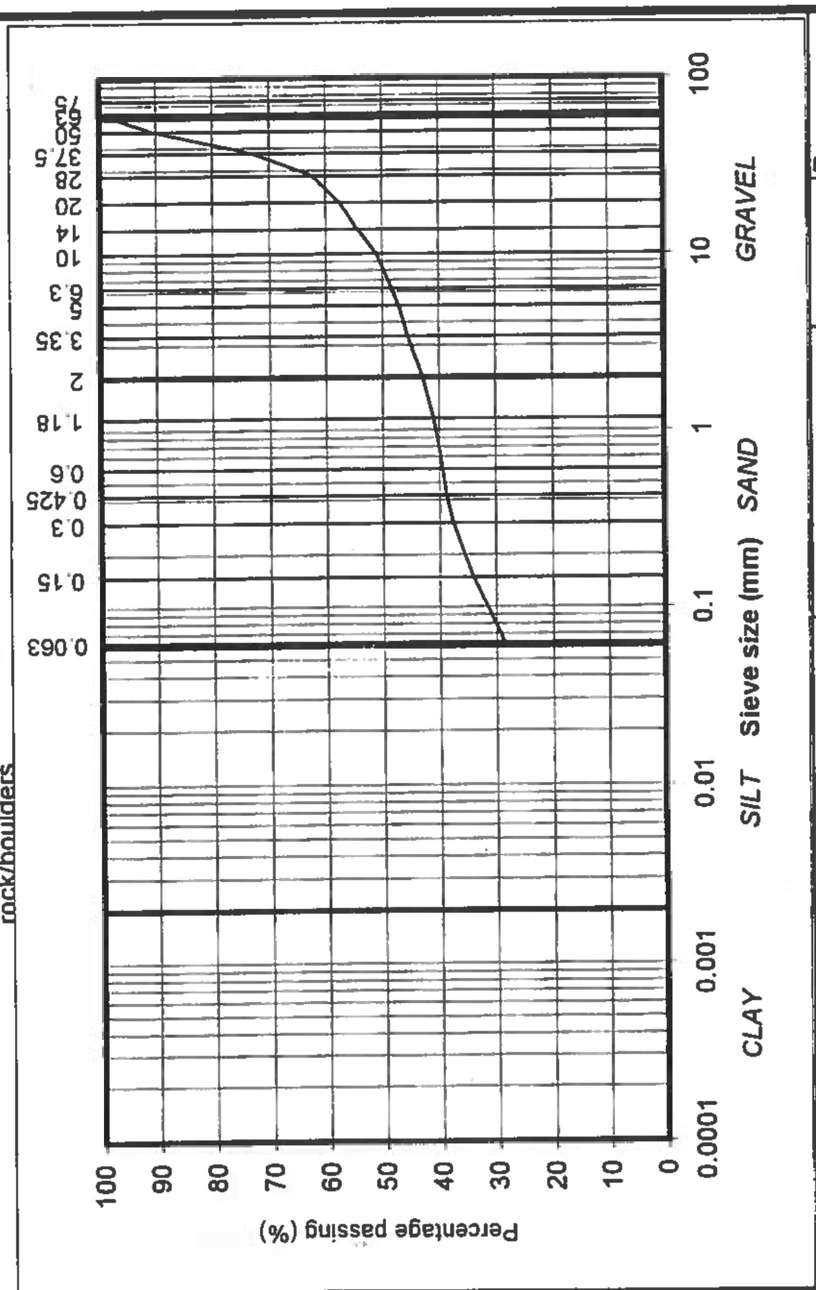
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

Contract No: 13184
Contract: TRINITY WHARF WEXFORD
BH/TP No: BH 22
SAMPLE No.: 7743
DEPTH (m): 2.50
TEST METHOD: Wet sieve
DESCRIPTION: Brown slightly sandy, gravelly, SILT/CLAY with broken rock/boulders

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	91	
37.5	73	
28	62	
20	58	
14	54	
10	51	
6.3	48	
5	47	
3.35	46	
2	43	SAND
1.18	41	
0.6	39	
0.425	39	
0.3	38	
0.15	34	
0.063	29	SILT/CLAY
0.041	#N/A	
0.029	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	



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IGSL Ltd.

Consolidated undrained Triaxial Compression with pore pressure measurement

BS1377:Part 8:1990 and K H Head *Manual of Soil Laboratory Testing* vol 3

Contract No. **13184** Contract Name **Wexford**

Location **BH3** Sample No. **AE3740** Depth (m) **2.75** Sample Type U

Method of Preparation Undisturbed Test Type Multi-stage

Description Orangish brown sandy slightly gravelly CLAY with grey sandy clay at base

Initial Dimensions and condition

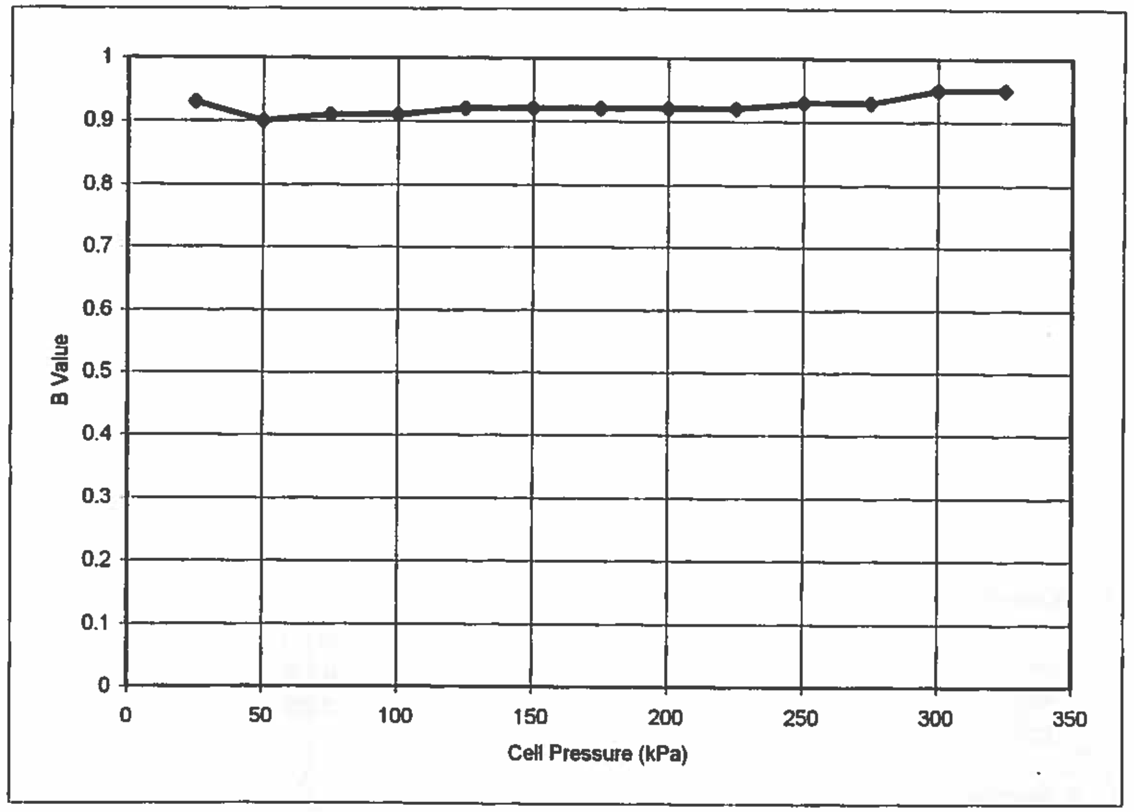
Height (mm) 200.5 Diameter (mm) 104.7 Side drains fitted No

	Initial	Final
Moisture Content (%)	19	18
Bulk Density (Mg/m^3)	2.02	2.03
Dry Density (Mg/m^3)	1.70	1.73

Saturation Stage

Saturation by increments of Cell & Back Pressure

Initial *B* Value 0.93 Final *B* Value 0.95 Increments of Pressure 25



Number of days saturating 5

Consolidated undrained Triaxial Compression with pore pressure measurement

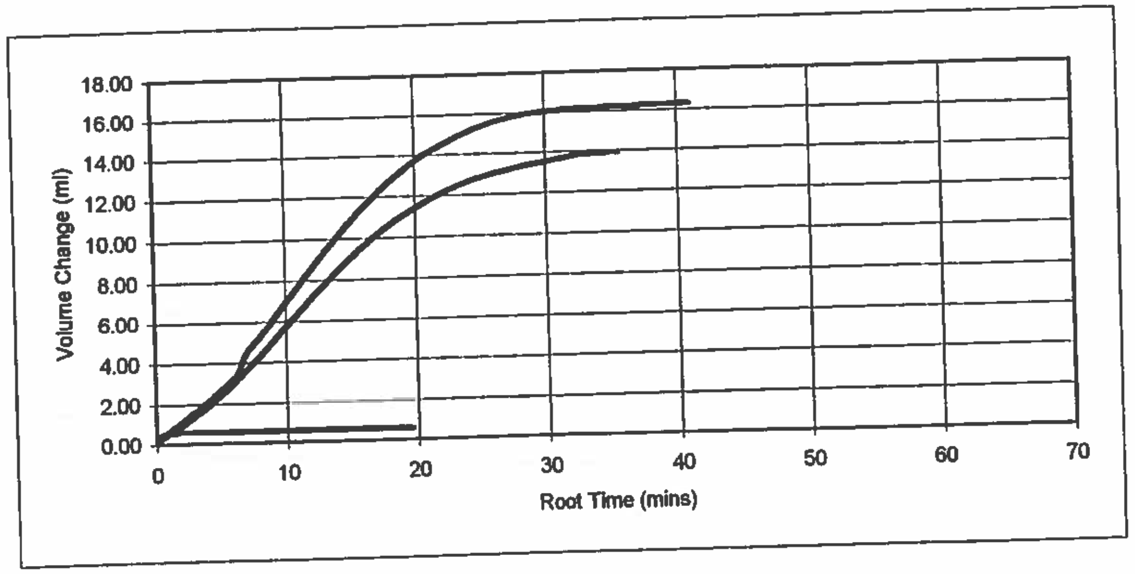
BS1377:Part 8:1990 and K H Head *Manual of Soil Laboratory Testing* vol 3

Contract No. **13184** Contract Name **Wexford**

Location **BH3** Sample No. **AE3740** Depth (m) **2.75** Sample Type U

Consolidation Stage

Stage Number	1	2	3
Cell Pressure (kPa)	325	350	400
Back Pressure (kPa)	300	300	300
Effective Pressure (kPa)	25	50	100
Final Pore Pressure (kPa)	298	300	300
Volume Change (ml)	0.60	13.89	16.29
% Pore Pressure Dissipation	100	100	100



Number of days consolidating 4

Compression Stage

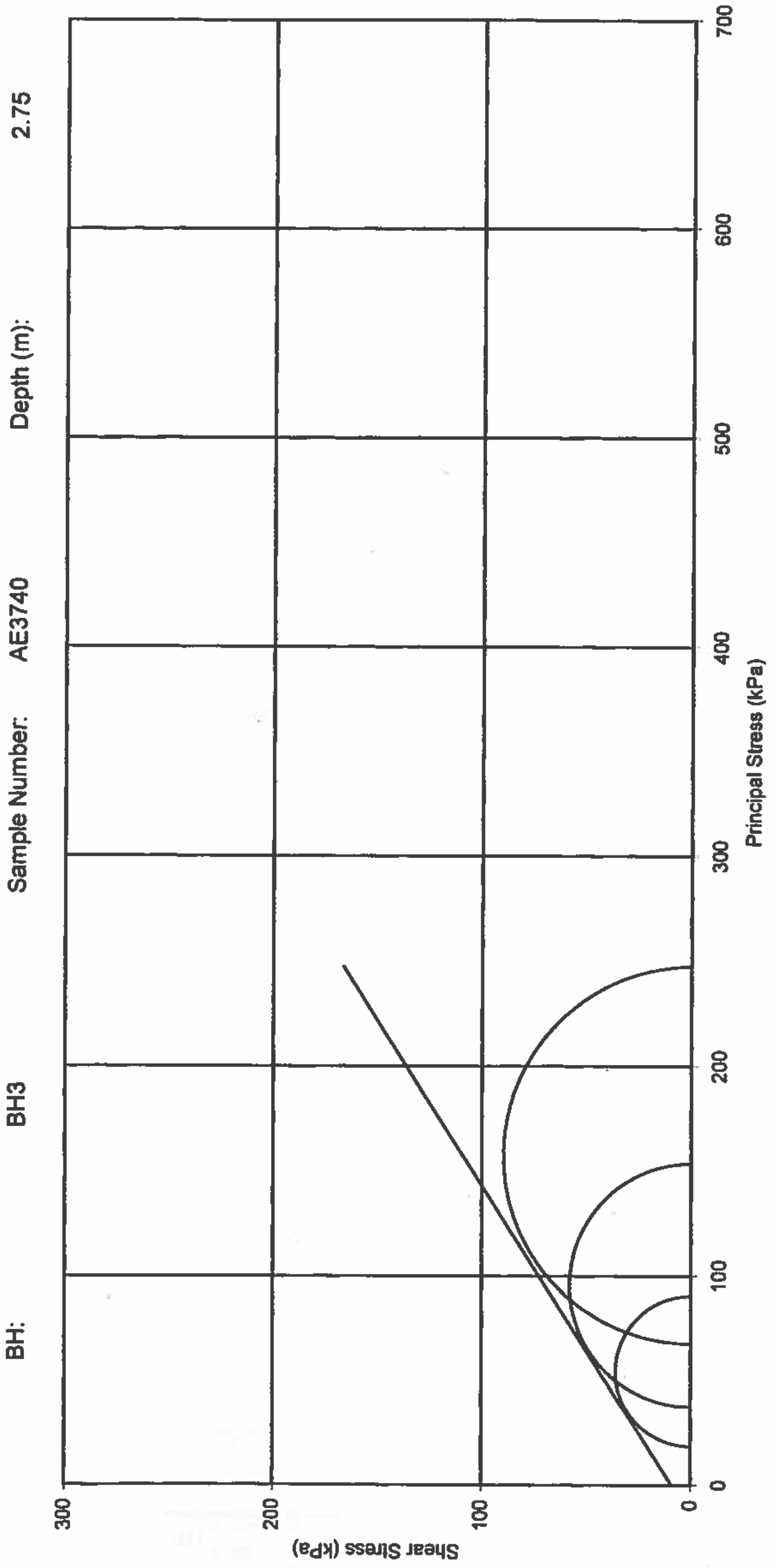
Failure criteria Maximum deviator stress

Stage	1	2	3
Effective Stress (kPa)	25	50	100
Rate of Strain (mm/min)	0.07	0.01	0.0233
Pore Pressure at start (kPa)	299	300	300
Axial strain at failure (%)	5.3	9.6	16.5
Deviator Stress at failure (kPa)	71.9	115.9	179.3
Pore Pressure at failure (kPa)	306.49	312.3	330.97
Major Principal stress at failure	90.4	153.6	247.1
Minor Principal stress at failure	18.5	37.7	67.8
Effective Principal Stress Ratio	4.89	4.07	3.65
Number of days in compression	1	1	1
Total Number of days on test	12		

CONSOLIDATED UNDRAINED TRIAXIAL TEST - MOHR CIRCLES

In accordance with BS1377:Part 8:1990 and K H Head *Manual of Soils Laboratory Testing* Vol 3

BH: BH3 Sample Number: AE3740 Depth (m): 2.75



IGSL Ltd
M7 Business
Park Naas
Co.Kildare

Contract
Wexford

C'= 9

ϕ' = 32.5

Contract No. 13184

Figure

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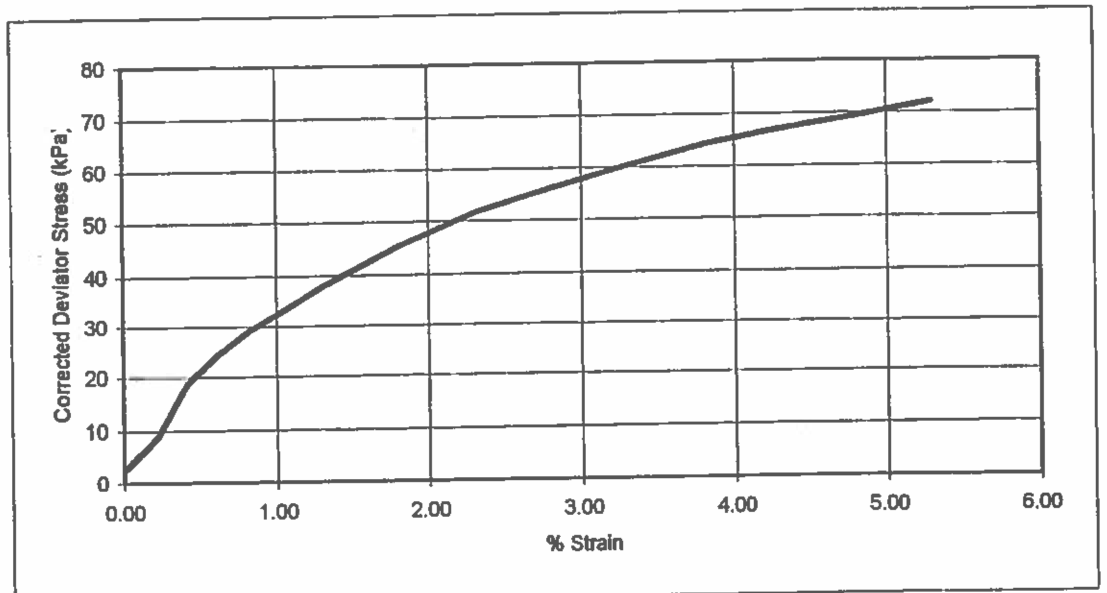
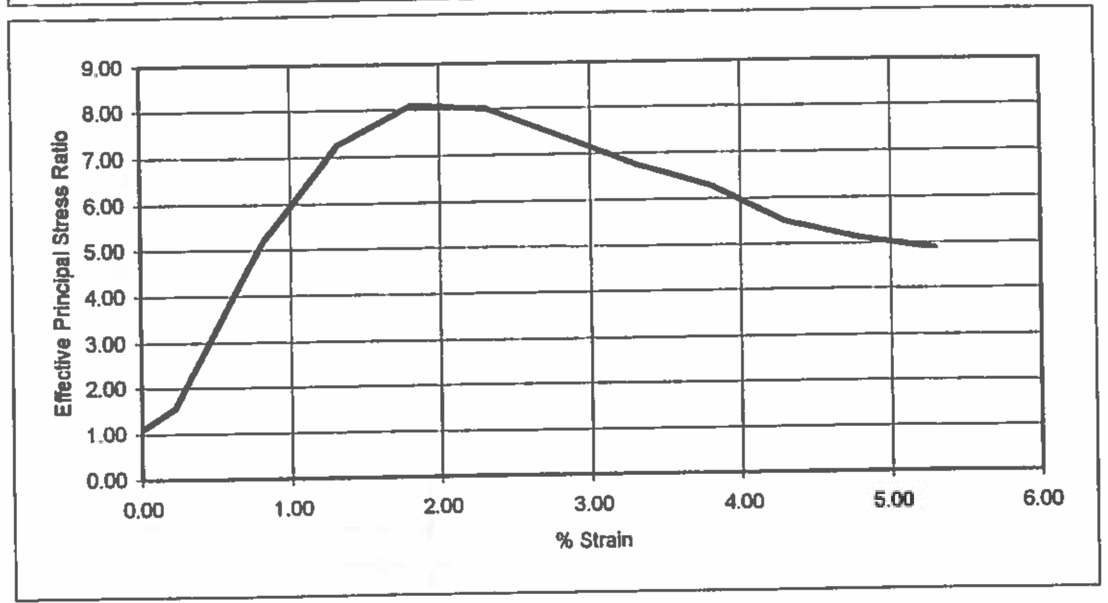
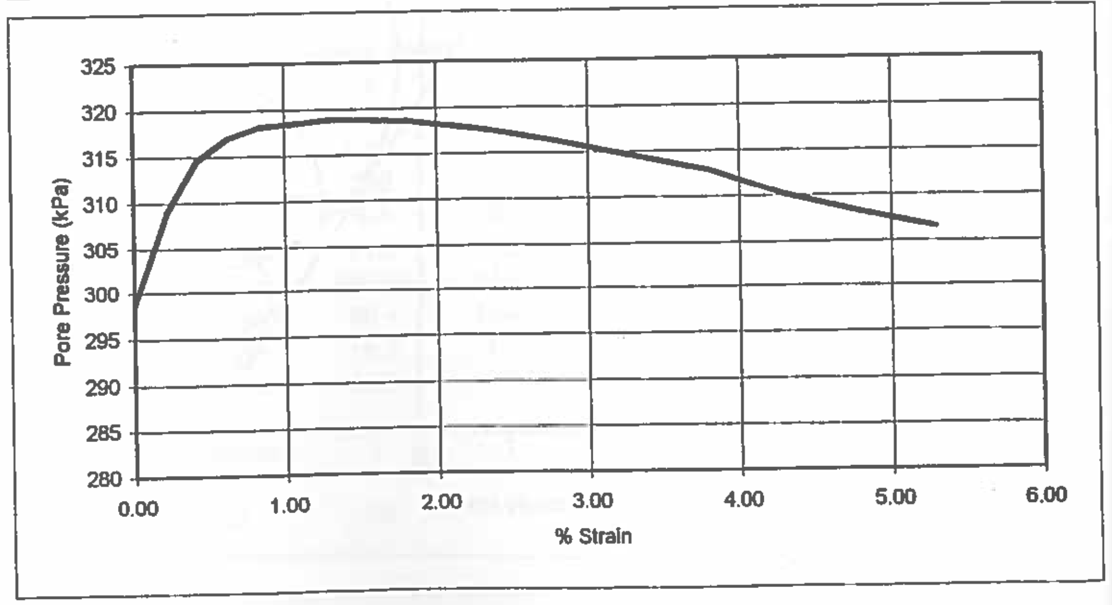
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH3 Sample No. AE3740 Depth 2.75

Stage 1



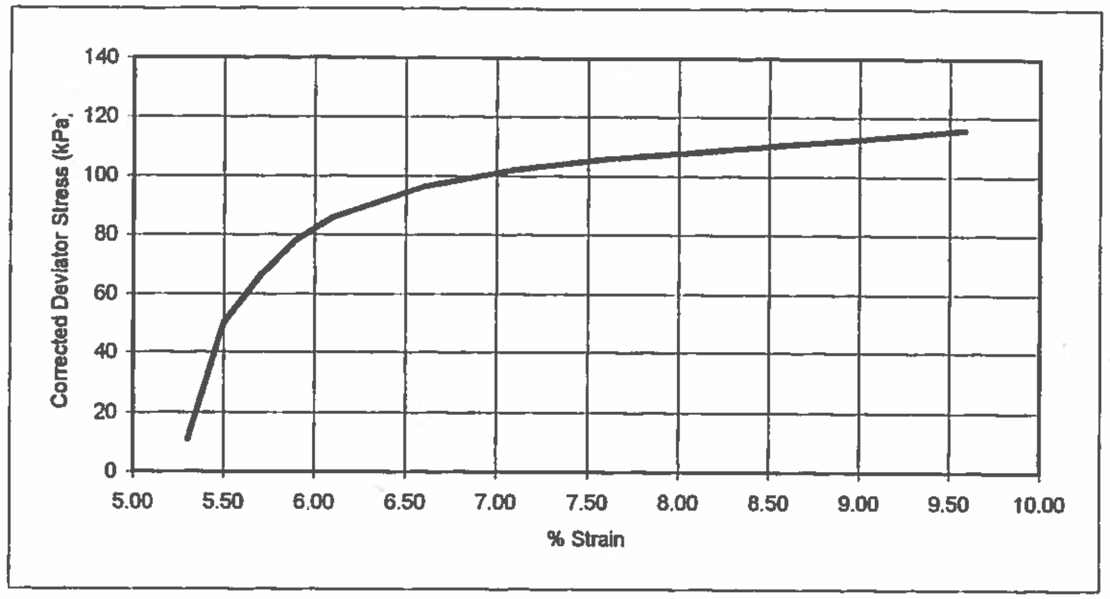


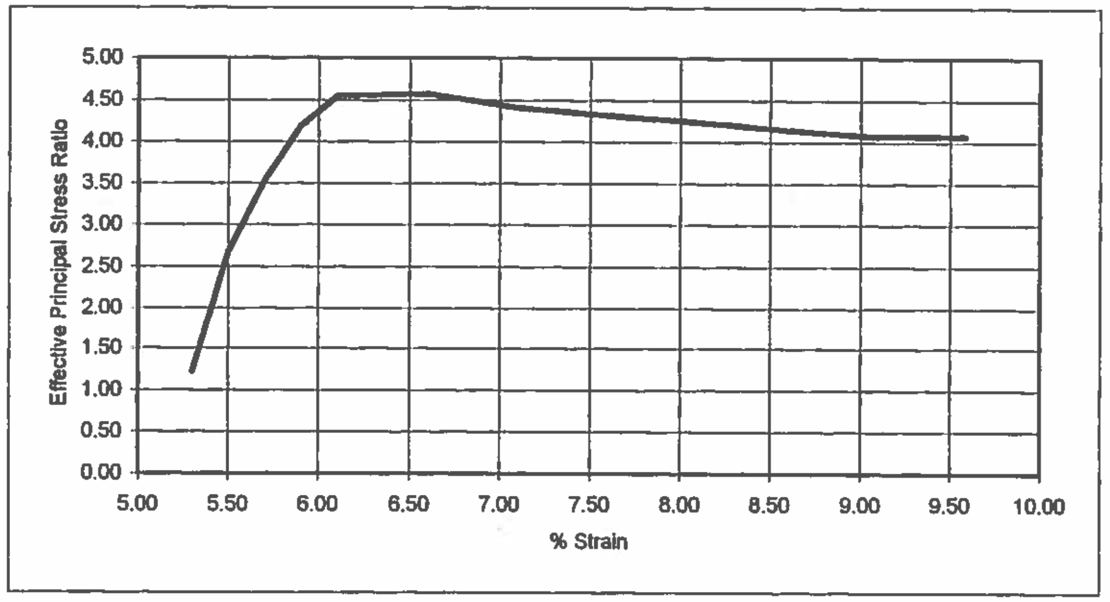


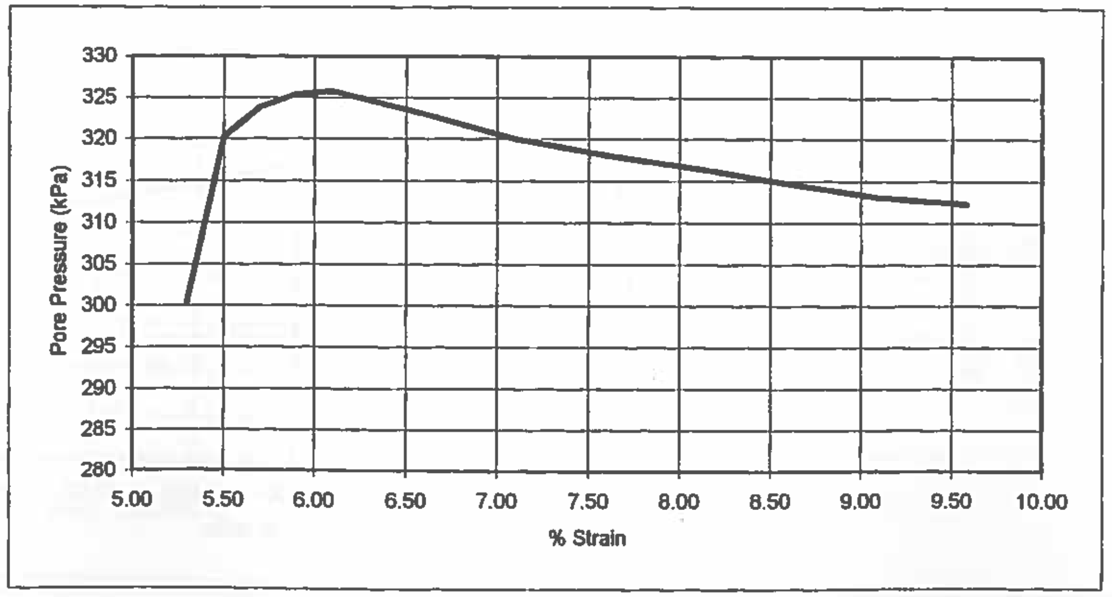
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH3 Sample No. AE3740 Depth 2.75

Stage 2



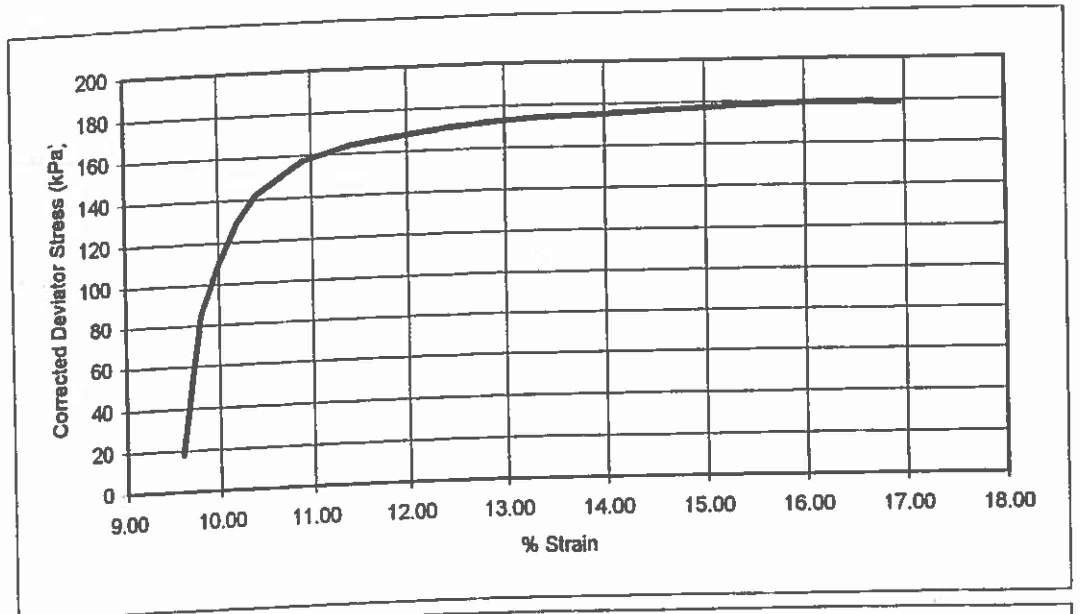


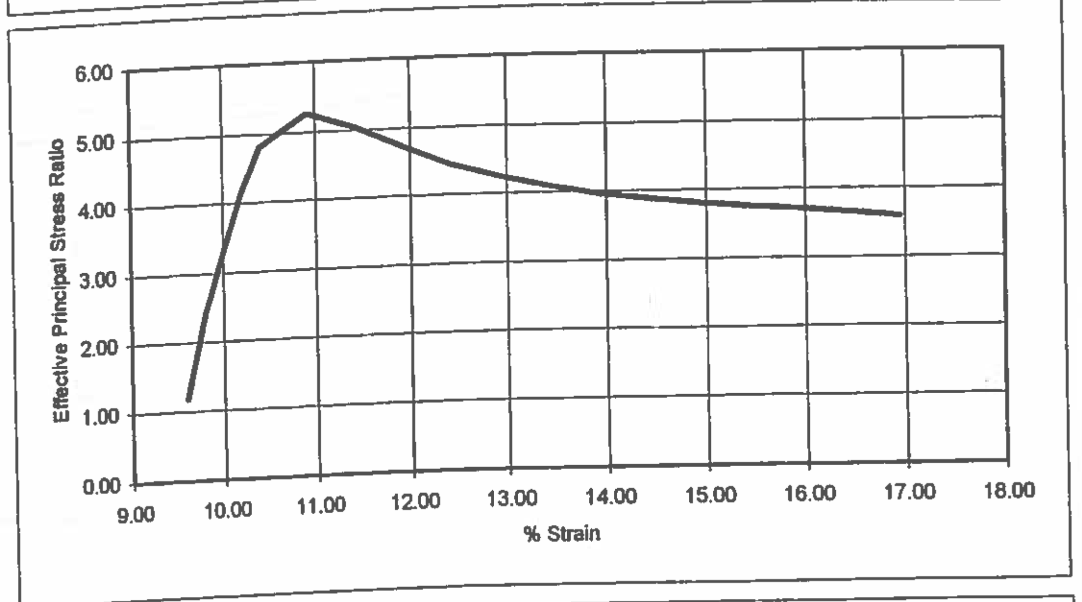


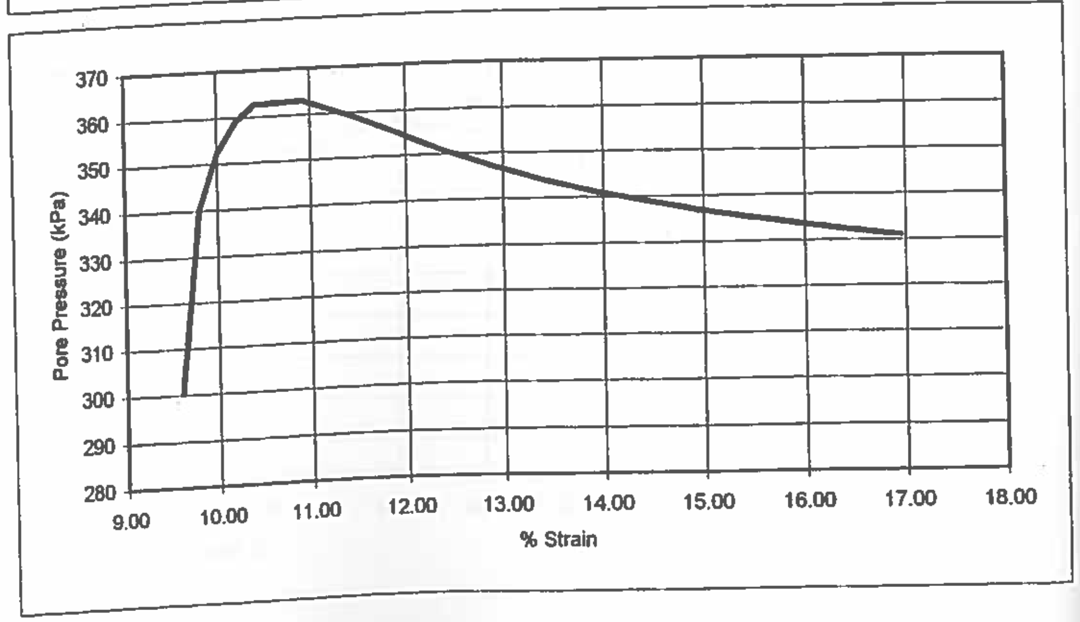
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH3 Sample No. AE3740 Depth 2.75

Stage 3







Consolidated undrained Triaxial Compression with pore pressure measurement

BS1377:Part 8:1990 and K H Head *Manual of Soil Laboratory Testing* vol 3

Contract No. **13184** Contract Name **Wexford**

Location **BH14** Sample No. **AE3762** Depth (m) **3.00** Sample Type U

Method of Preparation Undisturbed Test Type Multi-stage

Description Laminated: Greyish brown CLAY with shells and grey silty SAND with shells

Initial Dimensions and condition

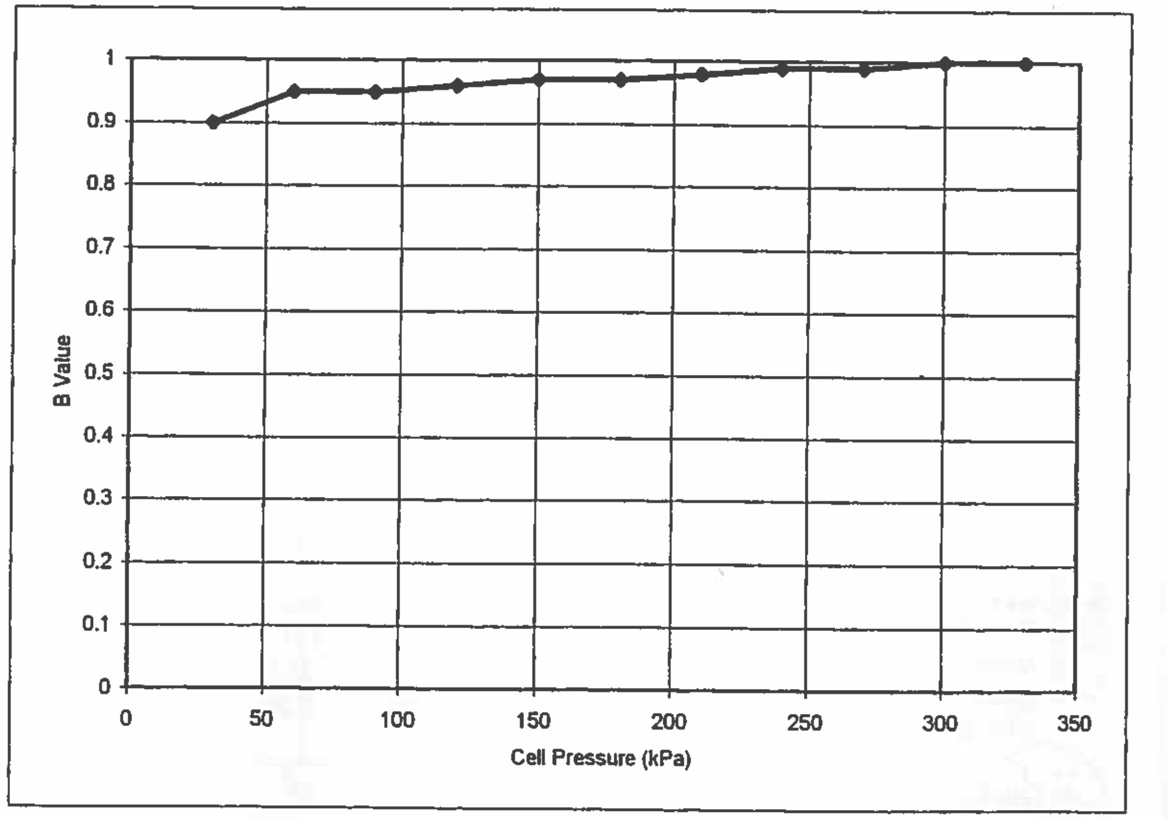
Height (mm) 200.5 Diameter (mm) 104.6 Side drains fitted No

	Initial	Final
Moisture Content (%)	54	43
Bulk Density (Mg/m^3)	1.58	1.65
Dry Density (Mg/m^3)	1.03	1.15

Saturation Stage

Saturation by increments of Cell & Back Pressure

Initial *B* Value 0.90 Final *B* Value 1.00 Increments of Pressure 30



Number of days saturating 2

IGSL Ltd.

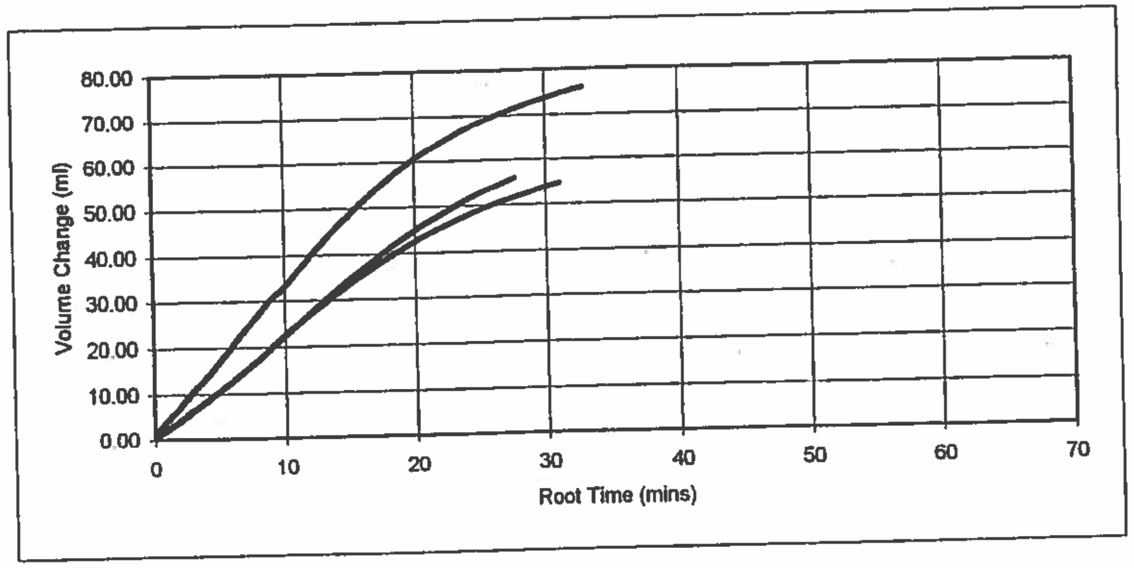
Consolidated undrained Triaxial Compression with pore pressure measurement

BS1377:Part 8:1990 and K H Head *Manual of Soil Laboratory Testing* vol 3

Contract No.	**13184**	Contract Name	**Wexford**				
Location	**BH14**	Sample No.	**AE3762**	Depth (m)	**3.00**	Sample Type	U

Consolidation Stage

Stage Number	1	2	3
Cell Pressure (kPa)	330	360	420
Back Pressure (kPa)	300	300	300
Effective Pressure (kPa)	30	60	120
Final Pore Pressure (kPa)	300	299	301
Volume Change (ml)	76.05	54.65	55.94
% Pore Pressure Dissipation	100	100	99



Number of days consolidating 6

Compression Stage

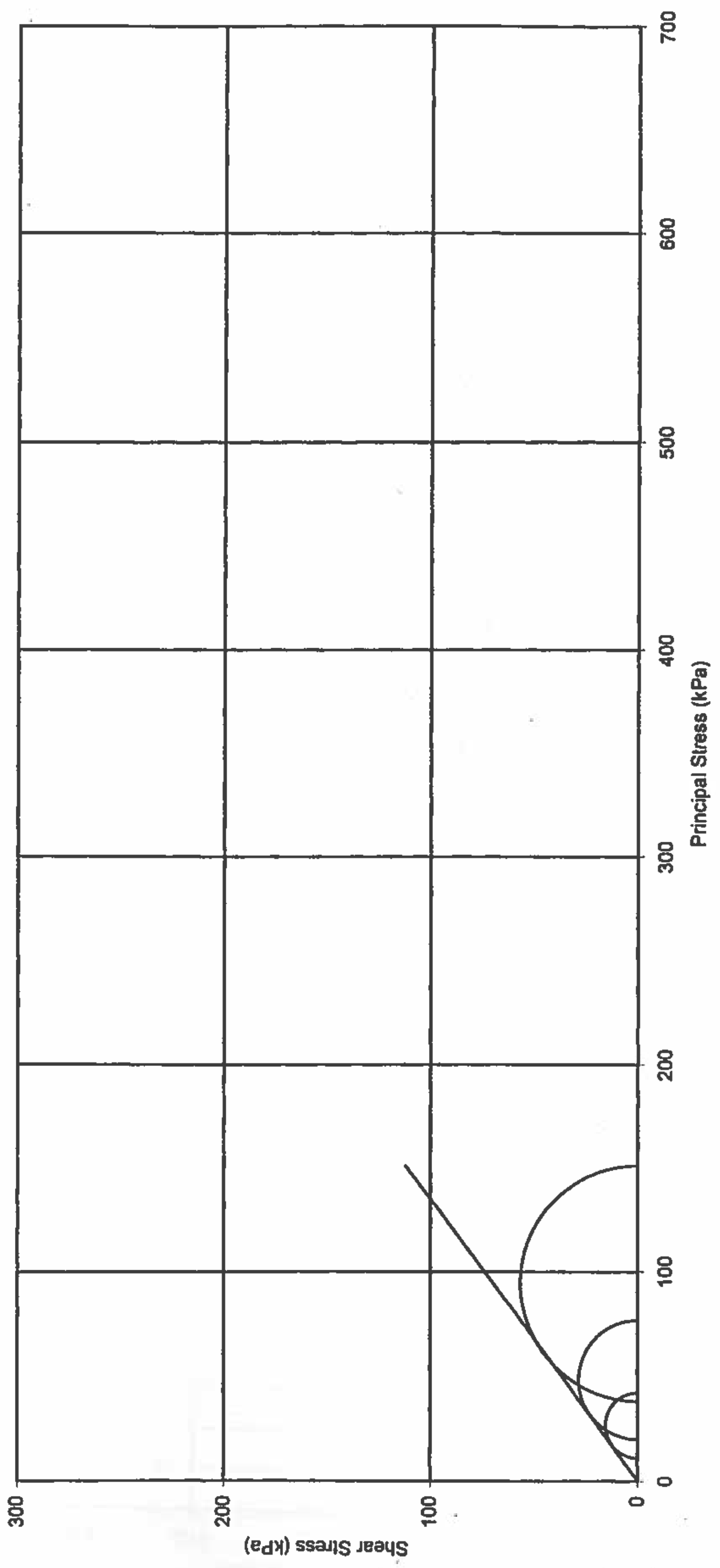
Failure criteria Maximum deviator stress

Stage	1	2	3
Effective Stress (kPa)	30	60	120
Rate of Strain (mm/min)	0.03	0.0302	0.0256
Pore Pressure at start (kPa)	300	300	301
Axial strain at failure (%)	6	12.3	20
Deviator Stress at failure (kPa)	31	56.8	113.5
Pore Pressure at failure (kPa)	319.1	340.3	382.1
Major Principal stress at failure	41.9	76.5	151.4
Minor Principal stress at failure	10.9	19.7	37.9
Effective Principal Stress Ratio	3.84	3.89	3.99
Number of days in compression	1	1	1
Total Number of days on test	11		

CONSOLIDATED UNDRAINED TRIAXIAL TEST - MOHR CIRCLES

In accordance with BS1377:Part 8:1990 and K H Head *Manual of Soils Laboratory Testing* Vol 3

BH: BH14 Sample Number: AE3762 Depth (m): 3.00



C'= 0

ϕ' = 36.5

Contract Wexford

Contract No. 13184

Figure

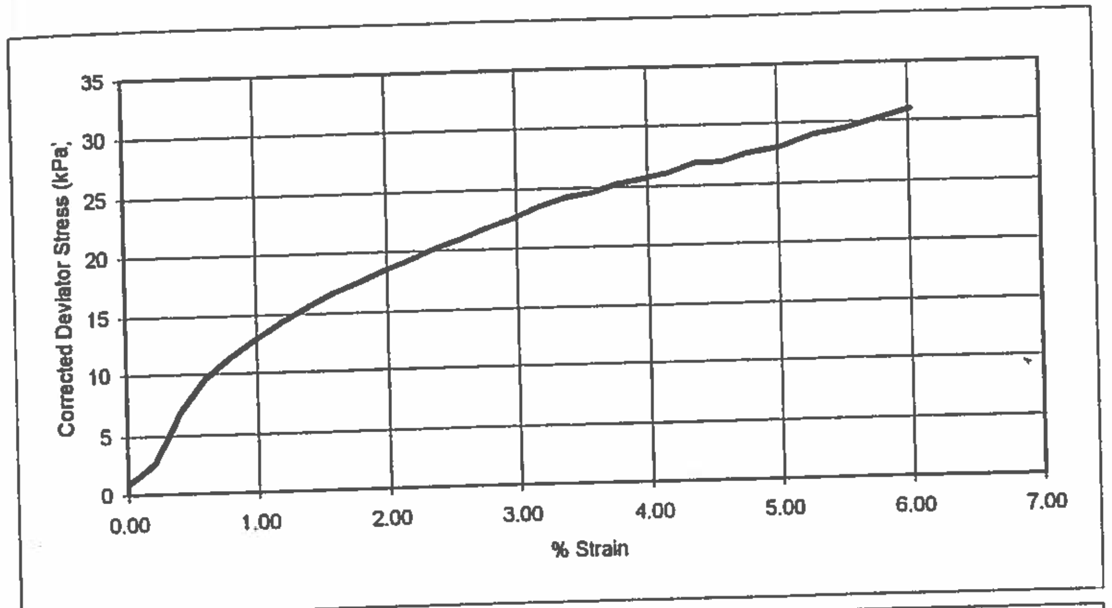
Page 3 of 6

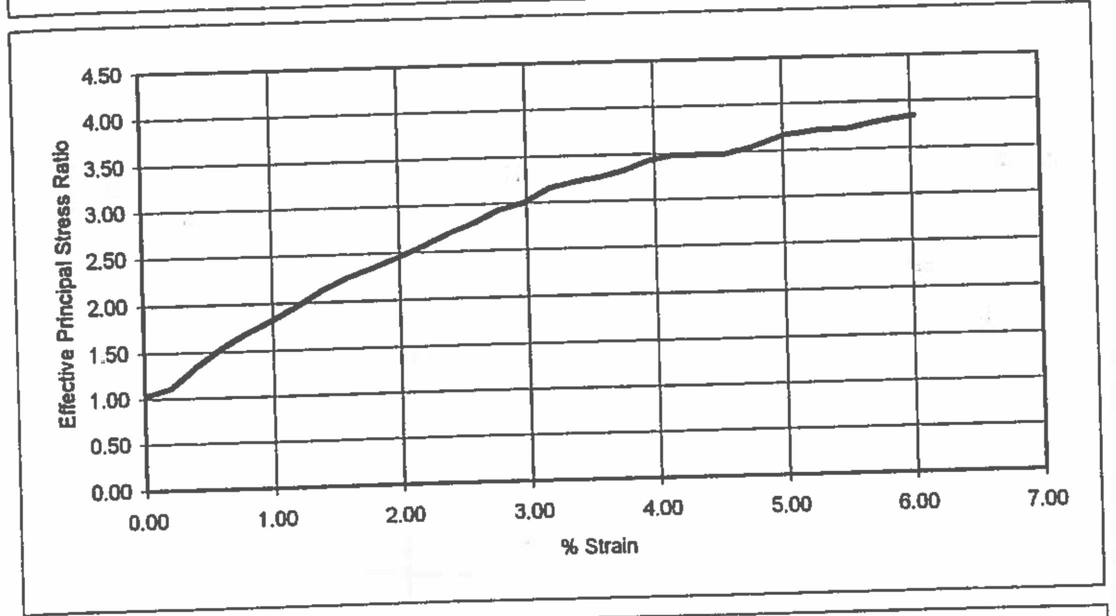
IGSL Ltd
M7 Business
Park Naas
Co.Kildare

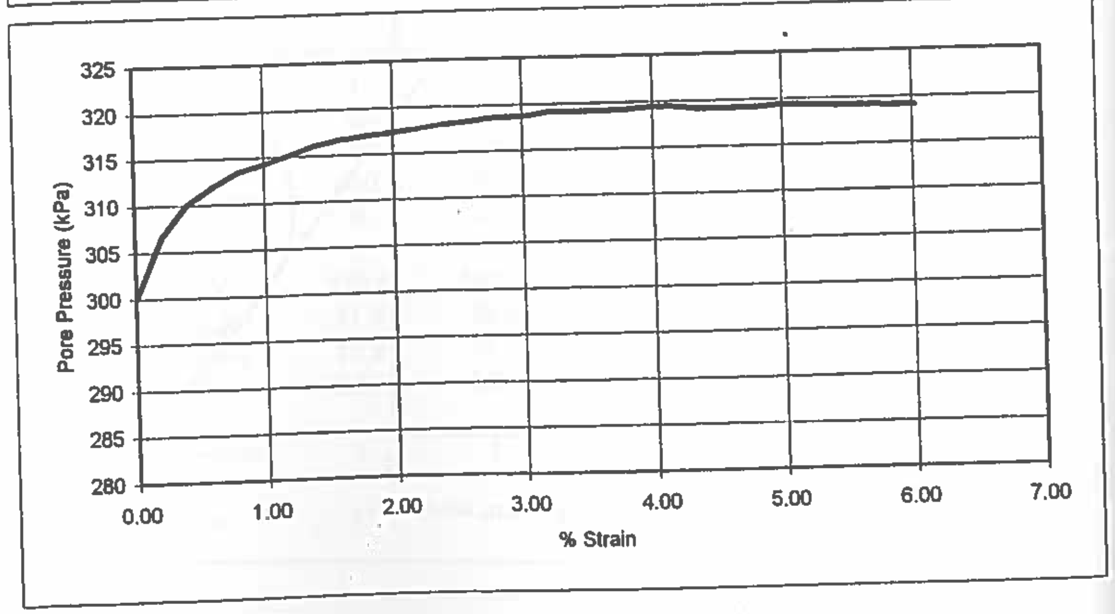
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH14 Sample No. AE3762 Depth 3.00

Stage 1



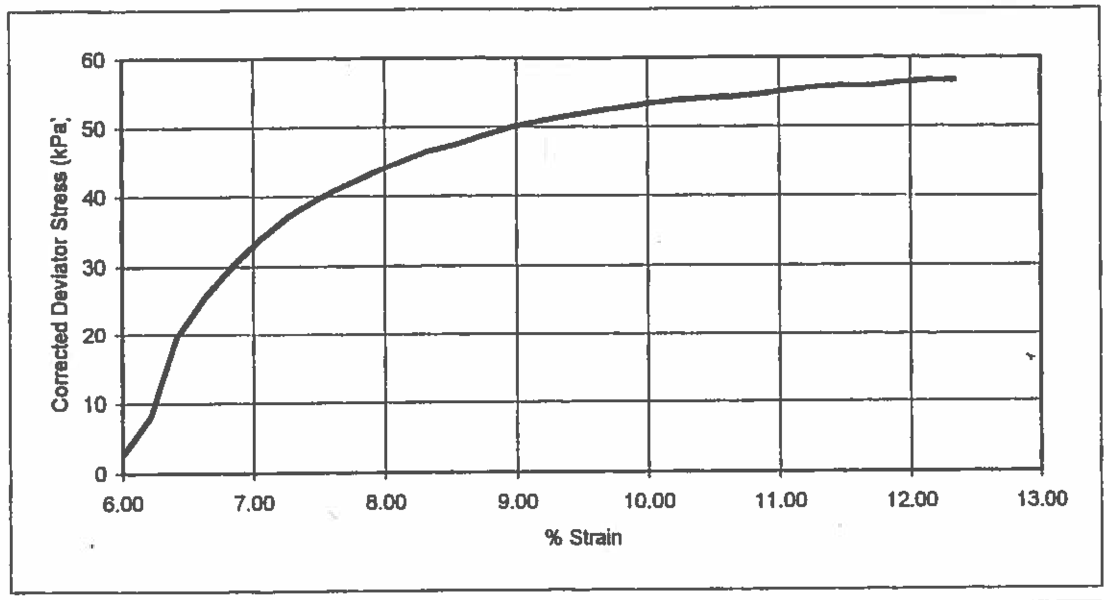


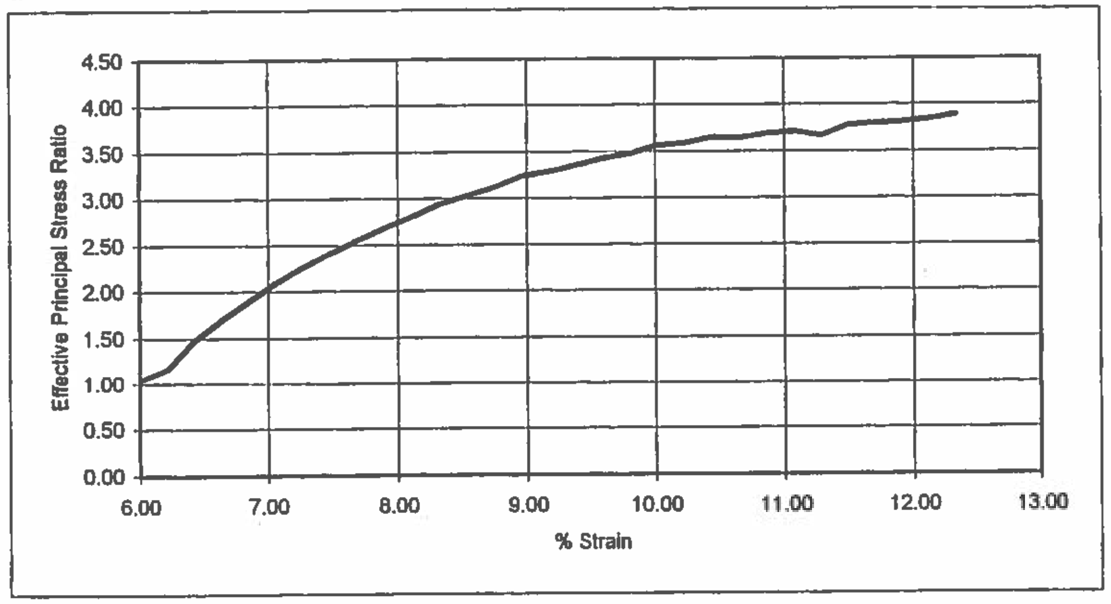


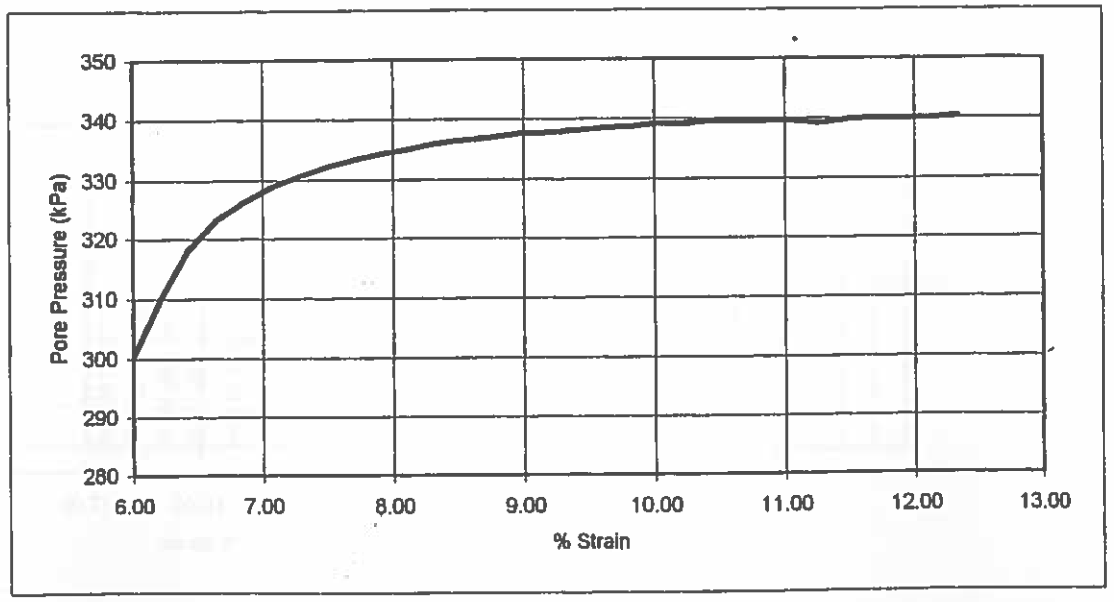
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH14 Sample No. AE3762 Depth 3.00

Stage 2



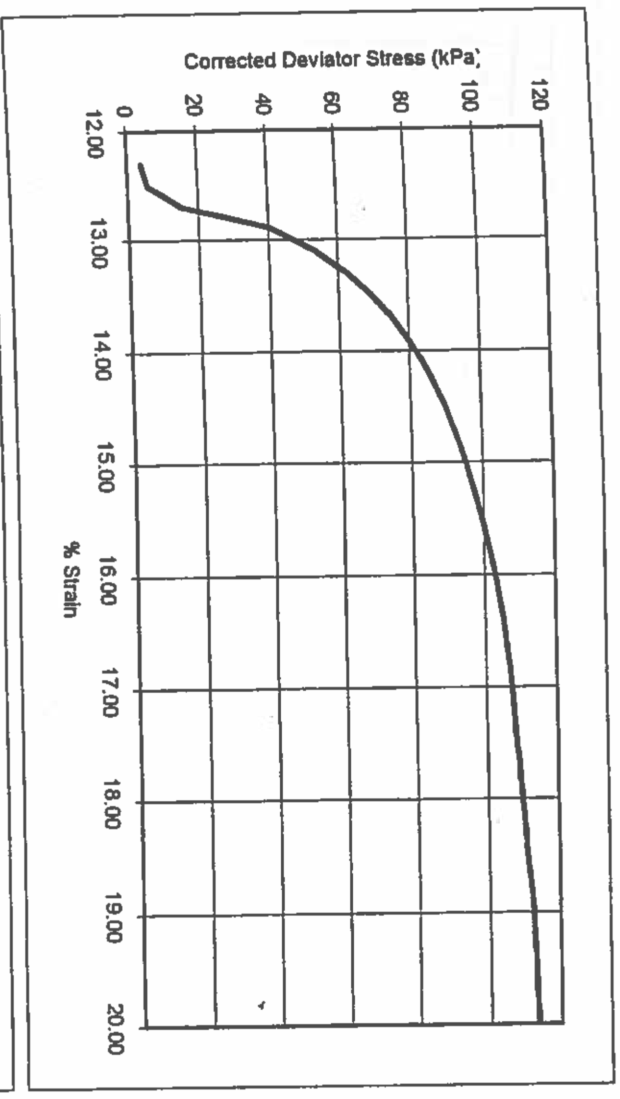


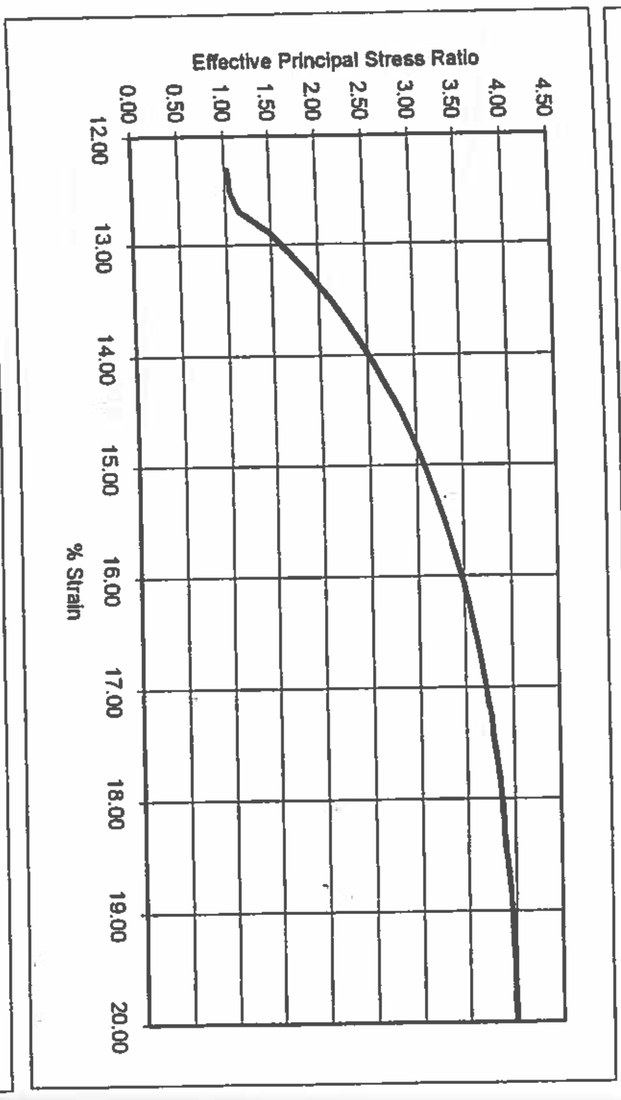


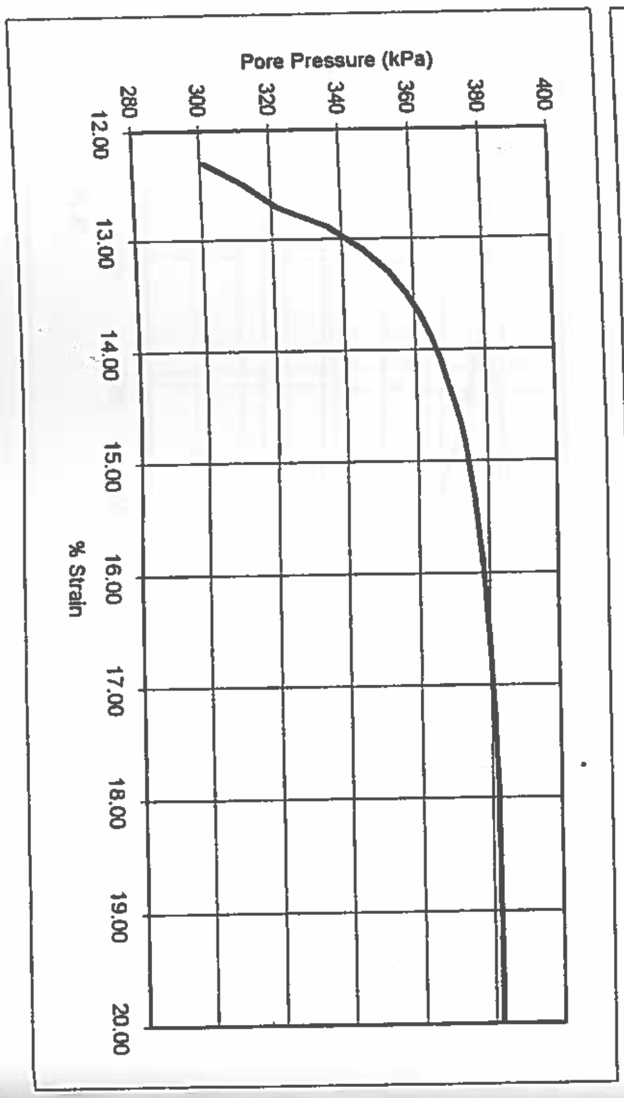
Consolidated Undrained Triaxial Compression with Pore Pressure Measurement

Contract No. 13184 Location BH14 Sample No. AE3762 Depth 3.00

Stage 3







CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	287.2	
final wet wt.	283	
final dry wt	259.3	
wt. of ring	90.7	
w/c initial	16.5%	
w/c final	14.1%	
S.G.	2.65	
e final	0.3725089	
change in e	0.0761997	*change in Ht.
Final Height		18.012

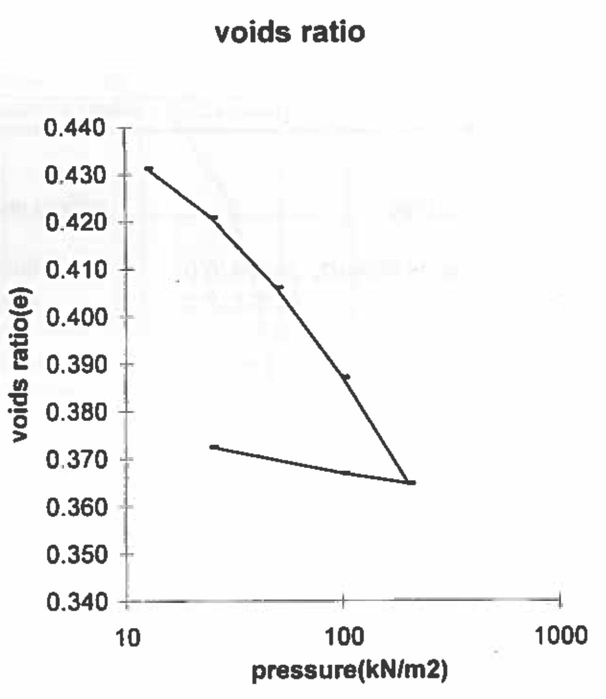
Contract: TRINITY WHARF WEXFORD
13184
Borehole No: BH3
Sample No: 3740
Depth: 2.50

Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					0.452			19.05	
0	12.5	12.5	0.266	0.020	0.431	0.441	1.125	18.784	18.917
12.5	25	12.5	0.136	0.010	0.421	0.426	0.581	18.648	18.716
25	50	25	0.196	0.015	0.406	0.414	0.423	18.452	18.55
50	100	50	0.248	0.019	0.387	0.397	0.271	18.204	18.328
100	200	100	0.294	0.022	0.365	0.376	0.163	17.91	18.057
200	100	-100	-0.028	-0.002	0.367	0.366	0.016	17.938	17.924
100	25	-75	-0.074	-0.006	0.373	0.370	0.055	18.012	17.975
					0.373				
					0.373				
					0.373				

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Orange yellow brown slightly sandy slightly gravelly CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.431	1.12	1.65
12.5	25	0.421	0.58	1.44
25	50	0.406	0.42	3.73
50	100	0.387	0.27	4.43
100	200	0.365	0.16	6.84
200	100	0.367		
100	25	0.373		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH3
Sample No.	3740
Depth:	2.50

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	280.2	
final wet wt.	276.3	
final dry wt	247.5	
wt. of ring	89.4	
w/c initial	20.7%	
w/c final	18.2%	
S.G.	2.65	
e final	0.4827324	
change in e	0.0821094	*change in Ht.
Final Height		18.058

Contract:	TRINITY WHARF WEXFORD
13184	
Borehole No:	BH4
Sample No:	3721
Depth:	5.00

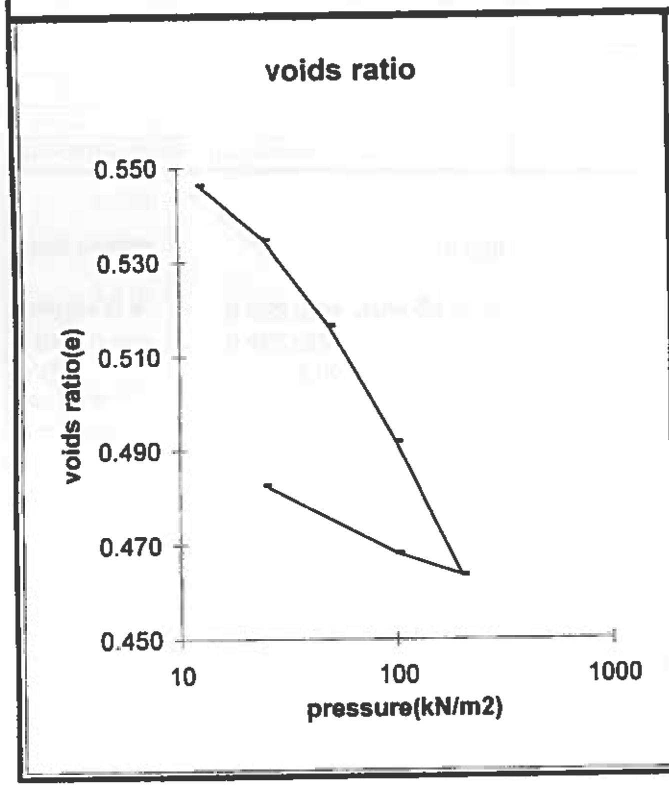
Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					0.564			19.05	
0	12.5	12.5	0.216	0.018	0.546	0.555	0.912	18.834	18.942
12.5	25	12.5	0.142	0.012	0.535	0.541	0.605	18.692	18.763
25	50	25	0.224	0.018	0.516	0.526	0.482	18.468	18.58
50	100	50	0.298	0.024	0.492	0.504	0.325	18.17	18.319
100	200	100	0.344	0.028	0.464	0.478	0.191	17.826	17.998
200	100	-100	-0.056	-0.005	0.468	0.466	0.031	17.882	17.854
100	25	-75	-0.176	-0.014	0.483	0.476	0.131	18.058	17.97
					0.483				
					0.483				
					0.483				

Consol bh4

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Mottled orange yellow brown slightly sandy slightly gravelly CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.546	0.91	0.40
12.5	25	0.535	0.61	0.64
25	50	0.516	0.48	1.53
50	100	0.492	0.33	1.49
100	200	0.464	0.19	2.94
200	100	0.468		
100	25	0.483		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH4
Sample No.	3721
Depth:	5.00

Consol bh14

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	242.3	
final wet wt.	227.3	
final dry wt	191.5	
wt. of ring	89.6	
w/c initial	49.9%	
w/c final	35.1%	
S.G.	2.65	
e final	0.9310108	
change in e	0.1244368	*change in Ht.
Final Height		15.518

Contract: TRINITY WHARF WEXFORD

13184

Borehole No: BH14

Sample No: 3762

Depth: 3.00

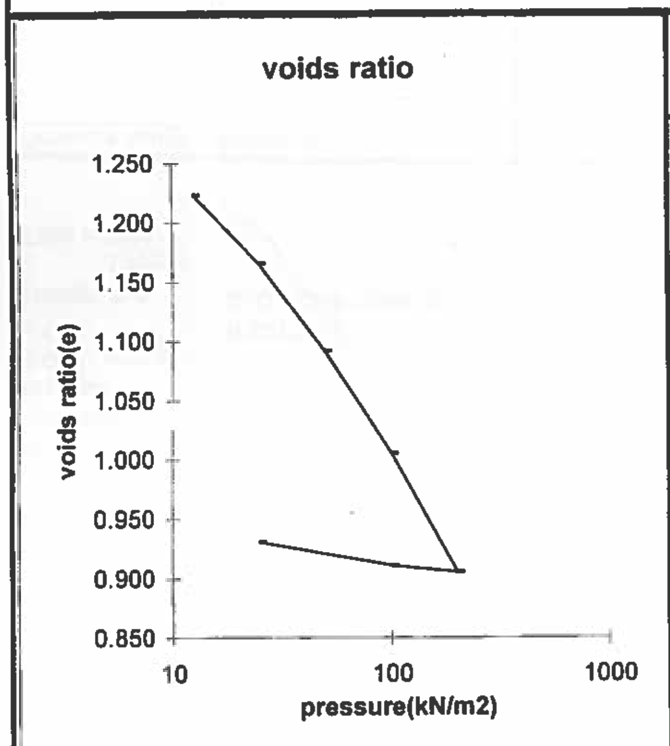
Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					1.371			19.05	
0	12.5	12.5	1.182	0.147	1.223	1.297	5.123	17.868	18.459
12.5	25	12.5	0.466	0.058	1.165	1.194	2.114	17.402	17.635
25	50	25	0.592	0.074	1.092	1.129	1.384	16.81	17.106
50	100	50	0.694	0.086	1.005	1.049	0.843	16.116	16.463
100	200	100	0.804	0.100	0.905	0.955	0.512	15.312	15.714
200	100	-100	-0.046	-0.006	0.911	0.908	0.030	15.358	15.335
100	25	-75	-0.16	-0.020	0.931	0.921	0.138	15.518	15.438
					0.931				
					0.931				
					0.931				

Consol bh14

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Grey silty slightly organic SAND



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	1.223	5.12	2.25
12.5	25	1.165	2.11	2.16
25	50	1.092	1.38	3.17
50	100	1.005	0.84	2.46
100	200	0.905	0.51	3.05
200	100	0.911		
100	25	0.931		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH14
Sample No.	3762
Depth:	3.00

Consol bh16

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	261.8	
final wet wt.	259.7	
final dry wt	228.8	
wt. of ring	89.5	
w/c initial	23.7%	
w/c final	22.2%	
S.G.	2.65	
e final	0.587832	
change in e	0.0855697	*change in Ht.
Final Height		18.556

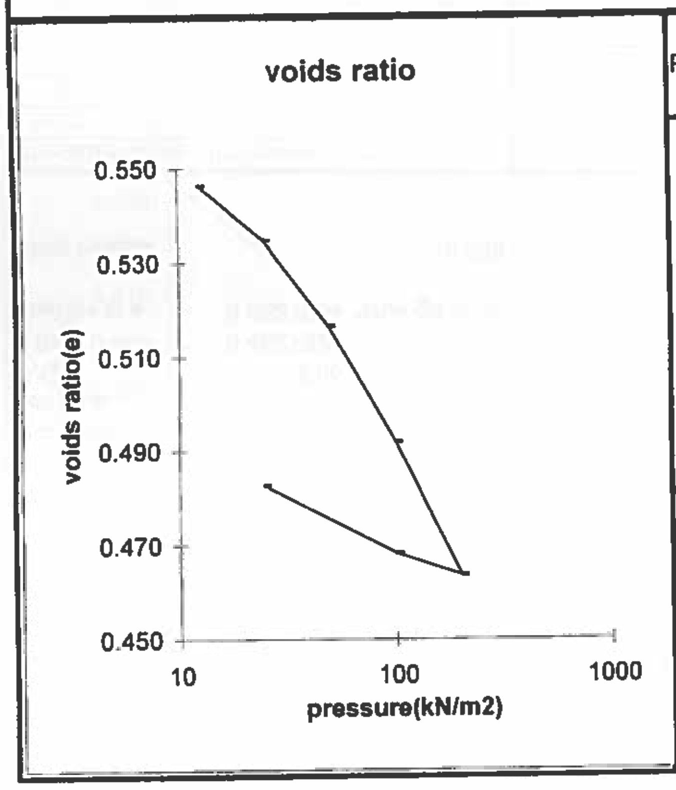
Contract:	TRINITY WHARF WEXFORD
13184	
Borehole No:	BH16
Sample No:	3780
Depth:	3.00

Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					0.630			19.05	
0	12.5	12.5	0.09	0.008	0.622	0.626	0.379	18.96	19.005
12.5	25	12.5	0.076	0.007	0.616	0.619	0.321	18.884	18.922
25	50	25	0.114	0.010	0.606	0.611	0.242	18.77	18.827
50	100	50	0.136	0.012	0.595	0.600	0.145	18.634	18.702
100	200	100	0.17	0.015	0.580	0.587	0.092	18.464	18.549
200	100	-100	-0.032	-0.003	0.583	0.581	0.017	18.496	18.48
100	25	-75	-0.06	-0.005	0.588	0.585	0.043	18.556	18.526
					0.588				
					0.588				
					0.588				

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Mottled orange yellow brown slightly sandy slightly gravelly CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.546	0.91	0.40
12.5	25	0.535	0.61	0.64
25	50	0.516	0.48	1.53
50	100	0.492	0.33	1.49
100	200	0.464	0.19	2.94
200	100	0.468		
100	25	0.483		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH4
Sample No.	3721
Depth:	5.00

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	242.3	
final wet wt.	227.3	
final dry wt	191.5	
wt. of ring	89.6	
w/c initial	49.9%	
w/c final	35.1%	
S.G.	2.65	
e final	0.9310108	
change in e	0.1244368	*change in Ht.
Final Height		15.518

Contract: TRINITY WHARF WEXFORD
13184
Borehole No: BH14

Sample No: 3762

Depth: 3.00

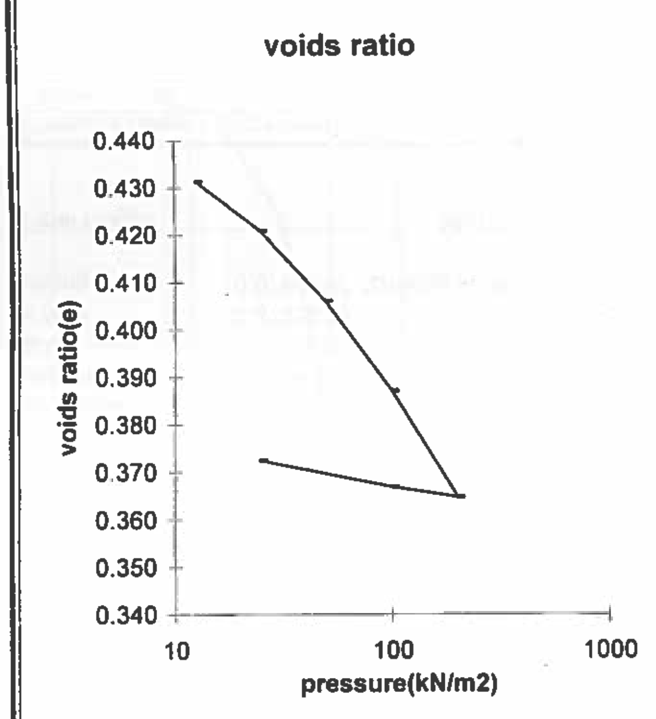
Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					1.371			19.05	
0	12.5	12.5	1.182	0.147	1.223	1.297	5.123	17.868	18.459
12.5	25	12.5	0.466	0.058	1.165	1.194	2.114	17.402	17.635
25	50	25	0.592	0.074	1.092	1.129	1.384	16.81	17.106
50	100	50	0.694	0.086	1.005	1.049	0.843	16.116	16.463
100	200	100	0.804	0.100	0.905	0.955	0.512	15.312	15.714
200	100	-100	-0.046	-0.006	0.911	0.908	0.030	15.358	15.335
100	25	-75	-0.16	-0.020	0.931	0.921	0.138	15.518	15.438
					0.931				
					0.931				
					0.931				

Consol bh5

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Orange yellow brown slightly sandy slightly gravelly CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.431	1.12	1.65
12.5	25	0.421	0.58	1.44
25	50	0.406	0.42	3.73
50	100	0.387	0.27	4.43
100	200	0.365	0.16	6.84
200	100	0.367		
100	25	0.373		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH3
Sample No.	3740
Depth:	2.50

Consol bh4

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	280.2	
final wet wt.	276.3	
final dry wt	247.5	
wt. of ring	89.4	
w/c initial	20.7%	
w/c final	18.2%	
S.G.	2.65	
e final	0.4827324	
change in e	0.0821094	*change in Ht.
Final Height		18.058

Contract:	TRINITY WHARF WEXFORD
13184	
Borehole No:	BH4
Sample No:	3721
Depth:	5.00

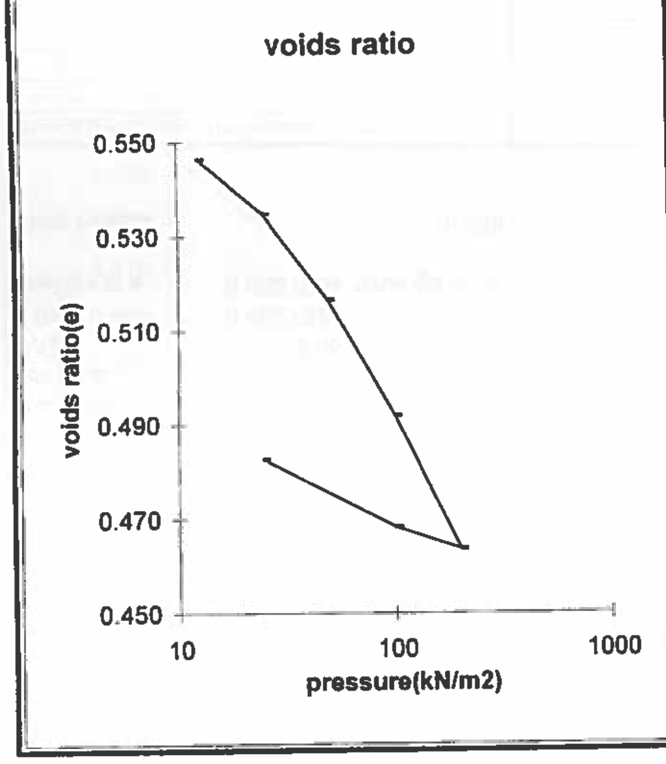
Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					0.564			19.05	
0	12.5	12.5	0.216	0.018	0.546	0.555	0.912	18.834	18.942
12.5	25	12.5	0.142	0.012	0.535	0.541	0.605	18.692	18.763
25	50	25	0.224	0.018	0.516	0.526	0.482	18.468	18.58
50	100	50	0.298	0.024	0.492	0.504	0.325	18.17	18.319
100	200	100	0.344	0.028	0.464	0.478	0.191	17.826	17.998
200	100	-100	-0.056	-0.005	0.468	0.466	0.031	17.882	17.854
100	25	-75	-0.176	-0.014	0.483	0.476	0.131	18.058	17.97
					0.483				
					0.483				
					0.483				

Consol bh4

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Mottled orange yellow brown slightly sandy slightly gravelly CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.546	0.91	0.40
12.5	25	0.535	0.61	0.64
25	50	0.516	0.48	1.53
50	100	0.492	0.33	1.49
100	200	0.464	0.19	2.94
200	100	0.468		
100	25	0.483		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH4
Sample No.	3721
Depth:	5.00

Consol bh14

CONSOLIDATION TEST CALCULATIONS IGSL

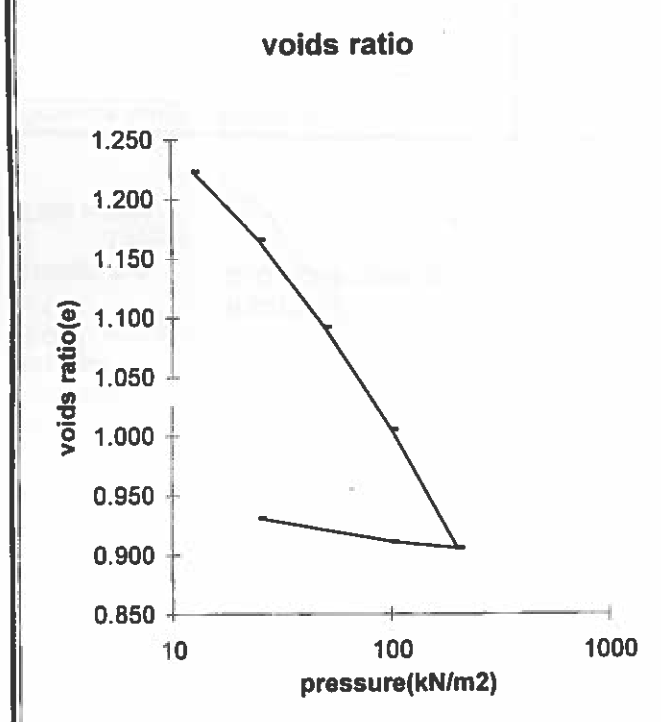
initial height	19.05	
Wt. soil+ring	242.3	
final wet wt.	227.3	
final dry wt	191.5	
wt. of ring	89.6	
w/c initial	49.9%	
w/c final	35.1%	
S.G.	2.65	
e final	0.9310108	
change in e	0.1244368	*change in Ht.
Final Height		15.518

Contract:	TRINITY WHARF WEXFORD
13184	
Borehole No:	BH14
Sample No:	3762
Depth:	3.00

Pressure range from	to	increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
					1.371			19.05	
0	12.5	12.5	1.182	0.147	1.223	1.297	5.123	17.868	18.459
12.5	25	12.5	0.466	0.058	1.165	1.194	2.114	17.402	17.635
25	50	25	0.592	0.074	1.092	1.129	1.384	16.81	17.106
50	100	50	0.694	0.086	1.005	1.049	0.843	16.116	16.463
100	200	100	0.804	0.100	0.905	0.955	0.512	15.312	15.714
200	100	-100	-0.046	-0.006	0.911	0.908	0.030	15.358	15.335
100	25	-75	-0.16	-0.020	0.931	0.921	0.138	15.518	15.438
					0.931				
					0.931				
					0.931				

CONSOLIDATION TEST RESULTS IGSL

Sample Description: Grey silty slightly organic SAND



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	1.223	5.12	2.25
12.5	25	1.165	2.11	2.16
25	50	1.092	1.38	3.17
50	100	1.005	0.84	2.46
100	200	0.905	0.51	3.05
200	100	0.911		
100	25	0.931		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH14
Sample No.	3762
Depth:	3.00

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	19.05	
Wt. soil+ring	261.8	
final wet wt.	259.7	
final dry wt	228.8	
wt. of ring	89.5	
w/c initial	23.7%	
w/c final	22.2%	
S.G.	2.65	
e final	0.587832	
change in e	0.0855697	*change in Ht.
Final Height		18.556

Contract:	TRINITY WHARF WEXFORD
13184	
Borehole No:	BH16
Sample No:	3780
Depth:	3.00

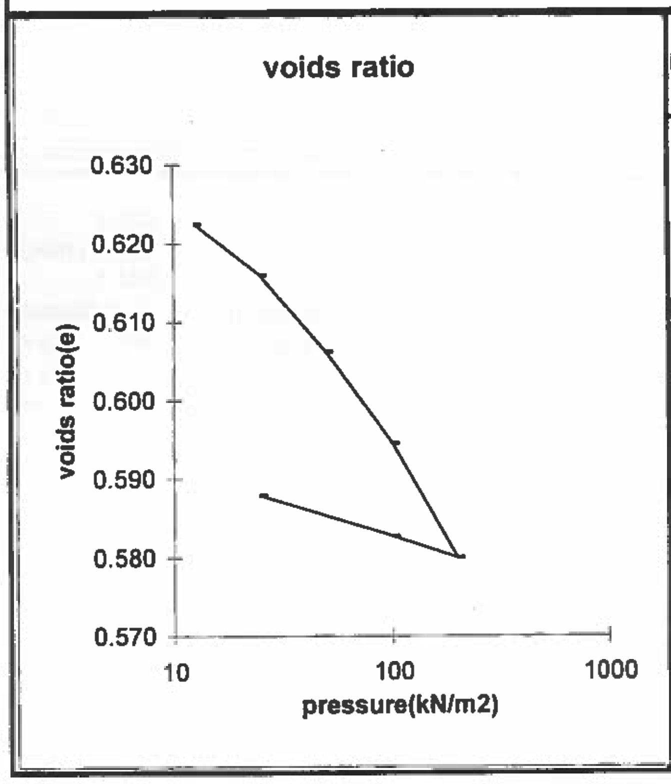
Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				0.630			19.05	
0	12.5	12.5	0.09	0.008	0.622	0.626	0.379	18.96	19.005
12.5	25	12.5	0.076	0.007	0.616	0.619	0.321	18.884	18.922
25	50	25	0.114	0.010	0.606	0.611	0.242	18.77	18.827
50	100	50	0.136	0.012	0.595	0.600	0.145	18.634	18.702
100	200	100	0.17	0.015	0.580	0.587	0.092	18.464	18.549
200	100	-100	-0.032	-0.003	0.583	0.581	0.017	18.496	18.48
100	25	-75	-0.06	-0.005	0.588	0.585	0.043	18.556	18.526
					0.588				
					0.588				
					0.588				

[redacted]

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Grey silty slightly organic SAND



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN	CV(m2/year)
0	12.5	0.622	0.38	12.37
12.5	25	0.616	0.32	3.24
25	50	0.606	0.24	5.02
50	100	0.595	0.15	6.21
100	200	0.580	0.09	7.89
200	100	0.583		
100	25	0.588		

Contract:	TRINITY WHARF WEXFORD
Borehole No.	BH16
Sample No.	3780
Depth:	3.00

REPORT NO.

SULPHATE ANALYSIS

IGSL

CONTRACT: **TRINITY WHARF WEXFORD** CONTRACT NO 13184

BH/TP NO.	DEPTH (M)	SAMPLE NO.	SAMPLE TYPE	TEST CODE	% Passing 2mm	SULPHUR TRIOXIDE WATER SO3 g/L	SULPHUR TRIOXIDE TOTAL SOIL so3 %	(so3 X 1.2) TOTAL SOIL so 4 %	pH VALUE
BH 4	2.00	3718	D	S	33		0.14	0.17	8.9
BH 5	2.50	3739	D	S	67		0.02	0.02	8.1
BH 8	3.50	3752	D	S	52		0.08	0.10	7.8
BH 9	5.50	7719	D	S	45		0.07	0.08	8.4
BH 11	2.50	7747	D	S	81		0.09	0.11	7.0
BH 14	10.00	3770	D	S	40		0.01	0.01	8.9
BH 16	11.00	3789	D	S	81		0.02	0.02	7.5
BH 18	2.50	3375	D	S	64		0.01	0.01	7.6
BH 21	1.50	7737	D	S	68		0.01	0.01	7.9

TEST CODE W = WATER S = SOIL A = AQUEOUS SOIL EXTRACT(2:1)

Appendix IV – Environmental Test Records

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: IGSL Ltd

Unit F
M7 Business Park
Naas
Co Kildare
Ireland

Attention: John Clancy

Date: 14 January, 2008

Our Reference: 07-B08783/01

Your Reference: TRINITY WHARF WEXFORD

Location:

A total of 7 samples was received for analysis on Thursday, 20 December 2007 and authorised on Monday, 14 January 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Lorraine Mc Namara

Lorraine McNamara
Laboratory Technical Manager

Compiled By Dylan Halpin
Dylan Halpin

UKAS
1291
GROUP

Printed at 10:12 on 15/01/2008

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

	Detection Method			CEN 10:1 Leach	CV AA	ELTRA	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS
UKAS Accredited [Testing Laboratory] No. 1291							✓	✓		✓		✓					
ALcontrol Reference	Sample Identity	Other ID	P / V	CEN 10:1 Leachate Test	Dissolved Mercury Low Level in CEN 10:1 Leachate	Total Organic Carbon	PRO & BTEX	Mineral Oil by GC	Coronene	PAH EPA (16)	PAH Total (17) GCMS (Solid)	PAH Total (6) GCMS <1.6mg/kg (Solid)	PCB 7 Congeners	Natural Moisture Content	Total Dissolved Solids Gravimetric CEN 10:1	Total Phenols by HPLC in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach
07-B08783-S0001-A01	BH4	1.00	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0002-A01	BH9	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0003-A01	BH12	0.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0004-A01	BH16	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0005-A01	BH16	2.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0006-A01	BH17	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0007-A01	BH22	0.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

	Detection Method			ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓													
ALcontrol Reference	Sample Identity	Other ID	P / V	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate
07-B08783-S0001-A01	BH4	1.00	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0002-A01	BH9	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0003-A01	BH12	0.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0004-A01	BH16	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0005-A01	BH16	2.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0006-A01	BH17	1.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B08783-S0007-A01	BH22	0.50	Non-Alcontrol Plastic Tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK . If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: **07-B08783/01**
Client: IGSL Ltd
Date of Receipt: 20/12/2007

Sample Type: **SOIL**
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

NTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ULE METHOD	TEST NAME	TOTAL
CEN 10:1 Leach	CEN 10:1 Leachate Test	7
CV AA	Dissolved Mercury Low Level in CEN 10:1 Leachate	7
ELTRA	Total Organic Carbon	7
GC	PRO & BTEX	7
GC FID/CALC	Mineral Oil by GC	7
GCMS	Coronene	7
GCMS	PAH EPA (16)	7
GCMS	PAH Total (17) GCMS (Solid)	7
GCMS	PAH Total (6) GCMS <1.6mg/kg (Solid)	7
GCMS	PCB 7 Congeners	7
GRAVIMETRIC	Natural Moisture Content	7
GRAVIMETRIC	Total Dissolved Solids Gravimetric CEN 10:1	7
HPLC	Total Phenols by HPLC in CEN 10:1 Leachate	7
ICP MS	Dissolved Antimony Low CEN 10:1 Leach	7
ICP MS	Dissolved Arsenic Low CEN 10:1 Leach	7
ICP MS	Dissolved Barium Low CEN 10:1 Leach	7
ICP MS	Dissolved Cadmium Low CEN 10:1 Leach	7
ICP MS	Dissolved Chromium Low CEN 10:1 Leach	7
ICP MS	Dissolved Copper Low CEN 10:1 Leach	7
ICP MS	Dissolved Lead Low CEN 10:1 Leach	7
ICP MS	Dissolved Molybdenum Low CEN 10:1 Leach	7
ICP MS	Dissolved Nickel Low CEN 10:1 Leach	7
ICP MS	Dissolved Selenium Low CEN 10:1 Leach	7
ICP MS	Dissolved Zinc Low CEN 10:1 Leach	7
IR	Dissolved Organic Carbon in CEN 10:1 Leachate	7
KONE	Chloride in CEN 10:1 Leachate	7
KONE	Fluoride in CEN 10:1 Leachate	7
KONE	Sulphate in CEN 10:1 Leachate	7

at 10:12 on 15/01/2008

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007
(of first sample)

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

		Detection Method	CV AA	ELTRA	GC	GC	GC	GC	GC	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS
		Method Detection Limit	<0.0005mg/kg	<0.2%	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<1mg/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg
UKAS Accredited [Testing Laboratory] No. 1291					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	Dissolved Mercury Low CEN 10:1 Leachate	Total Organic Carbon	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Benzene	Toluene	Ethylbenzene	Total Xylene	Mineral Oil by GC	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
			mg/kg	%	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
07-B08783-S0001	BH4	1.00	<0.0005	6.1	<10	<10	<10	<10	<10	<10	<1	523	1013	1385	1762	14527	3292
07-B08783-S0002	BH9	1.50	<0.0005	11.5	<10	<10	<10	<10	<10	<10	<1	197	273	288	267	819	330
07-B08783-S0003	BH12	0.50	<0.0005	0.9	<10	<10	<10	<10	<10	<10	<1	71	86	181	137	1067	339
07-B08783-S0004	BH16	1.50	<0.0005	7.1	93	2223	<10	<10	<10	<10	862	156	99	321	399	639	269
07-B08783-S0005	BH16	2.50	<0.0005	2.0	<10	<10	<10	<10	<10	<10	<1	46	33	55	66	176	65
07-B08783-S0006	BH17	1.50	<0.0005	4.4	75	7040	<10	<10	<10	<10	760	87	73	159	343	290	120
07-B08783-S0007	BH22	0.50	<0.0005	7.8	<10	<10	<10	<10	<10	<10	<1	46	43	74	87	776	168

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Printed at 10:12 on 15/01/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007
(of first sample)

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

ALcontrol Reference	Sample Identity	Other ID	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)+Benzo(k) fluoranthene	Benzo(a)pyrene	Indeno(123cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	Coronene	Total 6 PAHs	Total 16 EPA PAHs	Total 17 PAHs	PCB Congener 28	PCB Congener 52
	Detection Method		GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS
	Method Detection Limit		<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1.6mg/kg	<1ug/kg	<1ug/kg	<1 ug/kg	<1ug/kg
UKAS Accredited [Testing Laboratory] No. 1291			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg
07-B08783-S0001	BH4	1.00	16555	14345	14979	8698	16328	9233	9388	4932	11685	1554	54.8	128675	130200	<1	<1
07-B08783-S0002	BH9	1.50	1884	1466	1438	891	1572	860	810	340	966	127	5.5	12401	12528	<1	<1
07-B08783-S0003	BH12	0.50	2063	1759	1432	854	1618	948	850	407	1028	140	5.8	12840	12977	<1	<1
07-B08783-S0004	BH16	1.50	859	842	668	586	965	533	512	189	653	94	3.1	7692	7789	<1	<1
07-B08783-S0005	BH16	2.50	303	237	188	124	212	98	103	38	132	19	<1.6	1876	1897	<1	<1
07-B08783-S0006	BH17	1.50	491	406	390	342	435	202	220	69	261	26	<1.6	3888	3914	<1	<1
07-B08783-S0007	BH22	0.50	1656	1426	1609	1450	2377	1427	1462	765	1763	123	7.1	15129	15258	<1	<1

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007
(of first sample)

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

ALcontrol Reference	Sample Identity	Other ID	PCB Congener 101	PCB Congener 118	PCB Congener 153	PCB Congener 138	PCB Congener 180	PCB Total of 7 Congeners	Natural Moisture Content	Total Dissolved Solids in CEN 10:1 Leachate	Total Phenols in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach
	Detection Method		GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS
	Method Detection Limit		<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<0.1%	<350mg/kg	<0.1mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.004mg/kg	<0.01mg/kg	<0.01mg/kg
UKAS Accredited [Testing Laboratory] No. 1291													✓				
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
07-B08783-S0001	BH4	1.00	<1	<1	<1	<1	<1	<1	35.3	2980	<0.1	0.02	0.03	2.26	<0.004	0.47	1.38
07-B08783-S0002	BH9	1.50	<1	<1	<1	<1	<1	<1	21.2	2980	<0.1	0.05	0.27	5.48	<0.004	0.01	0.08
07-B08783-S0003	BH12	0.50	<1	<1	<1	<1	<1	<1	11.7	1660	<0.1	0.03	0.03	2.76	<0.004	<0.01	0.02
07-B08783-S0004	BH16	1.50	<1	<1	<1	<1	<1	<1	12.8	2940	<0.1	0.04	0.03	3.47	<0.004	<0.01	0.06
07-B08783-S0005	BH16	2.50	<1	<1	<1	<1	<1	<1	71.6	5900	<0.1	0.03	0.02	3.77	<0.004	0.02	0.08
07-B08783-S0006	BH17	1.50	<1	<1	<1	<1	<1	<1	10.9	3540	<0.1	0.02	0.05	3.65	<0.004	<0.01	0.05
07-B08783-S0007	BH22	0.50	<1	<1	<1	<1	<1	<1	22.6	2000	<0.1	0.32	0.02	4.08	<0.004	0.01	0.09

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B08783/01
Client: IGSL Ltd
Date of Receipt: 20/12/2007
(of first sample)

Sample Type: SOIL
Location:
Client Contact: John Clancy
Client Ref: TRINITY WHARF WEXFORD

		Detection Method	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE
		Method Detection Limit	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<20mg/kg	<10mg/kg	<1mg/kg	<30mg/kg
UKAS Accredited [Testing Laboratory] No. 1291											
ALcontrol Reference	Sample Identity	Other ID	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
07-B08783-S0001	BH4	1.00	<0.01	0.08	0.04	0.04	0.12	148	384	<1	414
07-B08783-S0002	BH9	1.50	<0.01	0.16	0.02	0.05	0.12	41	731	4	1196
07-B08783-S0003	BH12	0.50	<0.01	0.07	<0.01	0.03	0.15	64	362	6	259
07-B08783-S0004	BH16	1.50	<0.01	0.07	0.08	0.03	0.67	53	71	2	1089
07-B08783-S0005	BH16	2.50	<0.01	0.34	0.07	0.02	2.11	84	86	3	2667
07-B08783-S0006	BH17	1.50	<0.01	0.05	0.09	0.03	0.38	25	399	3	1076
07-B08783-S0007	BH22	0.50	<0.01	0.09	0.01	<0.01	0.42	39	597	4	269

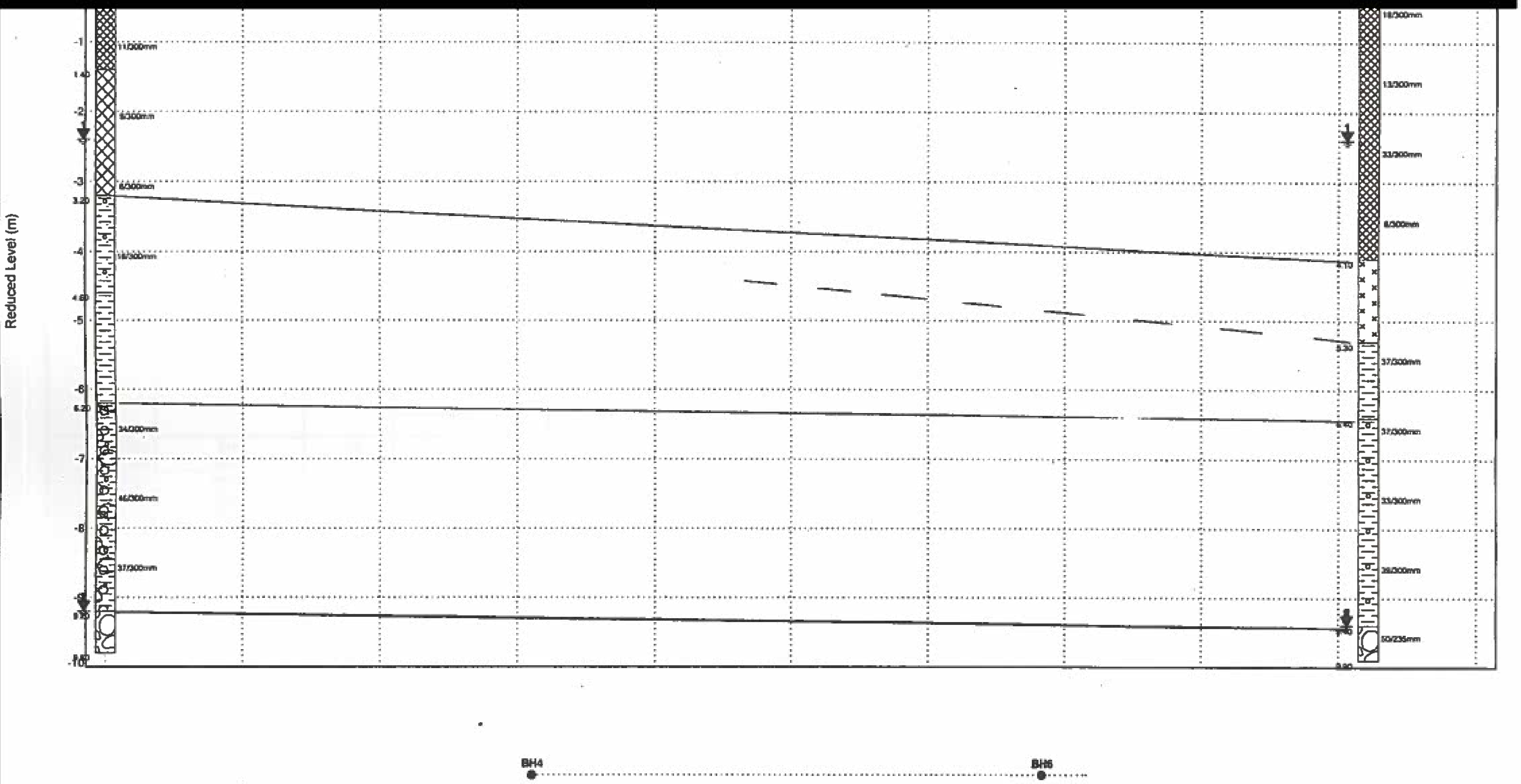
Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

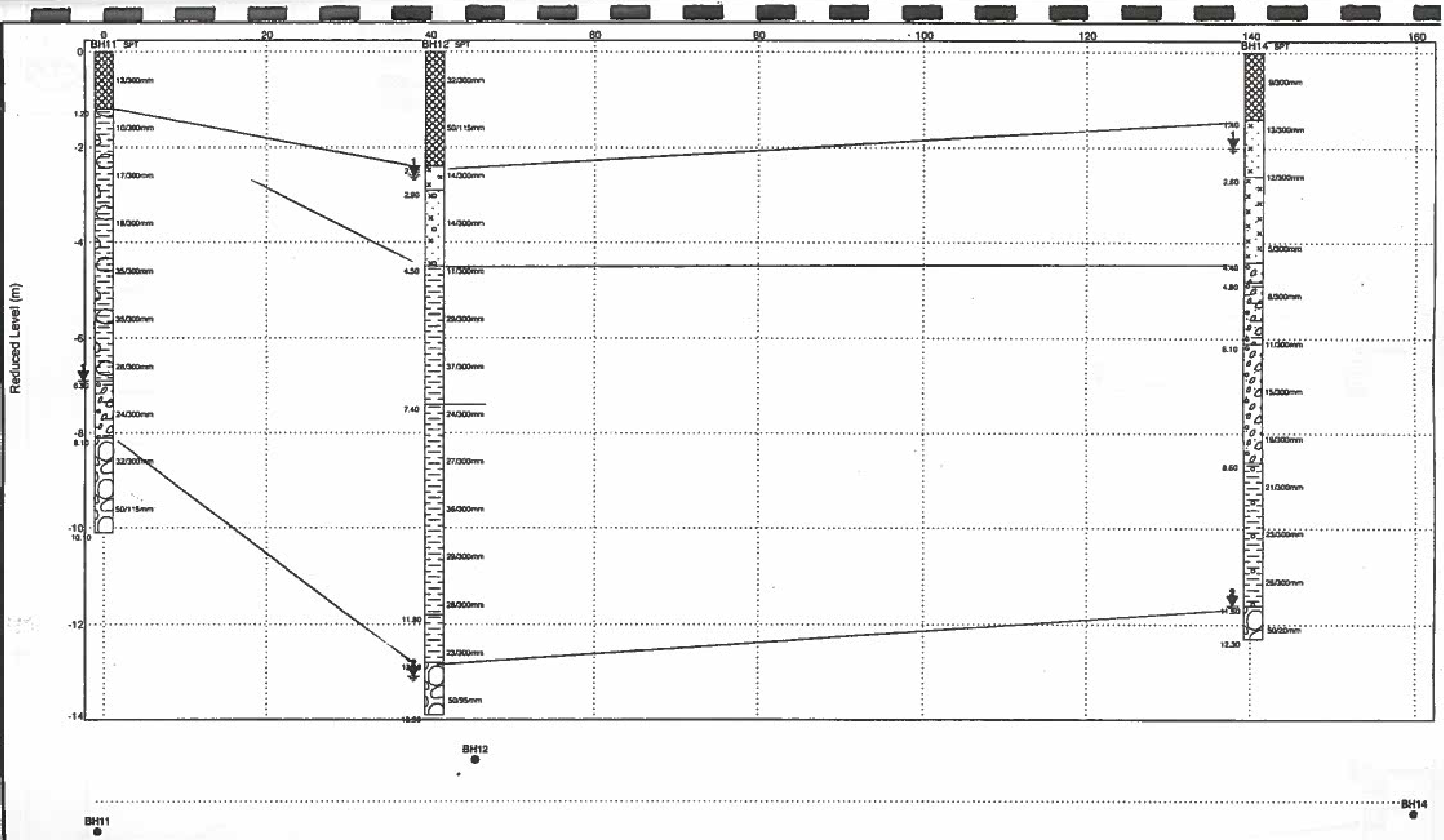
Appendix V Sections and Site Plans



LITHOLOGY GRAPHICS
▩ MADE GROUND
☒ MADE GROUND
▤ Sandy gravelly CLAY
☰ CLAY
▤ Silty sandy gravelly cobbly bouldery CLAY
◠ BOULDERS
☒ SILT
▤ Gravelly CLAY

SUBSURFACE SECTION

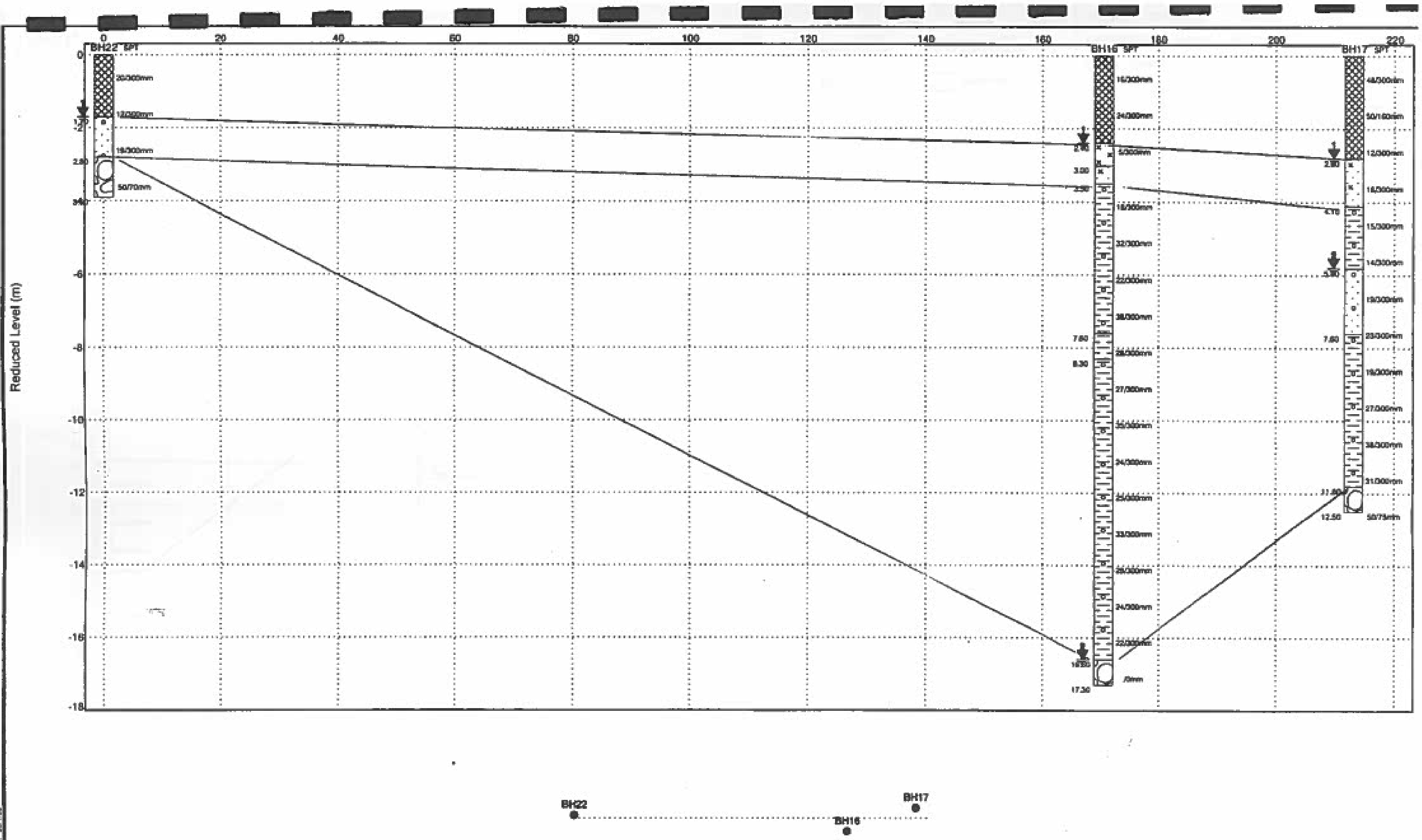
Client: Deerland Properties
Project: Trinity Wharf, Wexford
Number: 13184



LITHOLOGY GRAPHICS
▩ MADE GROUND
▤ Bouldery CLAY
▤ Clayey GRAVEL
◠ BOULDERS
☒ Sandy SILT
☒ Silty gravelly SAND
☰ CLAY
☒ Silty SAND
▤ Sandy GRAVEL
▤ Clayey sandy GRAVEL
▤ Gravelly CLAY

SUBSURFACE SECTION

Client: Deerland Properties
Project: Trinity Wharf, Wexford
Number: 13184

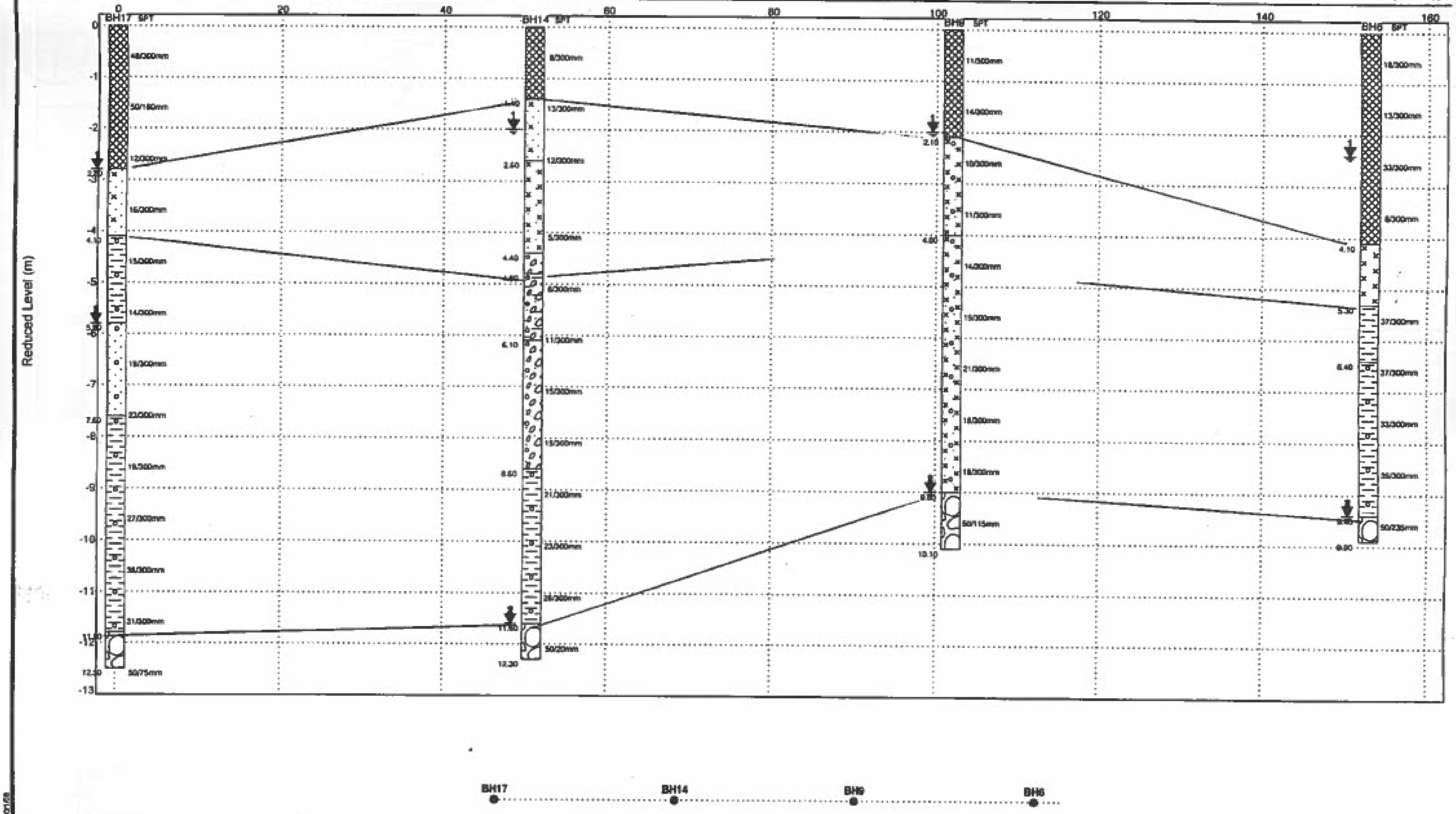


LITHOLOGY GRAPHICS

▩ MADE GROUND	SILT	Silty SAND	Gravelly CLAY	CLAY
BOULDERS	Gravelly SAND			

SUBSURFACE SECTION

Client: Deerland Properties
Project: Trinity Wharf, Wexford
Number: 13184

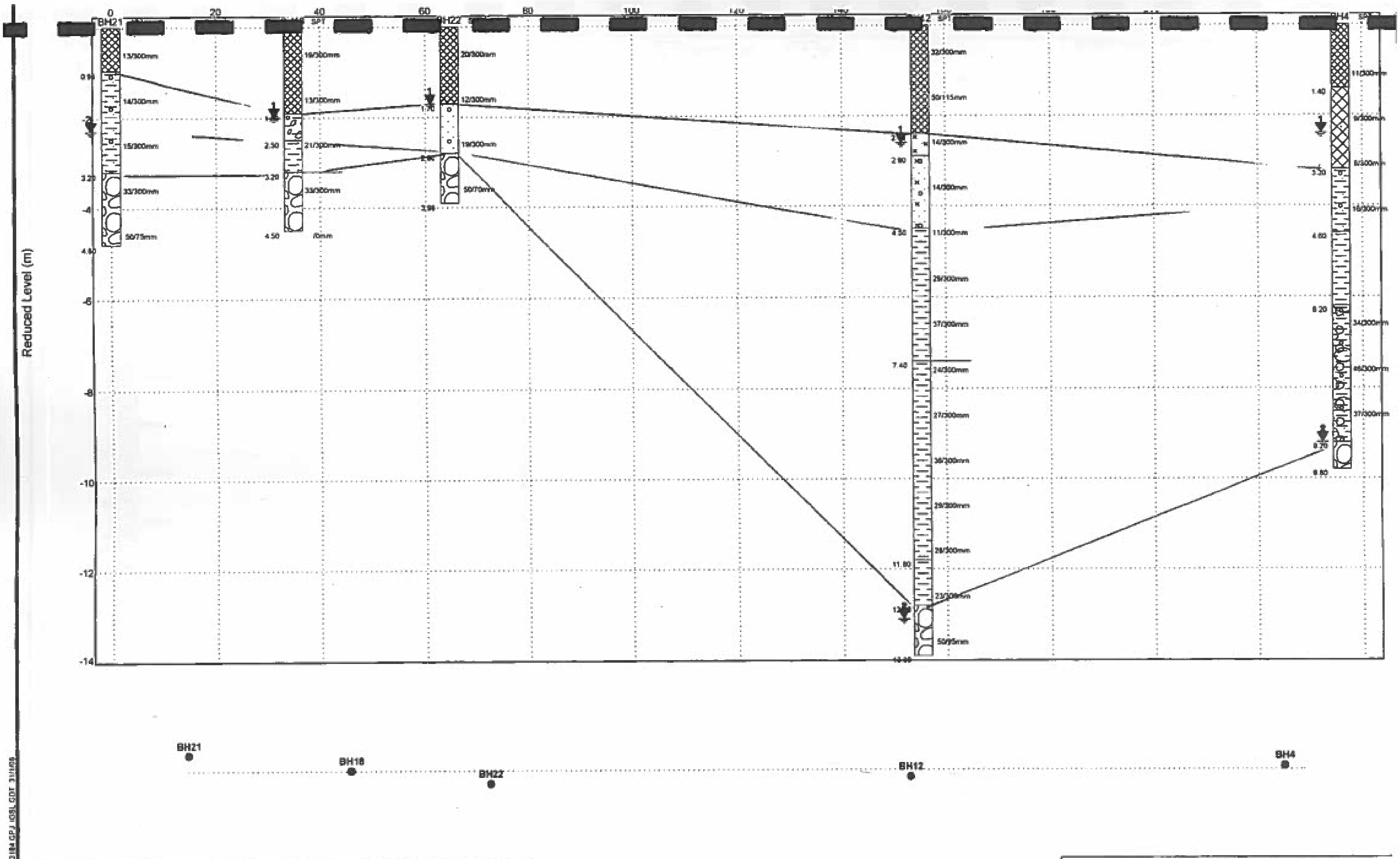


LITHOLOGY GRAPHICS

▩ MADE GROUND	Silty SAND	Sandy SILT	Sandy GRAVEL	Clayey sandy GRAVEL
Gravelly CLAY	BOULDERS	Gravelly SAND	SILT	CLAY
Sandy gravelly SILT				

SUBSURFACE SECTION

Client: Deerland Properties
Project: Trinity Wharf, Wexford
Number: 13184



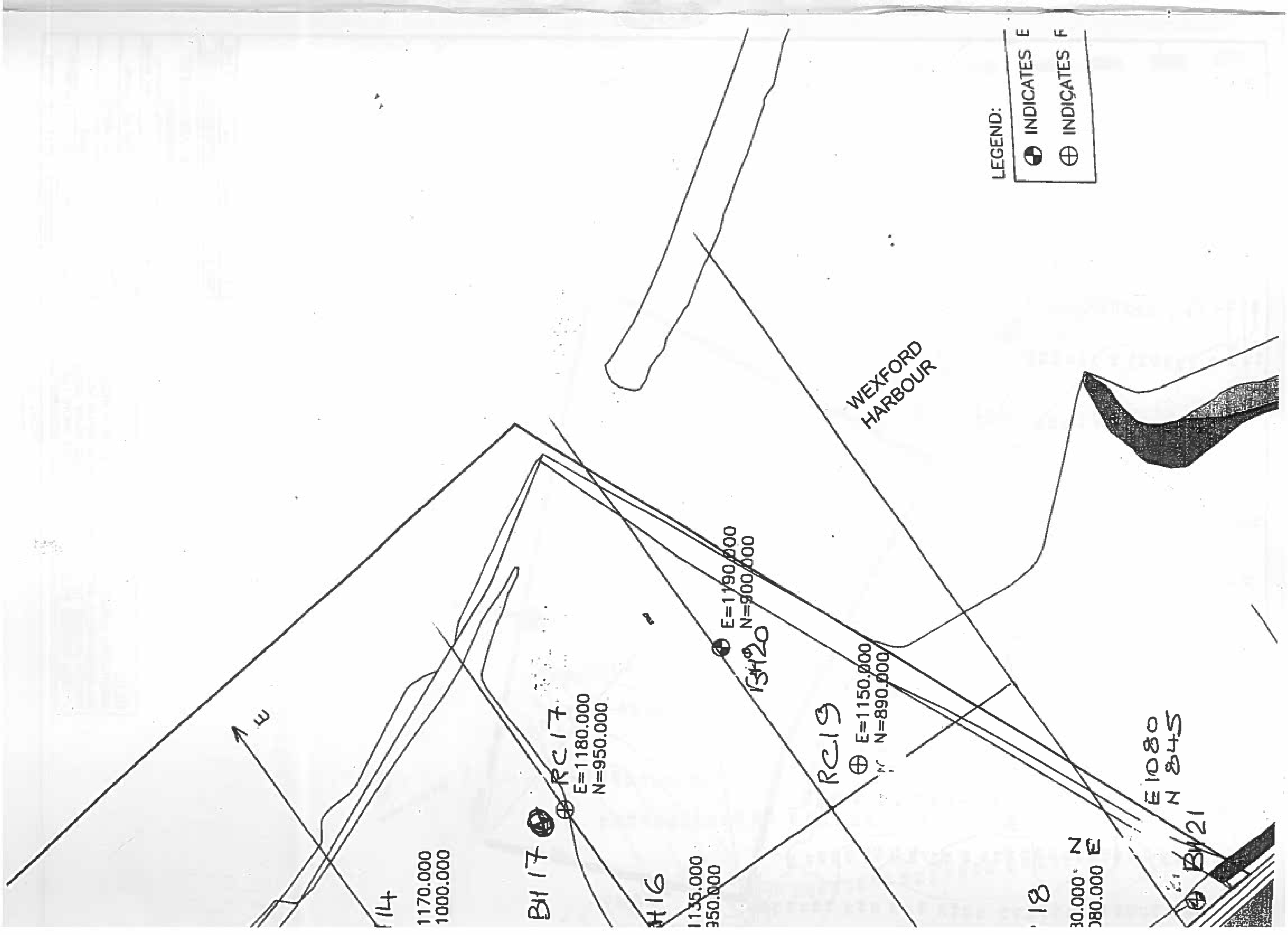
LITHOLOGY GRAPHICS

- ▨ MADE GROUND
- ▨ Clayey sandy GRAVEL
- ▨ Sandy SILT
- ▨ Sandy gravelly CLAY
- ▨ Silty gravelly SAND
- ▨ Gravelly SAND
- ▨ CLAY
- ▨ MADE GROUND
- ▨ BOULDERS
- ▨ Silty sandy gravelly cobbly bouldery CLAY

IGSL

SUBSURFACE SECTION

Client: Deerland Properties
Project: Trinity Wharf, Wexford
Number: 13184



Chapter 9:
Hydrogeology

ROUGHAN & O'DONOVAN

Chapter 9 Hydrogeology

9.1 Introduction

The proposed development for the Trinity Wharf site will facilitate a mix of office, leisure and residential development, with a primary objective of increased sustainable employment. It will also include the development of high-quality public realm spaces within the development and pedestrian friendly links along the waterfront linking to Crescent Quay and to Wexford town centre.

9.2 Methodology

This chapter has been prepared in accordance with the following guidelines:

- Institute of Geologists of Ireland (IGI) (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (NRA 2008) Environmental Impact Assessment of National Roads Schemes – A Practical Guide;
- National Roads Authority (NRA 2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Transport Infrastructure Ireland (TII 2015) Road Drainage and the Water Environment (DN-DNG-03065)
- Environmental Protection Agency (EPA 2015) Draft Advice Notes for Preparing Environmental Impact Statements; and
- Environmental Protection Agency (EPA 2017) Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

9.2.1 Desk Study

A desk study of the study area of the Proposed Development was carried out in order to establish baseline conditions. The desk study involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation with the following:

- Geological maps, Geological Survey of Ireland (GSI) (www.gsi.ie);
- Groundwater quality status maps (watermaps.wfdireland.ie);
- Teagasc Subsoils map (gis.epa.ie/Envision);
- Water Features, Rivers and Streams, EPA (gis.epa.ie/Envision);
- National Parks and Wildlife Services Map Viewer (webgis.npws.ie/npwsviewer/);
- Historic Maps from the Ordnance Survey of Ireland (www.geohive.ie); and
- Aerial Photography from the Ordnance Survey of Ireland (www.geohive.ie).

9.2.2 Site Investigations

A walkover survey of the site was undertaken by Roughan & O'Donovan in 2018. In 2007, IGSL were commissioned by Kavanagh Mansfield and Partners Consulting Engineers to carry out intrusive ground investigations at the development site. A total of 22 boreholes were investigated, with 7 samples sent to Al Control Geochem for environmental texting under the Murphy Suite requirements. The results of these surveys are detailed in Chapter 8 and in section 9.3.10 below. While adequate information was available from these previous investigations, additional and more detailed ground investigations have been commissioned to be undertaken at the development site prior to detailed design stage in order to further classify ground conditions for design and also to quantify the disposal options for excavated material which may be contaminated.

9.3 Description of Receiving Environment

9.3.1 Soils & Subsoils

GSI Mapping

The Teagasc soil mapping identifies both Made Ground and Marine Sands and Gravel at the proposed development site. Boreholes undertaken in 2007 by IGSL on the site indicate made ground underlain by sands, silt and gravels. Refer to Figure 9.1 of Volume 3 for Teagasc soils mapping of the area.

Intrusive Site Investigations

Site Investigations (2007) identified made ground, sand, clay, silts, gravels and boulders on the site at depths varying from 0m to 9.5m Below Ground Level (BGL) across the site.

9.3.2 Bedrock Geology

GSI Mapping

The proposed development site is underlain by the Shelmaliere Formation which is described as white, purple quartzites with slates. A number of fault lines are recorded running parallel and perpendicular to the development site. It is likely that the historic faulting in the vicinity of the site has either extended existing fracturing and/or has created additional fractures in the rock. Refer to Figure 9.2 of Volume 3 for GSI bedrock geology mapping of the area.

Intrusive Site Investigations

Limestone and Sandstone/Siltstone bedrock was encountered at depths varying from 5m to 15.4m Below Ground Level (BGL) across the site. A highly weathered zone of up to 5m thickness was generally encountered during the intrusive investigations.

9.3.3 Groundwater Bodies & Bedrock Aquifers

The site is located with the Castlebridge North Groundwater Body (IE_SE_G_031). The bedrock aquifer underlying the site is classified as a Poor Aquifer (PI) – Bedrock which is generally unproductive except for local zones. Refer to Figure 9.3 of Volume 3 for GSI Aquifer and Groundwater Body (GWB) mapping of the area.

9.3.4 Groundwater Vulnerabilities

Groundwater vulnerability mapping for the site indicates that groundwater is at low vulnerability to pollution at the ground surface as a result of human activities. Refer to Figure 9.4 of Volume 3 for GSI vulnerability mapping of the area. The intrusive site investigations generally encountered made ground overlying alluvium and sandy clays or gravels – refer to Section 8.4 for details. The actual groundwater vulnerability across the site therefore ranges between moderate and high depending on the exact thickness of silt/clay deposits present.

9.3.5 Groundwater Recharge

Taking account of the low permeability and storativity of the Shelmaliere Formation, a recharge cap of 100mm has been assigned to these rocks indicating rejection of infiltration water annually.

9.3.6 Groundwater Abstractions

There are no recorded public groundwater supplies or group water schemes on the GSI database within the study area. There are a small number of recorded boreholes within 1km of the development site which are for industrial use.

9.3.7 Groundwater Quality

Under the requirements of the Water Framework Directive (WFD), the Castlebridge North groundwater body is classified as having an overall good status for water quality and quantity 2010-2015.

9.3.8 Site Hydrology

The development site is bounded to the north, south and east by the Lower Slaney Estuary. Under the most recent Water Framework Directive monitoring period (2010 – 2015), the status of this water body is classified as being "poor".

9.3.9 Groundwater Dependant Terrestrial Ecosystems (GWDTE) /Special Areas of Conservation (SAC)

Sites designated under the Natura 2000 and within 2km are listed in Table 9.1 below:

Table 9.1 Designated Sites

Natura 2000 Sites	**Distance from Site**
Slaney River Valley SAC (000781)	Within Project Area
Wexford Harbour and Slobs SPA (004076)	Within Project Area
Nationally Designated Sites	**Distance from Site**
Wexford Slobs and Harbour Proposed NHA (000712)	Within Project Area

There are no GWDTE present within the site.

9.3.10 Ground Contamination

As part of the intrusive ground investigations undertaken previously at the site, samples of the made ground (sample depths between 0.5 – 2.5m below ground level) were taken from a number of exploratory boreholes as part of the investigations by IGSL and were tested at the ALcontrol Ltd. accredited Laboratory facility. Details of these ground investigations can be seen in Chapter 08.

The main findings from the soil analysis were as follows:

- The pH of the soil samples ranged between 7.0 – 8.9;
- Elevated levels of Sulphate were noted in nearly all of the soil samples;
- The presence of hydrocarbons was noted in 2 of the 7 samples, however concentrations were low when compared to the relevant LQM/CIEH Suitable 4 Use Levels (S4UL) threshold values. BTEX substances were not detected in any of the samples;

- Elevated levels of Polycyclic Aromatic Hydrocarbons (PAHs) were identified in all soil samples.

The results of the leachate analysis showed that the majority of the dissolved metals and other inorganics were below the level of detection or below the guideline values for the parameter. Sulphate concentrations within the leachate analysis were above the threshold for classification of a waste as inert but did not exceed the threshold for consideration as stable non-reactive hazardous waste and non-hazardous waste (WAC guidelines).

Non-intrusive investigations carried out to date of the site have found fragments of asbestos across the surface of the site, however the extent of which is still to be quantified. Prior to the start of any construction works, a site specific intrusive asbestos survey will be undertaken by a suitably qualified, licenced and experienced contractor to work with asbestos. The asbestos surveys will include intrusive asbestos surveys and site investigations. This will be implemented prior to site clearance works and the subsequent construction of the site. Measures for dealing with Asbestos are outlined in Chapters 4 and 8 of this EIAR).

The additional ground investigations will be undertaken to inform the development of a Remediation Strategy and to inform the detailed design stage however sufficient information is available at this stage for EIAR purposes.

9.4 Description of Potential Impacts

9.4.1 Construction Phase

During the construction phase the following activities may pose a potential impact:

- Excavation of made ground;
- Contamination of soils;
- Aquifer Contamination and;
- Piling and rock armour revetment installation.

9.4.1.1 Excavation of Made Ground

Limited excavation of made ground will take place during construction, particularly during the installation of the foul pumping station and any deep service trenches. The excavation of any localised areas of ground contamination will be a Permanent Positive impact on the soils environment due to the requirement to remove the material off-site and dispose or treat it in accordance with relevant legislation. During the construction phase, any excavated contaminated material which is stored on-site awaiting removal for disposal will present a risk due to contaminated surface runoff. This would represent a moderate to significant impact due to the downstream receptor being a European Site. Any improvement to the quality of soils will have a corresponding benefit to the underlying groundwater resources due to the removal of a potential source of contamination for percolating water. Therefore, the magnitude of this impact is Minor Beneficial due to a minor improvement to the attributes quality.

9.4.1.2 Contamination of Soils

There is a potential risk of localised contamination from construction materials leeching into the underlying soils by exposure, dewatering or construction related spillages resulting in a Permanent Negative impact on the soils. In the case of soils, the magnitude of this impact is Small Adverse as the requirement of good construction practices will necessitate the immediate excavation/remediation of any such spillage resulting in a very low risk of pollution to the soils and consequently the underlying aquifers. The significance of this impact is slight.

9.4.1.3 Aquifer Contamination

There is a potential risk of localised contamination of the surface water and groundwater bodies due to construction activities i.e. construction spillages, leaks from construction plant and material etc. resulting in a Permanent Negative impact on these water bodies. The main surface water body that would be affected is the Lower Slaney Estuary which is immediately adjacent to the development site.

The excavation of material at the site will have the effect of locally increasing the vulnerability rating of the underlying aquifer; however, the majority of the areas where the material will be excavated will be covered in hardstanding, which will mitigate the potential for contaminants to enter the underlying aquifer from the surface. As such the potential impact may be deemed slight.

9.4.1.4 Piling and Rock Armour Revetment Installation

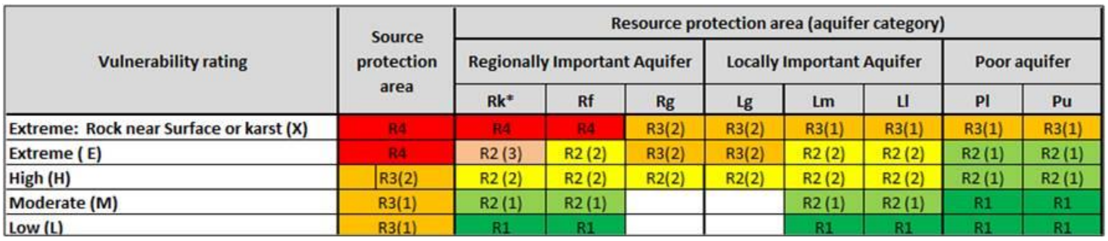
There is a potential risk of localised contamination during the installation of the proposed sheet pile wall surrounding the development and the pile foundations for the boardwalk, and/or proposed buildings and the chosen restraint option for the marina. The ground investigations undertaken in 2007 indicate that the site is moderately contaminated, while the presence of asbestos has also been discovered on the site. It is proposed that pile foundations be utilised and that these be driven into the existing ground. Along the northwest and south east edges of the site, a combined sheet pile wall and rock armour revetment will be constructed. There is a risk that the contaminants present in the made ground across the site may be brought to the surface during excavation works or driven down into underlying aquifer. The impact associated with driven piles is slight, as contaminated material will be dragged down into the underlying soil layers by shaft friction, however the displacement of these contaminants is likely to be insignificant. Any locally excavated material arising from these operations is assumed to be contaminated and will be removed off site and disposed of at an approved and licenced facility.

9.4.2 Operational Phase

9.4.2.1 Road Runoff – Groundwater Risk Assessment

A groundwater risk assessment has been carried out in line with the NRA (TII) Document DN-DNG-03065 in relation to potential impacts on groundwater from the proposed road drainage system and specifically in relation to the use of permeable drainage systems. DN-DNG-03065 outlines the required methodology for carrying out such an assessment and the specific criteria involved.

Table 9.2 Groundwater Protection Response Matrix for the use of permeable drains in road schemes (NRA (TII) DN-DNG-03065, 2015)



Vulnerability rating	Source protection area	Resource protection area (aquifer category)							
		Regionally Important Aquifer			Locally Important Aquifer			Poor aquifer	
		Rk*	Rf	Rg	Lg	Lm	Ll	Pl	Pu
Extreme: Rock near Surface or karst (X)	R4	R4	R4	R3(2)	R3(2)	R3(1)	R3(1)	R3(1)	R3(1)
Extreme (E)	R4	R2 (3)	R2 (2)	R3(2)	R3(2)	R2 (2)	R2 (2)	R2 (1)	R2 (1)
High (H)	R3(2)	R2 (2)	R2 (2)	R2(2)	R2(2)	R2 (2)	R2 (2)	R2 (1)	R2 (1)
Moderate (M)	R3(1)	R2 (1)	R2 (1)			R2 (1)	R2 (1)	R1	R1
Low (L)	R3(1)	R1	R1			R1	R1	R1	R1

As per Table 9.2 above *(Table A.4 of DN-DNG-03065 – Groundwater Protection Response Matrix for the use of permeable drains in road schemes),* the proposed development has a response of R1 indicating that the use of permeable road drainage systems is Acceptable subject to a number of criteria being met. The response R2(2) states that the use of permeable drainage systems is:

- Acceptable subject to minimum design standards in the NRA DMRB and Notes 1 and 2.

Water Strike readings ranged from 1.7m to 2.8m BGL on the development site. No karst features have been identified on the site.

9.4.2.2 Drainage and Foul Sewers

A new foul and surface water drainage system will be provided as part of the proposed development. Foul discharge will ultimately discharge to the existing combined network on Trinity Street and will not impact the existing groundwater body.

The surface water drainage system will comprise of sustainable urban drainage systems (SuDS). The proposed drainage system will comprise of SuDS components that will provide treatment to runoff and allow for limited infiltration to groundwater (see Section 9.4.2.3 below and Chapter 4), as deemed acceptable by the groundwater risk assessment undertaken.

9.4.2.3 Contaminated Land

Preliminary Intrusive Ground Investigations undertaken at the site have identified elevated levels of contaminants in the made ground (fill Material) principally PAH's and Sulphates. This material likely extends across the entire site within the made ground due to the historic uses of the site and the resulting disposal of contaminated materials.

For the purposes of this assessment, results have been benchmarked to both the LQM/CIEH Suitable 4 Use Levels (S4UL) and/or the Criteria for granular waste acceptable at landfills (Transposed from Council Decision annex 2003/33/EC). Soil leachate was assessed by comparing analytical results to the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (Statutory Instrument No. 9 of 2010), or 2016 (Statutory Instrument No. 366 of 2016) where added or replaced, and the Environmental Protection Agency's Draft Interim Guidelines Values (IGVs) for the Protection of Groundwater, 2003.

The means for assessing the significance of soil contamination in this assessment was the use of a Conceptual Site Model and consideration of the pollutant linkages using the Source-Pathway-Receptor Model.

Source – Pathway – Receptor

<u>Source</u>

Made ground across the site has been shown to have elevated levels of PAH's and Sulphates during preliminary Site Investigations. A total of 22 boreholes were drilled across the site and the made ground material (which is where the contaminated material is expected to be present) was generally between 0 – 2.5m below ground level however the made ground extended to 4.1m below ground level (at BH06, see Plate 8.1 in Chapter 8 Soils & Geology) towards the north-western end of the site. It must be noted that it is likely that a small portion of the contaminated material present at the site will be excavated and removed off-site for disposal to allow for the construction of elements of the development including the foul pumping station and any deep service trenches required.

Pathway

The contamination is already in place within the made ground and has been in place for an extended period. The main pathway therefore for the contamination to reach a receptor is mobilisation through infiltrating surface water with subsequent migration either downwards through the subsoil or migrating north-east towards the estuary.

Receptor

There are two possible receptors for mobilised contamination within infiltrating water:

- The River Slaney estuary (Slaney Slaney River Valley SAC) located along the east, south-east and north-western site boundaries. This is a European Site, which is of Extremely High Attribute Importance.
- The bedrock aquifer beneath the site (Mudstone/Limestone bedrock overlain by a highly weathered zone). This is a poorly productive aquifer which is of Low Attribute Importance.

Groundwater supplies in the vicinity of the site are not considered as potential receptors. This is due to the site being located immediately adjacent to the River Slaney and therefore down gradient of any potential groundwater abstraction sites. In addition, any groundwater abstractions which do occur within 1km of the site are not recorded as being utilised as potable water supplies.

Conceptual Site Model (CSM)

The contaminated material is contained within made ground (infill) deposits extending across the site which are generally between 0 – 2.5m in thickness but which were found to extend to a depth of up to 4.1m in isolated locations. The made ground deposits are underlain by silt/clays which overlie gravels/sandy clays beneath which the weathered bedrock is present. The bedrock aquifer is poorly productive and consists of limestone and mudstone. GSI mapping for the area also indicates the presence of quartzite and slate – neither of which were encountered during intrusive coring. A recharge cap of 100mm per annum has been assigned to the bedrock aquifer by the GSI at this location due to its poor primary (and secondary) porosity and subsequent limited ability to accept and store groundwater.

In addition, a significant portion of the site is overlain by subsoil of which the clay or silt fraction is high indicating low or moderate permeability. The presence of this silt (or alluvium with or without clay horizons) material will impede the infiltration of recharge water. The majority of rainwater falling across the site therefore runs off to the River Slaney Estuary and does not infiltrate through the subsoil. The groundwater table is relatively high due to the proximity to the estuary and is within 2 – 3m below ground level. The bedrock is overlain by a highly weathered zone of broken rock which was encountered across the entire site. The majority of groundwater flow beneath the site occurs within this weathered zone and within the gravel deposits, which overlie this zone. Groundwater flow is generally from west to east towards the estuary, which is likely a discharge zone – albeit discharge volumes will be low due to the nature of the aquifer. This Conceptual Site Model has been illustrated in a cross-section through the site given in Plate 9.1 below.

Potential Impact Assessment

The main pathway which exists to allow contaminants enter either the bedrock aquifer or the River Slaney Estuary is the infiltration of water through the made ground and underlying subsoil to groundwater. The proposed development will result in a significant proportion of the site being covered in hard-standing. This will limit the potential for infiltration of water through the contaminated material and subsequent mobilisation of contaminants to groundwater. However, runoff from a significant portion of these hardstanding areas (buildings/roads/parking areas etc.) is being routed to permeable paving and/or vegetated swales where attenuation will take place. These features will allow some portion of this water to infiltrate while it is stored with the remainder discharging to one of multiple outfalls to the estuary.

Whilst this does pose a potential risk to the two identified receptors, the risk is low due to the low permeability subsoils which underlie the fill material and the results of the soil leachate tests which were generally below threshold values. The entire site will require the importation of fill material in order to raise the level of the site to the required finished floor and road elevations. Generally, the extent of this fill will be 1m or greater in thickness with the uppermost 250mm of this fill material comprising of compacted clay with a permeability of 1 x 10^{-7} ms^{-1} or less. This clay layer will be located beneath all permeable paving, swales, and the growing media required for landscaped areas. This low permeability compacted clay will effectively prevent infiltration of rainwater to the underlying subsoil and therefore prevent mobilisation of contaminants into the underlying gravels and weathered bedrock. Some limited infiltration will ultimately still occur, but this will represent a small fraction of total effective annual rainfall. In addition, the proposed sheet-piled wall at the site perimeter will also provide a barrier to contain contaminated material within the site thus representing an additional level of protection.

Given that the bedrock aquifer is of low importance the associated risk arising from the proposed development in combination with the contaminated material is extremely low and the impact rating is therefore Imperceptible. The incorporation of the low permeability fill material (and additionally the sheet-piled wall) will in fact reduce the existing risk arising from the site in its current state. The risk to the River Slaney Estuary SAC is also low and the potential impact assessment is deemed to be Imperceptible.

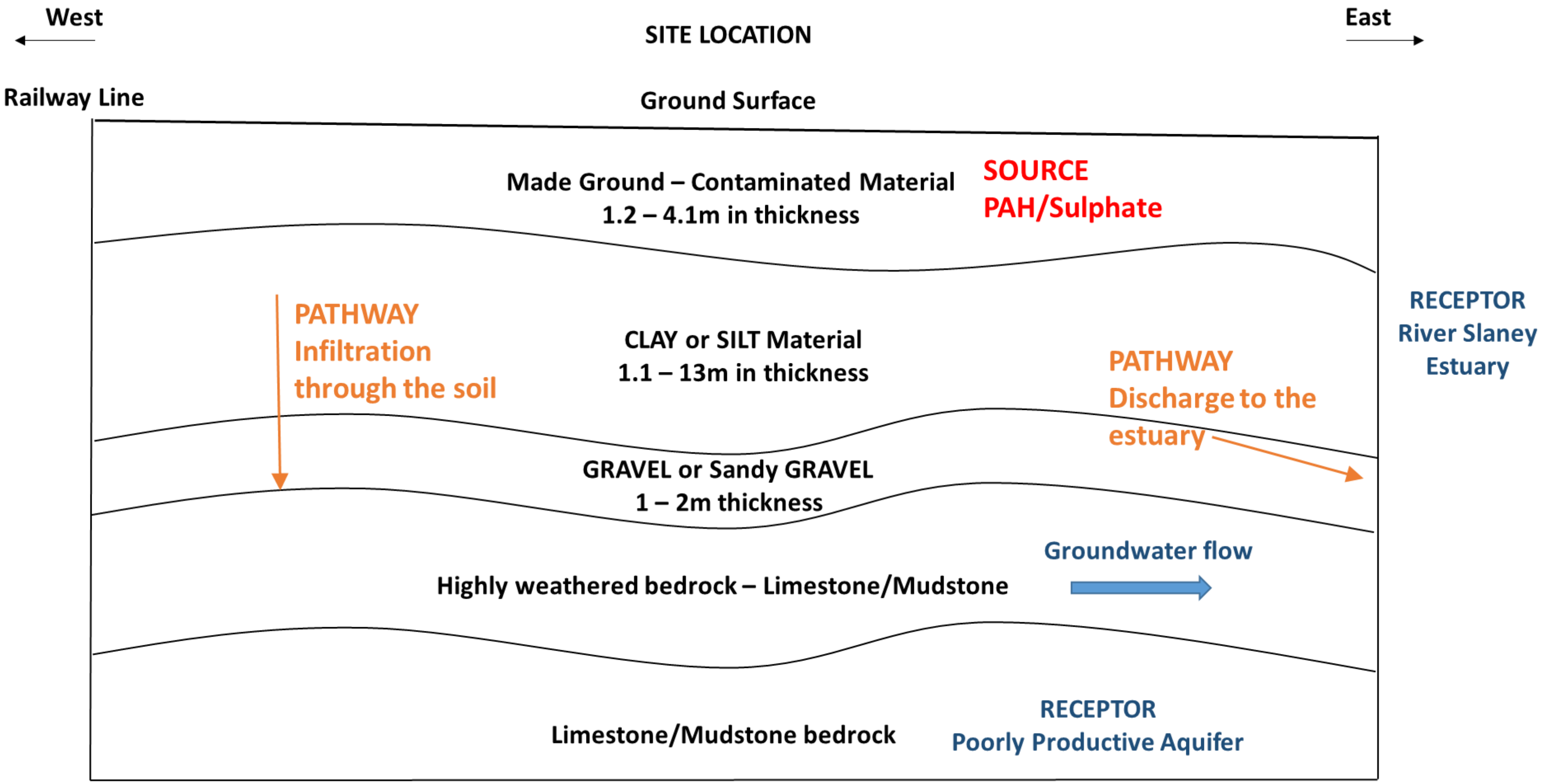


Plate 9.1 **Conceptual Site Model (CSM)**

9.4.2.4 Groundwater Supplies

The proposed development will not impact existing groundwater supplies and therefore there will be an imperceptible impact. It is proposed that the development be served from the existing water infrastructure in Wexford town.

9.4.2.5 Aquifer Recharge

As a result of the proposed development, there will be an increase in the total impermeable area of the site and correspondingly a potential reduction in aquifer recharge. Permeable paving in lightly trafficked areas such as cul-de-sacs and parking areas will be provided along with SuDS components such as swales which will be underlain by the low permeability clay material. This will allow for some surface water to infiltrate to ground however this will be limited. It is noted however that the low storage available within the underlying poorly productive bedrock aquifer already results in annual rejection of recharge with a recharge cap applied. Therefore, the potential impact to aquifer recharge is seen as imperceptible.

9.5 Mitigation & Monitoring Measures

9.5.1 Construction Phase

A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors for the development in line with the Outline CEMP and EOP appended to this EIAR (see Appendices 4.1 and 4.2). For the phased elements, it will be maintained by the separate contractors for the duration of the construction phase. The CEMP will cover all potentially polluting activities and include an Incident Response Plan. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice. The CEMP will include a range of site-specific measures which include:

- Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding;
- Runoff will be controlled and treated to minimise impacts to surface and groundwater;
- Prior to any works taking place on-site, a comprehensive and detailed ground investigation programme shall be undertaken to fully quantify the nature and extent of contaminated material present at the site;
- All material excavated at the site shall be assumed to be contaminated. Appropriate testing of this material by a suitably qualified and licenced waste contractor shall take place for all aspects of ground contamination and the material shall be disposed of off-site to a suitably licenced waste facility. Temporary storage of any contaminated material on-site shall be carefully managed so as to limit any risk of contaminated surface water runoff to the River Slaney Estuary. The material shall be stored at least 25m away from the high-water mark in the estuary. Runoff from the material shall be directed to lined pond or temporary sewer/tank and the water shall be disposed of off-site for treatment at an appropriate licenced facility. Alternatively, the material shall be covered while stored to remove the risk of surface water contamination;
- Excavations into the existing ground for the installation of the foul pumping station, deep service trenches and surface water drainage network serving the proposed access road off Trinity Street. The material removed will be assumed to be contaminated and will be appropriately disposed of (as outlined in the point above). Suitable backfill material to the pipes will be imported to site. A 250mm

layer of imported clay will be placed beneath the swale to prevent the infiltration of rainwater to the underlying subsoil and therefore prevent mobilisation of contaminants into the underlying gravels and weathered bedrock;

- Where temporary pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap;
- All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase;
- Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction; and
- Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering Wexford Harbour.

9.5.2 Operational Phase

All potential impacts have been identified as slight in the operational phase and as such no long-term mitigation measures are proposed.

9.6 Residual Impacts

The incorporation of the mitigation measures outlined in Section 9.5 will result in the magnitude of any impacts either during construction or operation to be considered as Negligible. As a result, the significance of all residual impacts is Imperceptible.

9.7 Difficulties Encountered

No difficulties were encountered in undertaking this hydrogeological assessment.

9.8 References

Geological maps, Geological Survey of Ireland (GSI) (www.gsi.ie);

Groundwater quality status maps (watermaps.wfdireland.ie);

Teagasc Subsoils map (gis.epa.ie/Envision);

Water Features, Rivers and Streams, EPA (gis.epa.ie/Envision);

National Parks and Wildlife Services Map Viewer (webgis.npws.ie/npwsviewer/);

Historic Maps from the Ordnance Survey of Ireland (www.geohive.ie);

Aerial Photography from the Ordnance Survey of Ireland (www.geohive.ie);

Kavanagh Mansfield and Partners (2008): Report on a site investigation for a development at Trinity Wharf Wexford

Chapter 10:
Hydrology

ROUGHAN & O'DONOVAN

Chapter 10 Hydrology

10.1 Introduction

The proposed development for the Trinity Wharf site will facilitate a mix of office, leisure and residential development, with a primary objective of increased sustainable employment. It will also include the development of high quality public realm spaces within the development and pedestrian friendly links along the waterfront linking to Crescent Quay and to Wexford town centre.

The development as described in Chapter 4 will include a boardwalk link to Paul Quay north of the Trinity Wharf site and a 64-berth marina within the Lower Slaney Estuary, located off the northern corner of the site. This chapter has assessed the potential impacts on the hydrology of the local environment as a result of the construction and operation phases of the proposed development.

10.2 Methodology

This chapter has been prepared having due regard to relevant legislation guidance documents which are listed below:

- EPA Guidelines on the Information to be contained in Environmental Impact Statements (2002);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (2003);
- Draft EPA (Environmental Protection Agency) Guidelines on the Information to be contained in Environmental Impact Assessment Reports, August 2017 (referred to where appropriate);
- Draft EPA Advice Notes for Preparing Environmental Impact Statements, September 2015;
- NRA 2009 Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- NRA 2008 Guidelines for the crossing of watercourses during the construction of National Road Schemes.

10.3 Description of Receiving Environment

10.3.1 Site Description & Topography

Trinity Wharf is a brownfield site, approximately 3.6 ha in area, located at the southern end of Wexford's quay-front. The total development will comprise 5.47 ha with the additional lands being required for the access from the Trinity Street, the marina, boardwalk and Paul Quay. The existing site consists of reclaimed land that extends into Wexford Harbour and was gradually reclaimed, with the northern part reclaimed around 1832 initially as a dockyard area and then extended south-eastwards through the late 1800s and early 1900s. The northern part of the site changed from being a dockyard to a market and then a bacon processing plant (Clover Meats) which closed in the late 1980s leaving the site vacant. The southern part of the site developed as an ironworks which operated from 1911 – 1964, following which it was used as a car assembly plant until the early 1980s, and then for manufacturing electronic components (Wexford Electronix) until 2001. The site is now disused and partly overgrown with most structures demolished, except for a masonry stone boundary wall dividing the two compounds.

There are a number of spoil embankments and concrete surfaces on the site, however the topography of the site generally falls from the centre towards the west and eastern boundaries.

10.3.2 Regional & Local Hydrology

The development site is bound to the north, south and east by the Lower Slaney Estuary. The River Slaney rises on Lugnaquilla Mountain, approximately 70km north of the subject site, and generally flows south towards the Irish Sea. The River Slaney becomes tidal, approximately 5km south of Enniscorthy town. There are a number of minor tributaries that join the River Slaney, upstream of the development site.

The River Slaney is located within Hydrometric Area No.12 (Slaney & Wexford Harbour). This catchment has a total draining area of approximately 1,980km^2. The proposed development is within the Forth Commons WFD sub-catchment.

10.3.2.1 EPA Monitoring River Programme

The EPA carries out water quality assessments of rivers, transitional and coastal water bodies as part of a nationwide monitoring programme. Data is collected from physico-chemical and biological surveys, sampling both river water and the benthic substrate (sediment).

Water sampling is carried out throughout the year and the main parameters analysed include: conductivity, pH, colour, alkalinity, hardness, dissolved oxygen, biochemical oxygen demand (BOD), ammonia, chloride, ortho-phosphate, oxidised nitrogen and temperature.

As is the case for rivers and lakes the impact of nutrient enrichment and the process of eutrophication is also a major concern in the tidal waters environment. The direct negative effects of excessive nutrient enrichment include increases in the frequency and duration of phytoplankton blooms and excessive growth of attached opportunistic macroalgae. The subsequent breakdown of this organic matter can lead to oxygen deficiency which in turn can result in the displacement or mortality of marine organisms. As such the effects of over enrichment can severely disrupt the normal functioning of tidal water ecosystems.

The status of individual estuarine and coastal water bodies is assessed using the EPA‟s Trophic Status Assessment Scheme (TSAS). This assessment is required for the Urban Waste Water Treatment Directive and Nitrates Directive. The scheme compares the compliance of individual parameters against a set of criteria indicative of trophic state (Table 10.1). These criteria fall into three different categories which broadly capture the cause-effect relationship of the eutrophication process, namely nutrient enrichment, accelerated plant growth, and disturbance to the level of dissolved oxygen normally present.

Table 10.1 Biological River Water Quality Classification System

Trophic Status	Pollution Status	Condition
Unpolluted	Unpolluted	Unpolluted water bodies are those which do not breach any of the criteria in any category
Intermediate	Unpolluted	Intermediate status water bodies are those which breach one or two of the criteria

Trophic Status	**Pollution Status**	**Condition**
Potentially Eutrophic	Slightly polluted	Potentially Eutrophic water bodies are those in which criteria in two of the categories are breached and the third falls within 15 per cent of the relevant threshold value
Eutrophic	Polluted	Eutrophic water bodies are those in which criteria in each of the categories are breached, i.e. where elevated nutrient concentrations, accelerated growth of plants and undesirable water quality disturbance occur simultaneously

The Lower Slaney Estuary had an EPA Transitional Surface Water Quality Status of "Potentially Eutrophic" from 2010 – 2012 and a Water Framework Directive (WFD) Status of "Poor" from 2010 - 2015.

10.3.3 Site Drainage

The development site is a brownfield site. Drainage records indicate that there is an existing combined sewer located along Trinity Street, immediately southwest of the site. These existing drainage records do not show a surface water outfall from the site to the existing drainage network on Trinity Street. The existing topography dictates that runoff discharges directly to the Lower Slaney Estuary.

10.3.4 Groundwater Dependant Terrestrial Ecosystems (GWDTE) /Special Areas of Conservation (SAC)

Sites designated under the Natura 2000 and within 2km are listed in Table 10.2 below:

Table 10.2 Sites designated under Natura 2000

Natura 2000 Sites	**Distance from Site**
Slaney River Valley SAC (000781)	Within Project Area
Wexford Harbour and Slobs SPA (004076)	Immediately Adjacent to site
Nationally Designated Sites	**Distance from Site**
Wexford Slobs and Harbour Proposed NHA (000712)	Within Project Area

There are no GWDTE present within the site.

10.3.5 Water Supplies

There are no recorded public groundwater supplies or group water schemes within the GSI database. There are a small number of recorded boreholes within 1km of the development site which are for industrial use. There are also a number of abstraction points on the River Slaney, upstream of the development site that are used for drinking water purposes.

10.3.6 Flood Risk Identification

The flood risk of the proposed development has been assessed as part of this study. Previous flood studies have been undertaken as part of the national Preliminary Flood Risk Assessment (PFRA), the Catchment Flood Risk Assessment and Management (CFRAM) Programme, the Irish Coastal Protection Strategy Study (ICPSS) and the Wexford Town and Environs Development Plan 2009 – 2015 (as extended).

10.3.6.1 OPW Preliminary Flood Risk Assessment (PFRA)

As required by the EU Floods Directive, the OPW carried out a PFRA to identify areas where the risk of flooding may be significant. The PFRA is a broad scale assessment based on historic flooding, predictive analysis and consultation with local communities and experts. As part of the PFRA, maps of the country were produced showing the indicative fluvial, pluvial and tidal flood extents. Areas for Further Assessment (AFA's) were identified.

The PFRA map at the proposed development location indicates that the site is located within the 1 in 200 year and extreme coastal flood extents. There is no indication of groundwater flooding within the vicinity of the site, however there is indications of pluvial flooding, immediately south east of the development site. The PFRA mapping shows the 1 in 100 year and extreme pluvial flood extents immediately to the south east of the site.

10.3.6.2 OPW Catchment Flood Risk Assessment and Management (CFRAM)

Following on from the PFRA study, the OPW commissioned The South Eastern CFRAM Study Flood Risk Review which highlighted Wexford as an AFA for fluvial and Coastal flooding. This was based on a review of historic flooding and the extents of flood risk determined during the PFRA study. The Wexford town AFA incorporates the River Slaney and its associated tributaries.

The published final CFRAM (20/04/2017) fluvial mapping indicates that the development site is within the 1 in 10 year, 1 in 100 year and 1 in 1000 year fluvial flood extents. The site also lies within the 1 in 10 year, 1 in 200 year and 1 in 1000 year tidal flood extents, as indicated on the final CFRAM (18/07/2018) tidal mapping.

10.3.6.3 OPW Irish Coastal Protection Strategy Study (ICPSS)

The Irish Coastal Protection Strategy Study (ICPSS) is a national study that was commissioned in 2003 with the objective of providing information to support decision making about how best to manage risks associated with coastal flooding and coastal erosion.

The published tidal flood extent mapping indicates that the development site is within the 1 in 200 year and 1 in 1000 year tidal flood extents.

10.3.6.4 Wexford Town and Environs Development Plan 2009-2015 (as extended)

No flood risk assessment was undertaken as part of the Wexford Town and Environs Development Plan however, policy statements SW6-SW11 relate to flood risk in the planning document. The plan stipulates that floor levels of all buildings must be 300mm above the 1 in 100 year fluvial or 1 in 200 year tidal flood level.

10.4 Description of Potential Impacts

This section will discuss the impacts associated with the proposed development before mitigation measures are applied.

10.4.1 Construction

The potential impacts as a result of construction works are discussed below.

10.4.1.1 Construction Works

Construction activities pose a significant risk to watercourses, particularly contaminated surface water runoff from construction activities entering the watercourses.

Construction activities within and alongside surface waters, can contribute to the deterioration of water quality and can physically alter the stream/river bed and bank morphology with the potential to alter erosion and deposition rates locally and downstream. Activities within or close to the watercourse channels can lead to increased turbidity through re-suspension of bed sediments and release of new sediments from earthworks. The potential impact is moderate to significant.

The main contaminants arising from construction runoff include:

- Elevated silt/sediment loading in construction site runoff. Elevated silt loading can lead to long-term damage to aquatic ecosystems by smothering spawning grounds and gravel beds and clogging the gills of fish. Increased silt load in receiving watercourses stunts aquatic plant growth, limits dissolved oxygen capacity and overall reduces the ecological quality with the most critical period associated with low flow conditions. Chemical contaminants in the watercourse can bind to silt which can lead to increased bioavailability of these contaminants. Should significant sediment loading occur in the River Slaney Estuary the associated impact rating is assessed as moderate to significant.
- Spillage of concrete, grout and other cement based products. These cement based products are highly alkaline (releasing fine highly alkaline silt) and extremely corrosive and can result in significant impact to watercourses altering the pH, smothering the stream bed and physically damaging fish through burning and clogging of gills due to the fine silt. Construction spillages, if uncontrolled, represent a moderate impact to the River Slaney Estuary.
- Accidental Spillage of hydrocarbons from construction plant and at storage depots / construction compounds. Construction spillages, if uncontrolled, represent a Moderate Impact to the River Slaney Estuary.
- Faecal contamination arising from inadequate treatment of on-site toilets and washing facilities – this represents a slight impact the River Slaney Estuary.
- Contaminated ground excavated as part of the rock armour revetment works entering the Slaney Estuary. Should contaminated material enter the River Slaney the associated impact rating is assessed as slight to moderate.

The construction works required for the proposed marina will most likely involve pre-cast concrete anchor blocks being gently lowered to the seabed where they will then embed within the existing silt/sediment/mud providing an anchoring point for the marina. The placement of the anchor blocks in this manner could potentially release a very short-term and limited quantity of sediment to the estuary. This would result in negligible impacts to the River Slaney Estuary given the existing disturbance of sediment during tidal events. In the unlikely event that the seabed be unsuitable for such works it would be necessary to locally excavate the seabed to provide a level area onto which block anchors would be placed and then partially buried. Alternatively, should bedrock be encountered at a shallow depth, chain mooring could be fixed to a metal plate which would be rock bolted down onto the surface of the bedrock. This option would also require the local excavation of seabed material to expose bedrock for fixing works by divers. Any local excavation works of the seabed could cause a short-term and temporary sediment load being released to the estuary. Local excavations for the installation of block anchors, in the absence of mitigation, represents a slight impact to the River Slaney Estuary.

During site clearance and grading works there is potential for generation of contaminated surface water runoff arising from rainwater coming in contact with temporarily exposed contaminated material. This contaminated runoff could, in the absence of controls, then enter the River Slaney estuary and negatively affect water quality. In addition, deep excavations which encounter contaminated material may require dewatering of potentially contaminated surface water or groundwater. This pumped water could, in the absence of control measures, discharge overland to the River Slaney. Should contaminated surface water or groundwater enter the River Slaney the associated impact rating is assessed as slight to moderate.

10.4.1.2 Flooding

The proposed construction works will include for the construction of a new sea wall consisting of steel sheet piles to be installed around the perimeter of the site, with a reinforced concrete capping beam to be constructed on top of the sheet piles which will support a handrail. The proposed boardwalk will also consist of driven pile foundations.

The volumes of water displaced by the proposed sheet pile wall and board walk foundations during the construction phase is extremely small relative to the volumes of the receiving waterbody and will result in an imperceptible impact.

10.4.1.3 Sediment Transport

Hydrodynamic modelling was undertaken for the proposed marina in 2018 by RPS Consulting Engineers as part of the Trinity Wharf Marina Feasibility Study (RPS). This study concluded that the marina development would not significantly alter the sediment supply or flow of sediment in Wexford Harbour. Therefore, the associated impact is deemed to be slight.

10.4.2 Operational

The potential impacts as a result of the operational phase of the development are outlined below.

10.4.2.1 Morphological Changes to Surface Watercourses & Drainage Patterns

The existing surface water drainage pathways on the site will be altered as a result of the development and as a result, the impact is deemed to be slight.

10.4.2.2 Hardstanding Runoff

As a result of the proposed development, runoff from hardstanding areas such as roads, parking bays, roofs and footpaths will be generated. Unmitigated, this would increase the rate of runoff from the site and as a result, the associated effect is deemed to be slight.

10.4.2.3 Drainage and Foul Sewers

There is no indication of any existing foul or surface water drainage connections to the site. New separate foul and surface water drainage systems will be developed to serve the site.

Due to topographical constraints, foul effluent will require pumping to the existing foul/combined sewer network located on Trinity Street, south west of the site, where the effluent will ultimately be conveyed to the Wexford Wastewater Treatment Works for treatment.

10.4.2.4 Implications for Designated Sites

The potential impact associated with discharging untreated surface water into the Slaney River Valley SAC, Wexford Harbour and Slobs SPA and Wexford Slobs and Harbour Proposed NHA is considered moderate to significant, due to the environmental sensitivities of the area.

10.4.3 Flood Risk

The development site is located within Flood Zone A. The OPW "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (The Guidelines), 2009 states that for Flood Zone A, the probability of flooding from rivers and the sea is highest (greater than 1% or a 1 in 100 return period for river flooding or 0.5% or a 1 in 200 year return period for coastal flooding). As a result of the proposed development, there will also be an increase in impermeable areas on the site, as mentioned in Section 10.4.2.2 above.

Flood risk assessments at strategic and site specific scale have been undertaken as part of the following studies:

- Irish Coastal Protection Strategy (ICPSS);
- The South Eastern CFRAMs and;
- Trinity Wharf Marina Feasibility Study (RPS).

Extreme sea level return periods detailed in these studies are listed in table 10.3 below.

Table 10.3 Calculated sea Water Levels (WL) (all figures include a climate change factor as per the OPW MRFS)

Study	1 in 200 year WL (mOD)	1 in 200 year WL (mOD) + 300mm	1 in 1000 year WL (mOD)
Irish Costal protection Strategy Study	2.24	2.54	2.47
South Eastern CFRAMs	2.14	2.44	2.32
Trinity Wharf Marina Feasibility Study	2.34	2.64	2.56

The highest values among the various flood studies (Table 10.3) were calculated as part of the Trinity Wharf Marina Feasibility Study (RPS). As per the precautionary approach, these are considered the most suitable indicators of flood risk prior to a detailed flood risk assessment of the Proposed Development being undertaken. The impact associated with flooding during the operational stage in the absence of appropriate mitigation is deemed to be moderate to significant.

10.4.4 Tide and Wave Height

The ICPSS states that there are no significant interactions of tidal currents and surges. Anecdotal evidence suggests that during frequent easterly wind conditions, the tidal levels in the Harbour do not drop during ebb flow (ICPSS Phase 2 South East Coast).

A Marina Feasibility Study was completed RPS Group for the Trinity Wharf Site in January 2018 (see Appendix 4.3), this builds upon the works undertaken as part of the ICPSS and South Eastern CFRAMs where extreme sea levels and wave action were examined.

The two wave height acceptance thresholds used in the study were based on guidelines published by the Yacht Harbour Association and the Australian Standard (AS3962) Guidelines for design of Marinas. The assessment concluded that for the marina to be viable and safe, a suitably designed defence structure would be required. The study calculated a 1 in 50 year significant wave height of 0.9m. The simulated wave height was significantly reduced by the implementation of defences such as breakwaters.

10.4.5 Cumulative Impacts of the Proposed Development

The cumulative impact as a result of the construction works and operational phase in the absence of mitigation is considered slight to moderate, mainly as a result of the proposed construction works. The construction related activities associated with the development are temporary and short term in nature. The mitigation and monitoring measures detailed below will aid in minimising the impacts associated with this development.

10.5 Mitigation and Monitoring Measures

10.5.1 Construction Mitigation

10.5.1.1 Construction Works

A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors appointed for the development following the Outline CEMP attached as Appendices 4.1 and 4.2 to this EIAR. The CEMP will list any difficulties encountered and it will be maintained by each Contractor for the duration of the construction phase. The CEMP and EOP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice. The following will be implemented as part of this plan:

- A draft Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of license or other such risks that could lead to a pollution incident, including flood risks;
- All necessary permits and licenses for in stream construction work for provision of the sea walls, boardwalk and marina works will be obtained prior to commencement of construction; and
- Inform and consult with Inland Fisheries Ireland (IFI) and Waterways Ireland (WI).

The draft CEMP and EOP will be developed by the selected construction contractors to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team.

During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.

- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board);
- Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers;
- CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors;
- CIRIA C648 Control of Water Pollution from Constructional Sites; and
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA/TII, 2006).

Based on the above guidance documents concerning control of constructional impacts on the water environment, the following outlines the principal mitigation measures that will be prescribed for the construction phase in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts:

- Exposure of contaminated material shall be minimised by placing the low permeability clay capping layer immediately following initial site grading and clearance works. Grading works shall progress in a manner which always allows runoff to be directed towards a temporary treatment facility without surface ponding. This will minimise contact time between the contaminated material and surface water and thus limit the opportunity for contamination to occur. Runoff which has been in contact with exposed contaminated material will be captured and directed to a temporary lined facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to Wexford Harbour.
- Should temporary dewatering be required during deep excavations within the contaminated material, strict control measures will be put in place for disposal of same. Water pumped from excavations within the contaminated material shall either be passed through the temporary surface water treatment/attenuation facilities before discharge to Wexford Harbour or discharged to a foul sewer. Should very heavily contaminated groundwater be encountered during deep excavations and pumping be required of same, temporary dewatering shall be either collected and discharged to a foul sewer via tanker or treated on-site by way of a temporary water treatment works. Groundwater samples shall be taken from boreholes across the site in advance of construction works taking place to determine which method of disposal is required. Specialist advice will be sought as to the most appropriate form of treatment required as determined by the pre-construction groundwater sampling results. The works shall be planned in an appropriate manner so as to minimise the need for construction dewatering. Where excavation into contaminated material does take place, control measures to limit or prevent surface water runoff from entering the excavation shall be incorporated. These measures may include shoring, sheet piling, benching/battering or embankment of the excavation perimeters.
- All construction compound areas will be required to be set back a minimum of 50m from the seaward boundary of the site. Protection of waterbodies from silt load will be carried out through use of grassed buffer areas, timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses;
- In order to attenuate flows and minimise sediment input into Wexford Harbour through run-off, all surface water run-off from the construction site shall be directed to a temporary facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to Wexford Harbour. An impermeable membrane overlaid with suitable fill will be provided to storage areas to prevent contamination or pollution of the groundwater;
- Settlement ponds, silt traps and bunds will be used where appropriate and construction within watercourses will be minimised. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap. General Constructional Compounds will not be permitted within 50m of Slaney River Valley SAC and Wexford Harbour and Slobs SPA. It may, however, be necessary to locate temporary storage areas adjacent to the Slaney Estuary when the marina and flood protection works are being undertaken. Measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the estuary. This will primarily be in the form of silt fences which will be installed along the

compound boundary to stop 'dirty' surface water runoff from entering the estuary without treatment;

- Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuelling locations will be contained within bunded areas and set back a minimum of 50m from watercourses;
- All construction machinery operating in-stream should be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery shall be steam cleaned and checked prior to commencement of in-stream works to avoid spread of invasive species;
- Oil booms and oil soakage pads should be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge;
- No refuelling of construction plant shall be undertaken while the vehicles are in or adjacent to watercourses, as this could lead to contamination of the watercourse through spillage of fuel. In addition, all construction vehicles entering the watercourse should be in good condition and be provided with drip trays to prevent pollution through dripping of oil or fuel from the vehicle;
- Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution;
- The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses;
- Any surface water abstracted from a watercourse for use during construction will be through a pump fitted with a filter to prevent intake of fish;
- The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Washout from concrete mixing plant will be carried out only in a designated contained impermeable area;
- All shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times;
- All pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather;
- Any concrete used in or over the estuary shall be pre-cast, where possible;
- Where concrete or other wet materials are to be used over water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials;
- A geotextile screen and boom with oil barrier will be required around such marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as boring in overburden or rock from polluting the river;
- Any materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan; and
- The placing of anchor blocs (if required) shall be undertaken so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.

10.5.2 General Operational Mitigation

10.5.2.1 Morphological Changes to Surface Watercourses & Drainage Patterns

SuDS components will convey runoff to the Lower Slaney Estuary while attenuation will be provided for the 1 in 100 year 6-hour event. The conveyance of runoff to the Lower Slaney Estuary will generally follow the existing site topography. The implementation of these proposed mitigation measures reduces the impact to imperceptible.

10.5.2.2 Hardstanding Runoff

As a result of the increase in hardstanding areas, runoff from the site will increase. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall. Whilst the base of the permeable paving and grassed swales will allow very limited percolation to the underlying subsoils, the percolating portion is expected to be minimal due to the incorporation of a low permeability clay layer across the entire site.

The surface water drainage system will be designed to store the 1 in 100 year 6 hour rainfall event plus a climate change factor (between tidal cycles). The OPW FSU Portal calculates this rainfall depth to be 80.76mm. Attenuation of surface water runoff will occur within a layer of coarse graded clean aggregate material installed below the permeable paving which will have a voids ratio of typically 30%. These proposed mitigation measures reduced the associated impact from hardstanding runoff from moderate/significant to slight. The provision of permeable paving within the development will negate the need to provide numerous individual petrol interceptors throughout the development. Treatment to runoff generated will be provided within the pavement layers through the processes of filtration, biodegradation, adsorption of pollutants and the settlement and retention of solids within the pavement layers.

10.5.2.3 Foul Drainage Infrastructure

In the event of a pump failure at the proposed foul pumping station, mitigation measures have been proposed. The pumping station has been designed to provide 24-hour effluent storage in case of failure. Standby pumps will also be provided.

10.5.2.4 Implications for Designated Sites

It is proposed that surface water from the proposed development discharges to the Slaney Estuary, which is an environmentally sensitive area. Mitigation measures that will be implemented include the design of a surface water drainage system to serve the proposed development. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall (with some limited percolation into the subsoil). The incorporation of a SuDS based approach will ensure that discharge will be controlled, and treatment of runoff will take place within the SuDS components. The implementation of these mitigation measures will reduce the associated impact from moderate/significant to imperceptible.

10.5.3 Flood Risk Mitigation

The flood risk associated with the proposed development is deemed to be moderate to significant. As discussed in Section 10.4.3, the following minimum levels will be required within the site:

- To satisfy the Wexford Town and Environs Development Plan 2009-2015 (as extended) all buildings as part of the proposed development must have a minimum floor level of 2.64mOD; and
- As per the OPWs Flood Risk Management Guidelines for Local Authorities (2009) "Less vulnerable developments" such as local transport infrastructure must have a minimum level of 2.34mOD.

The lowest proposed finished floor level for the development is 3.3mOD, while the lowest road level will be at 2.80mOD (generally 3.5mOD).

In addition to the flood risk measures above, a new steel sheet pile sea wall is to be provided along the northwest, southeast and northeast edges of the site as part of the development, while sections of the northwest and southwest edges will comprise an area of rock armour revetment outside of the sheet piles. A sheet pile driving rig will mobilise and begin driving sheet piles in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The existing wall will remain in place until the sheet pile wall is correctly installed and only then will be demolished. Construction of the rock armour revetment will involve suitable boulders being placed directly onto the silt/sediment of the seabed.

The marina will also be sheltered by a breakwater on the seaward side. This will involve driving pile sockets for the breakwater units and the pontoon walkways into the seabed. Vertical steel piles will then be grouted into the pile sockets to give good line and plumbness.

Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units and pontoon walkways and finger berths. Depending on substrate conditions, restraint chains could also be anchored by appropriately sized anchor blocks buried into the seabed.

The actual method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to ground investigations during detailed design phase. The proposed marina breakwater, sea wall and rock armour revetment along the perimeter of the site will protect the development against storm surge and wave action.

The proposed mitigation measures outlined above indicate that the risk associated with flooding can be reduced from moderate/significant to slight.

10.6 Residual Impacts

10.6.1 Construction Phase

Construction shall be undertaken in accordance with the measures outlined in Section 10.5.1 and the CEMP and EOP adapted by the contractors. If these measures are adapted, the risk of any residual impact as a result of construction should be imperceptible.

10.6.2 Operational Phase

The use of SuDS features and the attenuation of storm water will mitigate any potential impacts relating to changes in runoff rates and volumes whilst also maintaining or indeed potentially improving the quality of water in the estuary. The proposed design will also mitigate any potential impacts arising from flooding. There will therefore be an imperceptible impact from development in the operational phase.

10.7 Difficulties Encountered

No difficulties were encountered in undertaking this hydrological assessment.

10.8 References

Water Features, Rivers and Streams, EPA (gis.epa.ie/Envision);

Geological maps, Geological Survey of Ireland (GSI) (www.gsi.ie);

Groundwater quality status maps (watermaps.wfdireland.ie);

Environmental Protection Agency Drinking Water Reports;
OPW Flood Mapping (www.floodinfo.ie/map/floodmaps/);

Myplan.ie (http://www.myplan.ie/webapp/);

OPW Irish Coastal Protection Strategy Study Mapping
(https://www.opw.ie/en/floodriskmanagement/floodanderosionmapping/icpss/);

Trinity Wharf Marina Feasibility Study (RPS, 2018)

Chapter 11:
Landscape & Visual Analysis

ROUGHAN & O'DONOVAN

Chapter 11 Landscape and Visual Analysis

11.1 Introduction

The Landscape and Visual Impact Assessment (LVIA) was prepared by Evelyn Sikora of Cunnane Stratton Reynolds.

The study was informed by a desktop study and a survey of the site and receiving environment in September 2018. The assessment is in accordance with the methodology prescribed in the Guidelines for Landscape and Visual Impact Assessment, 3rd edition, 2013 (GLVIA) published by the UK Landscape Institute and the Institute for Environmental Management and Assessment.

The report identifies and discusses the landscape and visual constraints and effects in relation to the proposed development at Trinity Wharf, in Wexford Town.

11.2 Methodology

Ireland is a signatory to the European Landscape Convention (ELC). The ELC defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. This definition is important in that it expands beyond the idea that landscape is only a matter of aesthetics and visual amenity. It encourages a focus on landscape as a resource in its own right - a shared resource providing a complex range of cultural, environmental and economic benefits to individuals and society.

As a cultural resource, the landscape functions as the setting for our day-to-day lives, also providing opportunities for recreation and aesthetic enjoyment and inspiration. It contributes to the sense of place experienced by individuals and communities and provides a link to the past as a record of historic socio-economic and environmental conditions. As an environmental resource, the landscape provides habitat for fauna and flora. It receives, stores, conveys and cleans water, and vegetation in the landscape stores carbon and produces oxygen. As an economic resource, the landscape provides the raw materials and space for the production of food, materials (e.g. timber, aggregates) and energy (e.g. carbon-based fuels, wind, solar), living space and areas for recreation and tourism activities.

Forces for Landscape Change

Landscape is not unchanging. Many different pressures have progressively altered familiar landscapes over time and will continue to do so in the future, creating new landscapes. For example, within the receiving environment, the environs of the proposed development have altered over the last thousand years, from wilderness to agriculture and settlement.

Many of the drivers for change arise from the requirement for development to meet the needs of a growing population and economy. The concept of sustainable development recognises that change must and will occur to meet the needs of the present, but that it should not compromise the ability of future generations to meet their needs. This involves finding an appropriate balance between economic, social and environmental forces and values.

The reversibility of change is an important consideration. If change must occur to meet a current need, can it be reversed to return the resource (in this case, the landscape) to its previous state to allow for development or management for future needs.

Climate change is one of the major factors likely to bring about future change in the landscape, and it is accepted to be the most serious long-term threat to the natural environment, as well as economic activity (particularly primary production) and society. The need for climate change mitigation and adaptation, which includes the management of water and more extreme weather and rainfall patterns, is part of this.

Guidance

Landscape and Visual Impact Assessment (LVIA) 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 on people's views and visual amenity.

The methodology for assessment of the landscape and visual effects is informed by the following key guidance documents, namely:

- Guidelines for Landscape and Visual Impact Assessment, 3rd Edition 2013, published by the UK Landscape Institute and the Institute of Environmental Management and Assessment (hereafter referred to as the GLVIA).

References are also made to the '*Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities*' document, published in 2000 by the Department of Environment, Heritage and Local Government.

Use of the Term 'Effect' vs 'Impact'

The GLVIA advises that the terms 'impact' and effect' should be clearly distinguished and consistently used in the preparation of an LVIA.

'*Impact*' is defined as the action being taken. In the case of the proposed works, the impact would include the construction of the proposed development.

'Effect' is defined as the change or changes resulting from those actions, e.g. a change in landscape character, or changes to the composition, character and quality of views in the receiving environment. This report focusses on these effects.

Assessment of Both 'Landscape' and 'Visual' Effects

Another key distinction to make in a LVIA is that between landscape effects and the visual effects of development.

'Landscape' results from the interplay between the physical, natural and cultural components of our surroundings. Different combinations of these elements and their spatial distribution create the distinctive character of landscapes in different places. 'Landscape character assessment' is the method used in LVIA to describe landscape, and by which to understand the potential effects of a development on the landscape as 'a resource'. Character is not just about the physical elements and features that make up a landscape, but also embraces the aesthetic, perceptual and experiential aspects of landscape that make a place distinctive.

Views and 'visual amenity' refer to the interrelationship between people and the landscape. The GLVIA prescribes that effects on views and visual amenity should be assessed separately from landscape, although the two topics are inherently linked.

Visual assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity.

The assessment of landscape and visual effects included a desktop study, review of the proposed development drawings and visualisations, and a number of site visits which were carried out in September 2018.

Methodology for Landscape Assessment

In Section 11.5.2 of this report the landscape effects of the development are assessed. Landscape impact assessment considers the likely nature and scale of changes to the main landscape elements and characteristics, and the consequential effect on landscape character and value. Existing trends of change in the landscape are taken into account. The potential landscape effect is assessed based on measurement of the landscape sensitivity against the magnitude of change which would result from the development.

Sensitivity of the Landscape Resource

Landscape Sensitivity: Landscape sensitivity is a function of its land use, landscape patterns and scale, visual enclosure and distribution of visual receptors, scope for mitigation, and the value placed on the landscape. It also relates to the nature and scale of development proposed. It includes consideration of landscape values as well as the susceptibility of the landscape to the proposed change.

Landscape values can be identified by the presence of landscape designations or policies which indicate particular values, either on a national or local level. In addition, a number of criteria are used to assess the value of a landscape. These are described further in Section 11.3 below.

Landscape susceptibility is defined in the GLVIA as *the ability of the landscape receptor to accommodate the proposed development without undue consequences for the maintenance of the baseline scenario and/or the achievement of landscape planning policies and strategies*.

Susceptibility also relates to the type of development – a landscape may be highly susceptible to certain types of development but have a low susceptibility to other types of development.

Sensitivity is therefore a combination of Landscape value and Susceptibility. Landscape Values are discussed in Section 11.3, while Landscape Susceptibility is discussed in Section 11.4.

For the purpose of assessment, five categories are used to classify the landscape sensitivity of the receiving environment as detailed in Table 11.1.

Table 11.1 Categories of Landscape Sensitivity

Sensitivity	Description
Very High	Areas where the landscape exhibits a very strong, positive character with valued elements, features and characteristics that combine to give an experience of unity, richness and harmony. The character of the landscape is such that its capacity for accommodating change in the form of development is very low. These attributes are recognised in landscape policy or designations as being of national or international value and the principle management objective for the area is protection of the existing character from change.
High	Areas where the landscape exhibits strong, positive character with valued elements, features and characteristics. The character of the landscape is such that it has limited/low capacity for accommodating change in the form of development. These attributes are recognised in landscape policy or designations as being of national, regional or county value and the principle management objective for the area is conservation of the existing character.
Medium	Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong. The character of the landscape is such that there is some capacity for change in the form of development. These areas may be recognised in landscape policy at local or county level and the principle management objective may be to consolidate landscape character or facilitate appropriate, necessary change
Low	Areas where the landscape has few valued elements, features or characteristics and the character is weak. The character of the landscape is such that it has capacity for change; where development would make no significant change or would make a positive change. Such landscapes are generally unrecognised in policy and where the principle management objective is to facilitate change through development, repair, restoration or enhancement.
Negligible	Areas where the landscape exhibits negative character, with no valued elements, features or characteristics. The character of the landscape is such that its capacity for accommodating change is high; where development would make no significant change or would make a positive change. Such landscapes include derelict industrial lands or extraction sites, as well as sites or areas that are designated for a particular type of development. The principle management objective for the area is to facilitate change in the landscape through development, repair or restoration.

Magnitude of Landscape Change: The magnitude of change is a factor of the scale, extent and degree of change imposed on the landscape with reference to its key elements, features and characteristics (also known as 'landscape receptors'). Five categories are used to classify magnitude of landscape change as per Table 11.2.

Table 11.2 Magnitude of Landscape Change

Magnitude of Change	Description
Very High	Change that is large in extent, resulting in the loss of or major alteration to key elements, features or characteristics of the landscape (i.e. landscape receptors), and/or introduction of large elements considered totally uncharacteristic in the context. Such development results in fundamental change in the character of the landscape with loss of landscape quality and perceived value.

Magnitude of Change	Description
High	Change that is moderate to large in extent, resulting in major alteration or compromise of important landscape receptors, and/or introduction of large elements considered uncharacteristic in the context. Such development results in change to the character of the landscape with loss of landscape quality and perceived value.
Medium	Change that is moderate in extent, resulting in partial loss or alteration of landscape receptors, and/or introduction of elements that may be prominent but not necessarily substantially uncharacteristic in the context. Such development results in change to the character of the landscape but not necessarily reduction in landscape quality and perceived value.
Low	Change that is moderate or limited in scale, resulting in minor alteration of landscape receptors, and/or introduction of elements that are not uncharacteristic in the context. Such development results in minor change to the character of the landscape and no reduction in landscape quality and perceived value.
Negligible	Change that is limited in scale, resulting in no alteration to landscape receptors, and/or introduction of elements that are characteristic of the context. Such development results in no change to the landscape character, quality or perceived value.

Significance of Effects

In order to classify the significance of effects, the predicted magnitude of change is measured against the sensitivity of the landscape/viewpoint, using the following guide:

Table 11.3 Significance of Effects

		Sensitivity of the Landscape Resource				
		Very High	**High**	**Medium**	**Low**	**Negligible**
Magnitude of Change	**Very High**	Profound	Profound-Very Significant	Very Significant-Significant	Moderate	Slight
	High	Profound-Very Significant	Very Significant	Significant	Moderate-Slight	Slight-Not Significant
	Medium	Very Significant-Significant	Significant	Moderate	Slight	Not Significant
	Low	Moderate	Moderate-Slight	Slight	Not significant	Imperceptible
	Negligible	Slight	Slight-Not Significant	Not significant	Imperceptible	Imperceptible

The matrix above is used *as a guide only*. The assessor also uses professional judgement informed by their expertise, experience and common sense, to arrive at a classification of significance that is reasonable and justifiable.

Landscape effects are also classified as positive, neutral or negative/adverse (see definitions under Quality and Timescale below). Development has the potential to improve the environment as well as damage it. In certain situations, there might be policy encouraging a type of change in the landscape, and if a development achieves the objective of the policy the resulting effect might be positive, even if the landscape character is profoundly changed.

There are seven classifications of significance, namely: (1) imperceptible, (2) not significant, (3) slight, (4) moderate, (5) significant, (6) very significant, (7) profound.

Methodology for Visual Assessment

In Section 11.5.3 of this report the visual effects of the development are assessed. Visual assessment considers the changes to the composition character of views, the value of the views, and the visual amenity experienced by visual receptors (groups of people). The assessment is made for a number of viewpoints selected to represent the range of visual receptors in the receiving environment. The significance of the visual effects experienced at these locations is assessed by measuring the visual receptor sensitivity against the magnitude of change to the view resulting from the development.

Sensitivity of the Viewpoint/Visual Receptor

Visual receptor sensitivity is a function of two main considerations:

- *Susceptibility of the visual receptor to change*. This depends on the occupation or activity of the people experiencing the view, and the extent to which their attention or interest is focussed on the views or visual amenity they experience at that location.

  Visual receptors most susceptible to change include residents at home, people engaged in outdoor recreation focused on the landscape (e.g. trail users), and visitors to heritage or other attractions and places of community congregation where the setting contributes to the experience.

  Visual receptors less susceptible to change include travellers on road, rail and other transport routes (unless on recognised scenic routes which would be more susceptible), people engaged in outdoor recreation or sports where the surrounding landscape does not influence the experience, and people in their place of work or shopping where the setting does not influence their experience.
- *Value attached to the view*. This depends to a large extent on the subjective opinion of the visual receptor but also on factors such as policy and designations (e.g. scenic routes, protected views), or the view or setting being associated with a heritage asset, visitor attraction or having some other cultural status (e.g. by appearing in arts).

Visual receptor susceptibility and value of the viewpoints which are assessed, are discussed further in Section 11.5. For the purpose of assessment, five categories are used to classify a viewpoint's sensitivity:

Table 11.4 Categories of Visual Receptor Sensitivity

Sensitivity	Description
Very High	Iconic viewpoints - towards or from a landscape feature or area - that are recognised in policy or otherwise designated as being of national value. The composition, character and quality of the view are such that its capacity for accommodating change in the form of development is very low. The principle management objective for the view is its protection from change.

Sensitivity	Description
High	Viewpoints that that are recognised in policy or otherwise designated as being of value, or viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features focussed on the landscape). The composition, character and quality of the view may be such that its capacity for accommodating compositional change in the form of development may or may not be low. The principle management objective for the view is its protection from change that reduces visual amenity.
Medium	Viewpoints representing people travelling through or past the affected landscape in cars or on public transport, i.e. viewing but not focused on the landscape.
Low	Viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping, etc. The view may present an attractive backdrop to these activities but is not regarded as an important element of these activities.
Negligible	Viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping where the view has no relevance or is of poor quality.

Magnitude of Change to the View

Classification of the magnitude of change takes into account the size or scale of the intrusion of development into the view (relative to the other elements and features in the composition, i.e. its relative visual dominance), the degree to which it contrasts or integrates with the other elements and the general character of the view, and the way in which the change will be experienced (e.g. in full view, partial or peripheral, or glimpses). It also takes into account the geographical extent of the change, the duration and the reversibility of the visual effects.

Five categories are used to classify magnitude of change to a view:

Table 11.5 Categories of Visual Change

Magnitude of Change	Description
Very High	Full or extensive intrusion of the development in the view, or partial intrusion that obstructs valued features or characteristics, or introduction of elements that are completely out of character in the context, to the extent that the development becomes the dominant the composition and defines the character of the view and the visual amenity
High	Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.
Medium	Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity
Low	Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity
Negligible	Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.

Significance of Visual Effects

As for landscape effects, in order to classify the importance of visual effects, the magnitude of change to the view is measured against the sensitivity of the viewpoint. The seven categories as set out by the EPA (2017) are used to describe the significance of the effect.

Visual effects are also classified as positive, neutral or negative. This is an inherently subjective exercise. Visual receptors' attitudes to development of various types varies and this affects their perception of the visual effects of development.

Quality and Timescale

The predicted impacts are also classified as beneficial, neutral or adverse. This is not an absolute exercise; in particular, visual receptors' attitudes to development, and thus their response to the impact of a development, will vary. However, the methodology applied is designed to provide robust justification for the conclusions drawn. These qualitative impacts/effects are defined as:

- Adverse – Scheme at variance with landform, scale, pattern. Would degrade, diminish or destroy the integrity of valued features, elements or their setting or cause the quality of the landscape(townscape)/view to be diminished;
- Neutral – Scheme complements the scale, landform and pattern of the landscape(townscape)/view and maintains landscape quality;
- Beneficial – improves landscape(townscape)/view quality and character, fits with the scale, landform and pattern and enables the restoration of valued characteristic features or repairs / removes damage caused by existing land uses.

Impacts/effects are also categorised according to their longevity or timescale:

- Temporary – Lasting for one year or less;
- Short Term – Lasting one to seven years;
- Medium Term – Lasting seven to fifteen years;
- Long Term – Lasting fifteen years to sixty years;
- Permanent – Lasting over sixty years.

A statement is made as to the appropriateness of the proposed development based on the combined assessment of the predicted landscape and visual effects. This methodology, in accordance with the various guidelines for LVIA, results in a conclusion as to the appropriateness of the proposed development based on objective assessment of its likely landscape and visual impacts.

11.3 Study Area

The study area for both landscape and visual effects was determined through desktop study and site visits. A site visit was carried out in September 2018. The study area for visual effects tends to be more extensive than for landscape effects, as visual effects can occur at some distances. While the majority of the visual effects will be apparent in close proximity to the site, and the main landscape effects also occurring around the site, there are potential wider landscape and visual effects which are taken into account also.

In this instance, the landscape effects of the proposed development include landscape effects in the vicinity of the site in Wexford Town, but also consideration of the wider landscape character of the Coastal Landscape. With regard to visual effects, the study area is relatively extensive as the assessment of visual effects on receptors at Raven Point and Rosslare Point were included. Therefore, the Study Area, which is relatively extensive, and takes in much of Wexford Harbour, is illustrated below. However, the area closer to the site which is described in some more detail, is shown in by the smaller ellipse, in Plate 11.1 below

Plate 11.1 **Landscape and Visual Study Area**

11.3.1 Relationship to other assessments

The Landscape and Visual Assessment contains references to the historic character of the surrounds of Wexford Town and notes the presence of certain structures such as the Town Walls, and some buildings and structures which are valued such as those indicated on the Record of Protected Structures (RPS) or part of an Architectural Conservation Area. These contribute to the character of the area and townscape and serve to indicate that buildings, structures or areas are valued.

The assessment of landscape and visual effects may include references, where appropriate, to the historic features, especially if in the context of their character or as a location for a photomontage, and views to or from historic areas may be included.

However, the effects of the development on these historic structures, and on their setting, are not directly assessed in the LVIA but are assessed in the Archaeological and Cultural Heritage Chapter (Chapter 14) and the Architectural Heritage, (Chapter 15).

11.4 Description of Receiving Environment

This section describes both the policy context of the proposed development site, as well as the character of the landscape. This section also identifies potential visual receptors, as well as the extent of likely visibility of the proposed development.

11.4.1 Landscape Policy Context

The Trinity Wharf site lies in Wexford Town, along the waterfront. Therefore, the following section includes policies and objectives from the Wexford County Development Plan 2013-2019 (hereafter referred as the Plan) as well as the Wexford Town and Environs Plan (hereafter referred to as the TEP).

Wexford County Development Plan 2013-2019

Landscape Character Assessment

The Plan includes reference to the Landscape Character Assessment (LCA) for County Wexford, which was prepared for the 2007-2013 Plan. The LCA is provided as Appendix 3 to the current Plan. The LCA is a relatively broad level assessment and divides the County into four main landscape types or units – Uplands, Lowlands, River Valleys and Coastal areas. Areas which are deemed Landscapes of Greater Sensitivity are also indicated.

Plate 11.2 below shows Map 13: Landscape Character Units from the Development Plan, with the site location indicated. The site of the proposed development lies in the Coastal Area. These are described in the LCA as areas which are similar in characteristics to the Lowlands but have more scenic appearance and is described as very sensitive to development. The Plan describes long straight beaches backed by low cliffs and sand dunes and dunes as characteristic of Coastal areas, and notes that these are punctuated by promontories and slobs (which lie north and south of Wexford Harbour). A number of settlements including Wexford, Rosslare Strand and Rosslare Harbour lie within the Coastal area. The Plan notes that parts of the coast are considered sensitive to development.

Landscapes of Greater Sensitivity

The site is not located within a Landscape of Greater Sensitivity. The nearest Landscapes of Greater Sensitivity are located at Wexford Harbour, The Raven nature reserve, The Wexford Slobs and Rosslare Point. Several of these are publicly accessible locations and are included in the list of sensitive visual receptors.

These areas also represent features in the landscape and seascape which have the most visual interest and prominence, and which are considered generally more sensitive to development. The Plan also notes that many of these landscapes have profound historical, socio-cultural and/or religious interest.

The Plan notes that the Council will assess the visual impact of developments within these areas, or in the vicinity of these boundaries, on the Landscapes of Greater Sensitivity. The site of the proposed development is not within or near a boundary, and the nearest landscape so designated is approximately 2.8km from the site. The nearest publicly accessible point is approximately 4.2km, and potential impacts on a number of these Landscapes are considered in Section 11.5.

It should however be noted that as set out in Section 11.2 above, the GLVIA guidelines emphasis that landscape sensitivity is also related to the type of development, and not only the type of landscape.

Plate 11.2 below shows the extract from the Development Plan:

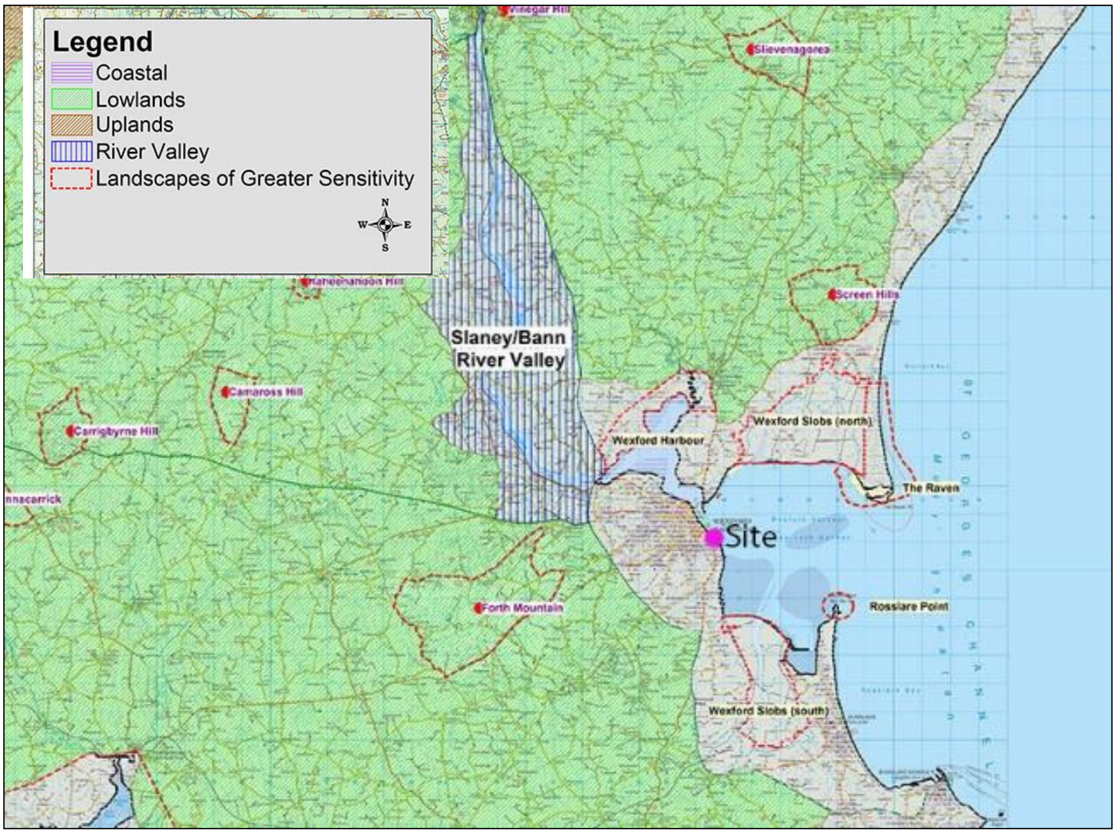


Plate 11.2 **Site and Landscape Character (Wexford CDP 2013-2019)**

The Plan contains a number of policies and objectives relating to landscape character, landscape sensitivity and development within the landscape. Those relevant are as follows:

Objective L04: *To require all developments to be appropriate in scale and sited, designed and landscaped having regard to their setting in the landscape so as to ensure that any potential adverse visual impacts are minimised.*

Objectives L05: *To prohibit developments which are likely to have significant adverse visual impacts, either individually or cumulatively, on the character of the Uplands, River Valley or Coastal landscape or a Landscape of Greater Sensitivity and where there is no overriding need for the development to be in that particular location.*

Objective L06: *To ensure that, where an overriding need is demonstrated for a particular development in an Upland, River Valley or Coastal landscape unit or on or in the vicinity of a Landscape of Greater Sensitivity, careful consideration is given to site selection. The development should be appropriate in scale and be sited, designed and landscaped in a manner which minimises potential adverse impacts on the subject landscape and will be required to comply with all normal planning and environmental criteria and the development management standards contained in Chapter 18.*

Objective L07: *To encourage appropriate development which would enhance an existing degraded landscape, and/or which would enhance and introduce views to or from a Landscape of Greater Sensitivity from public viewpoints, subject to compliance with all normal planning and environmental criteria and the development management standards contained in Chapter 18.*

Objective L09: *To require developments to be sited, designed and landscaped in manner which has regard to the site-specific characteristics of the natural and built landscape for example, developments should be sited, designed and landscaped to minimise loss of natural features such as mature trees and hedging and built features.*

Objective TM15: *To protect the views and vistas from waterways from inappropriate development which would detract from the amenity of the waterways.*

Green Infrastructure:

Section 14.3 of the Plan notes the intention of the Council to prepare a Green Infrastructure Strategy for Wexford, and there are a number of relevant policies and objectives, which are as follows:

- ***Objective GI01****: To ensure the protection, enhancement and maintenance of the natural environment and recognise the economic, social, environmental and physical value of green spaces through the integration of Green Infrastructure planning and development in the planning process.*
- ***Objective GI02:*** *To develop and implement a Green Infrastructure Strategy for the county within the lifetime of the Plan in consultation with adjoining local authorities, key stakeholders and the public, subject to compliance with Articles 6 and 10 of the Habitats Directive. The Strategy will integrate policies and objectives under a number of headings including; natural heritage, parks and open spaces, built heritage and archaeology, water management, flooding and climate change allowing for a strategic approach to green space planning in the County.*
- ***Objective GI04****: To ensure the principles of Green Infrastructure and the County Green Infrastructure Strategy are used to inform the development management process in terms of design and layout of new residential schemes, business and industrial developments and other relevant projects, for example, through the integration of Sustainable Drainage Systems (SuDS) into the overall site concept and layout.*

Views and Prospects

There are no specific references to protected views in the Plan, but there are general references to views to and from waterways in Objective TM15 above.

Architectural Guidance

Section 17.3 of the Plan includes some detailed guidance in terms of design, scale, form and profile, while 17.4 contains guidance in relation to landmark buildings. Due to the nature of the development and the prominent waterfront location in Wexford town, it is considered the following aspects of guidance are relevant:

- *For buildings at prominent sites, for example corner sites, end of streets or closing off vistas, it may be appropriate to increase building height to provide a greater emphasis on the building, but there will also be a greater expectation of design quality and architectural treatment. Corner sites should equally address both street frontages.*
- *A landmark building must make a positive contribution to the appearance and activity of the streetscape.*
- *Landmark buildings should aid in the permeability of their context.*
- *Landmark buildings can better integrate with their surrounds by providing internal or external spaces for public access such as parks, cafes, shops and thoroughfares.*
- *Particular attention must be paid to the impact that a landmark building may have upon adjacent heritage sites or areas of special urban character.*
- *The impact that a landmark building may have upon natural features, such as waterways or landscapes, or public spaces is also an important consideration.*

Wexford Town and Environs Plan 2009-2015 (as extended to 2019)

The Wexford TEP outlines a general overview of the town and its context. It describes Wexford town's significant agricultural hinterland and notes the scenic quality of the coastal landscape in which the town is set. The Plan mentions these aspects of the town and environs, which also function as tourist attractions, including the Raven nature reserve, Curracloe Beach, and Wexford Harbour itself and the town walls.

The urban form is also described in the town, and in particular the striking setting of the town, which is in the Slaney estuary, which is itself an important part of the character of the town. A bridge connects the town centre with the small settlement of Ferrybank, on the opposite bank. A bridge also connects the town with the area of Ferrycarrig to the north.

The town originates where the Slaney meets the sea, and the medieval origins of the town are evident in the central spine from Main Street which runs north - south, with narrow lanes leading off this. The Plan notes that this is an attractive scale for the pedestrian with small scale plots, while it describes the waterfront area, just a short distance to the east, as an area with larger scale plots, describing it as a 'service edge' to the town centre.

The Plan also notes that the form of the town is relatively compact but there is noticeable development on the agricultural lands between the town and the bypass.

A key component of the development strategy is to enhance the compact urban form, and to provide a wide range of dwelling types and densities to stem the current spread of residential development into the surrounding towns and rural areas. This is also to enhance the existing town centre and its role as a market place, meeting place and living place.

Wexford town has been divided into 20 masterplan zones, which outline future development of each zone. The site of the proposed development at Trinity Wharf is located within Zone 13B.

A number of sites in the town are identified as 'Key Opportunity Sites'. These include Trinity Wharf.

Masterplan Zoning

Plate 11.3 below illustrates the zoning for the Trinity Wharf Site area 13B.

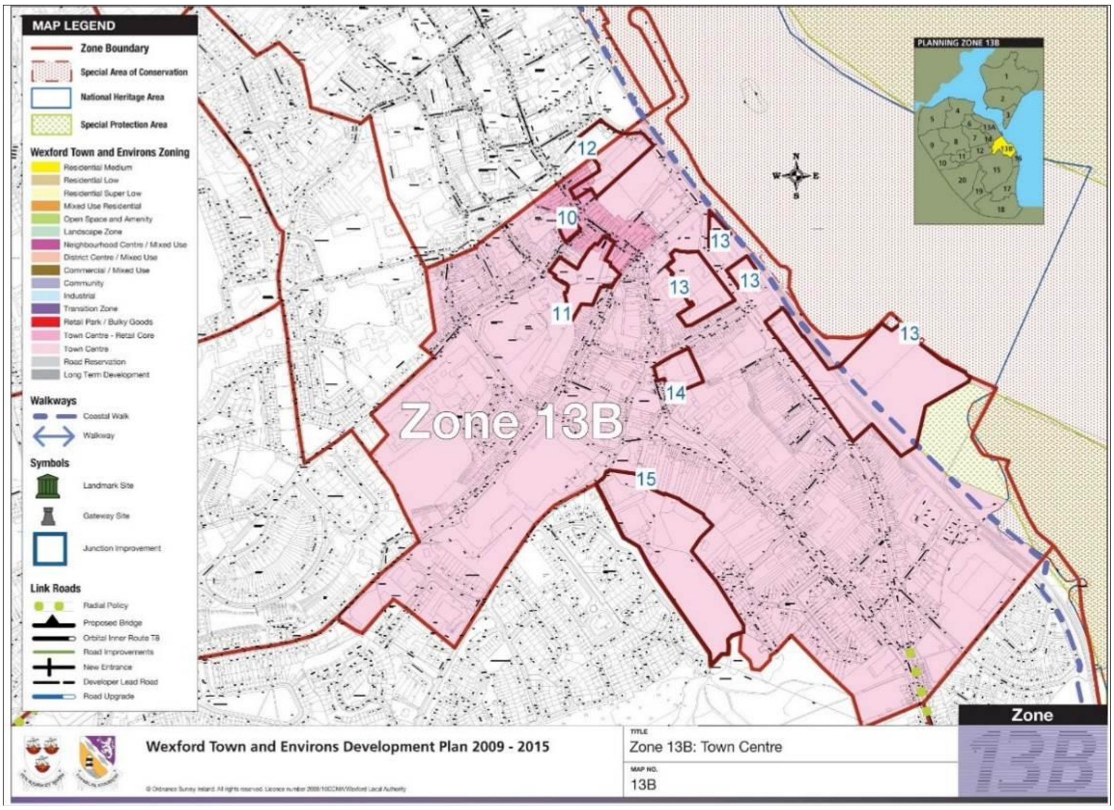


Plate 11.3: **Masterplan zoning for 13B, Town Centre (Wexford Town and Environs Plan 2009-2015 as extended)**

The Masterplan zoning for the town centre identifies opportunities and constraints for a number of areas in the town centre. The Trinity Street areas is zoned as Town Centre – Retail Core, with a small portion to the southeast designated as SPA. A Coastal Walkway objective runs along the railway line through the Trinity Wharf site. This runs from north of Wexford Bridge to the southern extents of the town.

Wexford harbour, adjacent to the site, is designated SAC and SPA.

The following opportunities and constraints are identified:

> *'A number of sites exist that offer development and redevelopment opportunities. Existing lanes such as Sinnott Place, Slaughterhouse lane could see redevelopment of 3-4 storeys to create and enhance pedestrian routes from South Main Street to Trinity Wharf. Redevelopment opportunities could include the Talbot Hotel car park, Wexford Building Supplies, Trinity Hire and redevelopment of garages and warehouses to town centre retailing. The Council will consider the development potential of lands which are currently located within the SAC/SPA, but which may be suitable for future development subject to agreement with the Department of Environment, the National Parks and Wildlife Service and the Dept. of the Marine. If sites become available new buildings of 5-6 storeys could be developed along this road. Whilst this may not happen in the lifetime of this Plan there is a long term objective to expand the town centre retail core from South Main Street to the Trinity Wharf site.*

Views and Prospects

The Wexford Town Development Plan does not contain a list of protected or scenic views.

Recreation and Tourism

The following objectives are included:

- TO1: Explore the possible provision of a heritage trail in the town.
- TO2: To ensure the full recreational potential of the River Slaney and its estuary is realised.
- TO3: Provide a pedestrian walkway along the banks of the River Slaney estuary.

Architectural Conservation Areas

There are three Architectural Conservation Areas in Wexford Town. The closest ACA is approximately 285 m from the site.

Town Walls Conservation Plan

The centre of the town along the Main Street spine was once surrounded by walls, and remnants of the walls are still visible. The Town Walls Conservation Plan was put in place to identify the significance of the Wexford Town Walls, the threats to significance, and to proposed policies for the future protection and management of the walls.

The closest section of town walls to the site on Trinity Wharf is the section on Barrack Street. This area does not have views of the site.

The Plan notes that impacts of development are not solely related to views in the immediate vicinity of the walls; it notes that views to the walls from the walls and to the surrounding streetscape are available in some areas. It also mentions areas of the town where views of the walls are available, notably the Market Square and St. Patrick's Graveyard.

Policy 15 in the Plan states:

Views to and from the town walls should be enhanced to reinforce the role of the town walls in the Wexford and Environs Development Plan

Section 1-3 of the Wexford TEP also contains design guidance in relation to building form, profile, scale and massing, connectivity with the surrounds, as well as advice on landmark buildings, which is similar to the advice contained in the County Development Plan. The TEP advocates that :

- *Building form, scale, profile and massing are the larger scale design elements which will define the appearance of a building from a distance and influence how it sits in its streetscape context.*
- *A new development must consider and respond to its context in this regard, particularly in relation to any heritage sites, or buildings and spaces of significance.*

Regarding landmark buildings, the TEP notes that a 'landmark building' is any building that is higher than its context, one that may shape a town's skyline or that is of an exceptionally high architectural quality. It also notes that any proposal for a landmark building should identify elements that create local character, and which will be important features or constraints in the development of proposals for landmark buildings. This will include:

- Streetscape – the scale and height of buildings and the urban grain;
- Important local views and panoramas;
- The Town's skyline;

- The topography; and
- Landmarks and their settings.

The Plan notes that well designed and sited landmark buildings can be seen to bring advantages to an urban area, and states that with rapid changes occurring in Wexford Town Centre, that it is imperative that proposals for any landmark buildings are rigorously and strategically assessed in terms of their siting, detailed design quality and function. As the Development Plan also states, landmark buildings are to make a positive contribution to the appearance and activity of the streetscape.

Policy Summary

- There are a number of Landscapes of Greater Sensitivity in the wider environs of the site but the site itself does not lie within such an area;
- Views and vistas to and from waterways are considered important in policy;
- The historic character of Wexford town and the town walls are recognised in policy;
- There is policy support for the redevelopment of Trinity Wharf and it is zoned as part of the Town Centre;
- Objectives also include a walkway along the Wexford town waterfront;
- Design guidance regarding landmark buildings and the impact on their surroundings is emphasised in the TEP; and
- Policy in the TEP relating to Zone 13b Trinity Street notes that 5-6 storey buildings are considered appropriate.

Wexford Quays Economic Development and Spatial Implementation Plan – Stage 2B Report

Wexford Quays Economic Development and Spatial Implementation Plan as commissioned by Wexford County Council aims to provide a strategic vision for the revitalisation and regeneration of the Wexford Quays area.

The Strategic Plan aims to address the urgent need to promote economic development and physical growth and to revitalise the town's economy with proposals that enhance the town's physical attractiveness and wellbeing as a place for people work, shop, visit and live.

Though this Strategy is not a part of the Development Plan, it is seen as an important document as it carries out detailed analysis of the town and also carried out extensive consultation with stakeholders.

Its recommendations include the development of Trinity Wharf, but, importantly, this is set, in the context of a number of objectives for the wider town and includes measures which relate to the waterfront area, the Crescent and the wider town, and seeks to connect the site to the town's waterfront. The Plan is soon to be presented to the Elected Members of Wexford County Council and aims to provide a strategic vision for the revitalisation and regeneration of the Wexford Quays area.

Plate 11.4 below shows the Overall Vision as included in the Strategic Plan, which shows the vision for whole of the Waterfront areas, including visions for the Trinity Wharf area.

Plate 11.4: Overall Vision set out in Wexford Quays Economic Development and Spatial Implementation Plan

The objectives include:

- The development of Trinity Wharf, connected with the rest of the town centre by a direct connection with The Crescent by an extended Paul Quay;
- The transformation of the Crescent as a focal point for the town centre between the Quays and Trinity Wharf;
- Public realm improvements along the waterfront, quays and the streets, lanes and squares connecting with Main Street to create a varied and pedestrian-friendly pubic realm;
- Development of a north-south 'Heritage Route';
- Measures to encourage the upgrade and improvement of the quality and care of the existing built fabric throughout the town centre; and
- A coordinated lighting strategy.

The Strategy includes the commissioning of a site-specific masterplan for Trinity Wharf which was developed by Scott Tallon Walker in 2018 and informed the design of the proposed development.

A previously permitted scheme was proposed on the site (Ref W2006025) and amended (W0006042). This scheme consisted of a mixed-use scheme with 8 no. buildings ranging from 2 to 14 storeys in height above quay level, as well as including reclamation of an area of the foreshore. The details of this development are included in Chapter 3, Section 3.5 of the EIAR.

11.4.2 Site Location and Context

The site and environs are described below in terms of its location and access, as well as its character in terms of landform, landcover, land use, cultural heritage, and overall character. Under each heading, the site and environs are first described, and then the wider context.

Historic Context

As set out in Chapter 15 Architectural Heritage, the site is on land which was reclaimed in stages, and under previous industrial uses. These included Wexford Dockyard, and factory buildings for the Wexford Engineering Company as well as a metal works (Star Iron Works) and a meat factory. The Cassini map (Figure 11.5 below) shows the historical buildings and uses of the site, and the land adjacent to Trinity Street where the railway occupied considerable land.

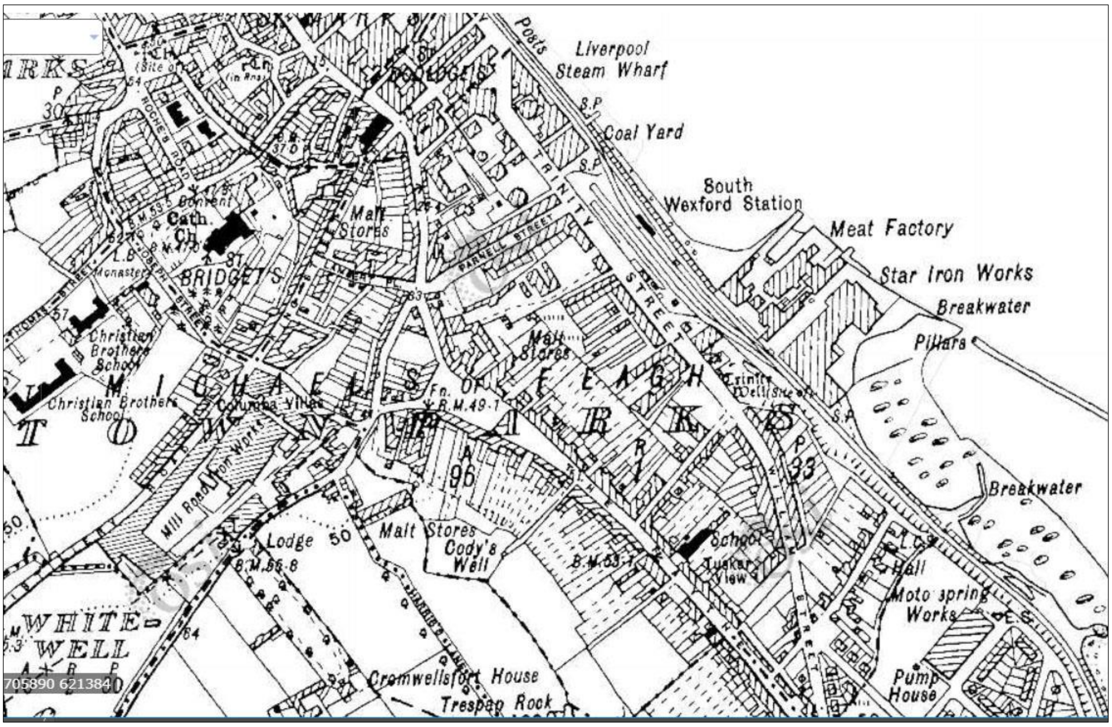


Plate 11.5 **Trinity Wharf and environs (Source: Ordnance Survey Ireland www.osi.ie)**

An aerial image taken in 1961 (see Plate 11.6 below) shows Trinity Wharf had a considerable number of warehouse buildings on the site. The Wexford- Rosslare railway line, opened in 1882, is also visible in the image. The railway lines took up a considerable portion of land adjacent to Trinity Street, north of the site, and the Wexford South railway station was located adjacent to Trinity Street, north of the site.

Plate 11.6 **Previous Industrial uses on site (Source: Wexford County Council)**

Images from the 1990s also show warehousing on the site, which would have restricted views to the harbour from several locations. The site, having previously been occupied for over 100 years with warehouses as above, was cleared in the early 2000s following the closure of Wexford Electronix in 2001 and is currently vacant.

The site, Trinity Wharf, is a prominent brownfield waterfront site slightly southeast of the historic medieval centre of Wexford Town, and along the southern end of the quay front. In Plate 11.7 below, the main town centre area is shown close to the site.

Plate 11.7 **Trinity Wharf – Site Location (Source: Bing Maps)**

The Dublin to Rosslare railway line runs along the length of the waterfront, and divides the promenade, just south of Wexford Bridge, from the rest of the town. It also divides the Trinity Wharf site from the town. Waterfront open spaces and walkways are found to the north of the site, on both sides of Wexford Bridge. Open space is also located southwest of the site, where Trespan Rock Park or The Rocks, an area of rock outcrops and woods, is a popular amenity area and is elevated in relation to the site.

Immediately around the site there is a mix of industrial and commercial units along Trinity Street, with small scale, mainly nineteenth and twentieth dwellings in close proximity to the area. Further south some large-scale industrial buildings are noticeable.

The site is largely bounded by the water, to the east, north and south, while the land side to the west is bordered by the Railway line. West of the Railway line are the rear of the buildings and residences which line Trinity Street and William Street Lower. These are illustrated in Plate 11.8 below:

Plate 11.8 **Trinity Wharf, looking south– the site is bounded by Wexford Harbour to the east, and the Dublin-Rosslare railway line to the west.**

Access

The site is currently accessed in a number of ways, but all accesses involve crossing the Dublin-Rosslare railway line which runs through Wexford Town, along the waterfront. There are number of unauthorised informal pedestrian access points which involve walking alongside and crossing the railway line, one of which is shown in Plate 11.8 above. There is an access point from Trinity Street, which is gated and would also involve crossing the railway line, as seen in Plate 11.9 below.

Plate 11.9 **Trinity Street- access point between buildings**

The site is both visually and physically somewhat cut off from its surrounds.

Landform – Topography and Drainage

Site and immediate environs

The topography of the site and immediate environs is relatively level, with the site and adjacent railway line on low-lying ground (the site was reclaimed) on the waterfront. Plate 11.10 below shows the view over the site, looking back to the higher ground to the west. The ground rises along Trinity Street and towards William Street Lower as one moves south, away from the town centre.

Plate 11.10 **Low lying topography on the site with rising ground to the west**

Plate 11.11 below shows a view over the site from Batt Street, to the south, which shows the difference in height between Batt Street and the site, which is at a much lower level.

Plate 11.11 View of lower topography of Trinity Wharf from the end of Batt Street

Wider Vicinity

In the wider vicinity, low lying ground along the waterfront contrasts with rising ground as one moves west, away from the water. An escarpment, visible in certain areas of the town, in particular the area known as 'The Rocks', shows a considerable change in level between the ground to the west of the site. The land rises to the northwest as one moves along Main Street, and also to the southwest, as one moves south along William Street. Plate 11.12 below shows the topography of the site and surrounds as seen from across the river in Ferrybank.

Plate 11.12 Ground levels rise as one moves away from the waterfront

Drainage

The site is a waterfront site, and there are no signs of a watercourse on site. The surrounding land drains to the harbour.

Landcover –Vegetation and Buildings

Site and immediate environs

The site is in an urban location, but currently derelict, with little evidence of the relatively recent industrial uses of meat processing plant and manufacturing. The site, along Wexford's waterfront, comprises man-made, reclaimed land. The site was initially reclaimed in approximately 1832, and used as a dockyard, and subsequently extended. Plates 11.5 and 11.6 illustrate the former warehouses and industrial buildings on the site as well as the railway adjacent to Trinity Street. An extensive area of Wexford's waterfront, including the present Railway line and a number of shipping yards were created from this reclaimed land.

The main elements include vegetation, stone quay walls, as shown in Plate 11.13 below, as well as a larger central wall, and areas of concrete shown in Plate 11.14.

Plate 11.13 Northern boundary of Trinity Wharf, showing vegetation and waterfront wall

Vegetation has colonised parts of the site, and species are typical of a derelict site, including Buddleja, Willow, as well as grasses. In some parts of the site, concrete still remains on the ground, as shown in Plate 11.14 below.

Plate 11.14 Walls, vegetation and areas of concrete on site

The main elements which remain on site are masonry walls, visible along the waterfront, as well as walls which divide parts of the site, as seen in Plate 11.14 above. Boulders and chunks of concrete are visible, and the dereliction of the site is evident. Some large areas of concrete slab are visible as in Plate 11.15 below.

Plate 11.15 Concrete areas on site

The site has few elements which contribute to its character, and the areas along the water's edge remain the more interesting areas of the site due to the views from the waterfront. Along the eastern edge, remains of the wharf structure is evident, as seen in Plate 11.16 below:

Plate 11.16 Wharf remnants along eastern edge

The railway line divides the site from its surrounds. On the opposite side of the railway line, vegetation and buildings along Trinity Street and William Street form a buffer with the site. The illustrations below (Plates 11.17-11.18) show the character of this 'transition zone' between the site and its surroundings. The buildings and vegetation serve to restrict views between the site and Trinity Street and contribute to the isolated and derelict character of the site, which has few connections to its immediate context. Plate 11.18 shows the site's proximity to the town's waterfront.

Plate 11.17 Walls, industrial units and vegetation to west of railway line (looking south)

Plate 11.18 Fences and industrial units to west of railway line (looking north)

Built Form – Trinity Street and William Street Lower

Trinity Street's current form is influenced by the previous land uses including the lands formerly occupied by the railway, adjacent to the eastern side of Trinity Street, which were subsequently built over with warehouses and large footprint buildings. The buildings and properties which back onto the railway line include those along Trinity Street and William Street Lower. The character of Trinity Street is somewhat mixed, with large-scale plot sizes to the east, (on the site of the former railway tracks) backing onto the railway line, which are mainly occupied by industrial units, as shown in Plates 11.17-11.18 above and Plates 11.19-11.21 below. These are interspersed with several sections of industrial fencing and gates and serve to restrict views of the water and of the Trinity Wharf site. There is at present, almost no visual connectivity between this street and the Trinity Wharf site. The buildings along William Street are small scale residential dwellings.

Plate 11.19-21 Large scale units along eastern side of Trinity Street

Close to the junction of Trinity Street and William Street Lower, a vacant plot of land with fencing (shown in Plate 11.20 above) allows limited views to the sea in the direction of the site. This is the site of a former warehouse, which was demolished in the recent past, circa 2008.

Plates 11.22 and 11.23 show the small-scale residential areas along the western side of Trinity Street, and at Trinity Place, which are of a different scale and character to the built form on the opposite side of the street. Several narrow lanes and streets lead from Trinity Street north to The Faythe.

Plates 11.22-23 Smaller scale residential terraces and lanes on western side of Trinity street

William Street Lower, which is a continuation of Trinity Street to the south, consists of terraced two storey buildings, which, although not part of an Architectural Conservation Area, have an identifiable and distinctive character, are of a similar scale and design, giving the appearance of a relatively intact streetscape. Some of these buildings are protected structures. The gardens of some of these dwellings slope down towards the railway line.

Plate 11.24 Smaller scale terraces on William Street looking towards site

Wider context

The wider areas include the wider Wexford Town, including certain areas notable for character of built form and urban grain. The residential areas east of the site include distinctive nineteenth and twentieth century buildings in the vicinity of The Faythe, with more recent residential developments to the west and southwest. To the south, built form includes more recent residential developments and some industrial buildings on the waterfront, with most of the built form to the east of the Rosslare Road (R370). An area of considerable natural vegetation including The Rocks amenity area is located southwest of the site. The distinctive form of the medieval town lies to the northwest of the site, with enclosed narrow streets and lanes. The waterfront area along Commercial Quay, south of Wexford Bridge, has its own character with a wide waterfront promenade and open views to the harbour, with buildings on the western side divided by the road and railway line.

Land use

Site and immediate environs

The site is a derelict site which was formerly occupied by a number of warehouse buildings, demolished in the early 2000s. The site was, at the time of the site visit, used informally by members of the public for walking, though access is unauthorised. The railway line runs directly adjacent to the Trinity Wharf site. Industrial and commercial uses are found along the eastern side of Trinity Street, while residential uses are found along the northern end as well as the western side of Trinity Street, and along William Street Lower (see Plate 11.22 above). Other local land uses include the Talbot Hotel which is located at the northern end of Trinity Street.

Wider context

Surrounding land uses in the wider town include industrial, commercial, cultural and residential. The railway line is present along the waterfront of the town. The extensive waterfront areas to the north of the site are used for shopping and recreation as well as berthing for fishing vessels. Areas used for recreation include those to the southwest (The Rocks) and north and northeast (the waterfront and Ferrybank areas).

Summary of landscape character of site and immediate environs

The character of the site itself is largely defined by its location, as it is surrounded on water by three sides, rather than any strong features or landscape elements on the site itself. It is a derelict site with a remote character due to its inaccessibility except along the railway track. The site does not contribute significantly to the landscape character of the areas around it and is largely distinct in character from its surrounds.

The former industrial uses of the site are still apparent, due to the presence of built form on the site until relatively recently, being only partially covered by emergent vegetation. The area can be described as an area in transition between the industrial and warehousing and the residential area. The policies support for the redevelopment of the area recognises this.

The immediate vicinity of the site, including the Trinity Street area and nearby streets and quays vary in character from Trinity Street's mix of warehouse buildings and 19th and 20th century terraces. Some of these streets and terraces have a distinctive character including some buildings which are protected structures. Views of the harbour are also a feature of the areas' character, which range from open and extensive views of the harbour from the areas mainly to the north but also some to the of the site, as well as some glimpses from the streets west of the site.

Summary of landscape character of wider context

The wider context of Wexford town with its waterfront, medieval centre and urban form, situated within Wexford Harbour has a distinctive character and the element of water is an important characteristic of the area.

The medieval town centre and town wall remnants, though not far from the proposed development, has a dense urban form and creates a sense of enclosure, restricting views to the waterfront. South Main street, the main spine, runs parallel to the water, though some views of the harbour are available from the perpendicular streets and lanes, such as King Street.

The distinctive enclosed character of the medieval town is vastly different to the site's immediate surroundings at Trinity Wharf, and also distinct from the waterfront area. The main view south along South Main Street is terminated by the Barracks, preventing further views, as seen in Plate 11.25:

Plate 11.25 & 11.26 Views along South Main Street and Barrack Street

Plate 11.26 above shows the view from Barrack Street, which is one of the locations where the town wall remains, seen to the right of the image. It is also the site of

Wexford Castle and the current location of the Barracks, which is a distinctive building of considerable height seen just to the right of the image, behind the wall. The narrow street with high walls and buildings, prevents views out to the wider town, the waterfront and to the site.

Certain areas of the town and in particular the waterfront areas in the vicinity of Wexford Bridge and Ferrybank as well as the amenity area known as The Rocks, are characterised by their openness and extensive views over Wexford town and the harbour.

Summary of Landscape Values

Landscape value can be indicated by formal designations, such as landscape designations, cultural landscape designations, protected views or scenic routes, or important tourist designations. Elements which are locally valued are more difficult to identify, and a number of criteria are included below which help to identify elements of landscape value on the site and surrounds:

- **Policy and Designations**: There are a number of Landscapes of Greater Sensitivity in the wider environs of the site – within Wexford Harbour - but the site itself does not lie within such an area and has no landscape related designations. Policy is supportive in principle of the site's redevelopment. Urban design guidance is contained in both the County Development and Town and Environs Plans.
- **Landscape Quality/Condition**: The site is located in an urban area. The site itself can be described as degraded and derelict, and there are opportunities to improve the landscape quality and condition of the site. Important characteristics include the views, in particular those over Wexford Harbour, and the proximity to the water, which are a key feature of the site's character. However, in the vicinity of the site there are examples of urban terraces with a strong historic character. Parts of the wider environs of the Waterfront and the medieval town are considered to be townscape areas of high quality.
- **Cultural features**: There are few distinctive features on the site itself. The remains of the wharf and quay walls are elements of the site's history. The townscape quality is varied in the immediate vicinity of the site, but there are valued elements such as the surrounding nineteenth and twentieth century terraces, town walls and historic character of the town centre and waterfront areas.
- **Aesthetic quality**: There are pleasant views from the site and surrounds to the water and to locations such as The Raven and over the harbour. There are also good views to the Wexford townscape and waterfront. The waterfront location and associated views is a key feature of the site's character. In the wider townscape, views to the harbour have a high scenic quality.
- **Sense of naturalness/Wildness:** The site has a partly remote character, though it is not physically remote from its surrounds, but the derelict nature of the site, the difficulty in accessing the site and its location as an area of land surrounded by water on three sides, contribute to a sense of remoteness, and of an abandoned landscape. There is not a strong sense of naturalness, as the former industrial uses are evident in the large areas of concrete on the site.
- **Public Accessibility and Recreation Value**: The site has no formal public access, is currently fenced off and is not a public space. Unauthorised access does occur in the area however with the site also being known for antisocial behaviour. At the time of the site visit it was informally used by the public as a walking area and therefore may have been used for recreation. In the wider

area, the waterfront area to the north of the site along Paul Quay and up to Commercial quay, and the Ferrybank area, is a popular recreation location.

Overall, the site itself would be considered of Low to Moderate landscape value. There are no formal landscape or visual amenity designations on the site. There are ecological designations which apply to the site - the southern section of the site is within the SAC. The site is surrounded by the Slaney River Valley SAC and the southern side bounds the Wexford Harbour and Slobs SPA. All associated ecological designations are discussed further in Chapter 7 Biodiversity of this EIAR.

However, the wider surrounds of the town contain some elements of Moderate to High landscape value, in areas such as the waterfront, and the core of the medieval town. The overall landscape sensitivity of the site to this type of development is discussed further in Section 11.4.

Visual Amenity

There are considerable views of scenic quality from the site. The most striking element of the site is its waterfront location, surrounded as it is by water on three sides. The proximity to water, and the views across the water over Wexford Harbour, are key characteristics of the site.

Views to the north and north west include Wexford townscape along the waterfront to Wexford Bridge, as seen in Plate 11.27 below. Prominent elements include the Church of the Assumption spire, as well as the waterfront. In the distance hills can be seen behind Wexford Bridge, to the right of the image.

Plate 11.27 Views to Wexford townscape and waterfront from the site

Other notable views include the view to Wexford Bridge and Ferrybank to the north, towards the relatively flat coastline.

Plate 11.28 Views to Wexford Bridge and Ferrybank

Looking towards the mouth of the harbour to the east, the wooded peninsula of The Raven nature reserve, can be seen in the distance.

Plate 11.29 Views towards Raven Point

Views to the south east are also available from the site. Plate 11.30 below shows a view in which Rosslare Point is visible in the distance, in good weather.

Plate 11.30 Views towards Rosslare Strand

Views to the west, towards the town, towards Trinity Street and William Street Lower, show a mixture of residential and industrial buildings, including telecommunications towers, as illustrated in Plates 11.31 and 11.32 below.

Plate 11.31 Views west towards Trinity Street

Plate 11.32 **Views towards William Street Lower and Batt Street**

Views from the streets surrounding Trinity Wharf are varied, but some contain or frame views or glimpses of the harbour, while others are pleasant views of nineteenth and twentieth century streetscapes. Some views along Trinity Street are of the warehouses and steel fences which block sea views and detract from the streetscape as seen in Plates 11.19-21.

Visual Amenity – wider context

Views to the harbour are considered important, and a characteristic of the area. Views, often panoramic, are available from the waterfront promenade to the north of the site along Paul Quay, the waterfront further north as far as Wexford Bridge, as well as from some locations south of the site at Harbour View and the end of Batt Street. As illustrated below, views from the waterfront at Commercial Quay and to the south and east are more open and expansive, but views to the north, to Wexford Bridge and Ferrybank, are also remarkable, as shown in Plate 11.34.

Plate 11.33 **Wexford's distinctive waterfront – view south from Commercial Quay towards site**

Plate 11.34 **Wexford's distinctive waterfront – view north to Wexford Bridge**

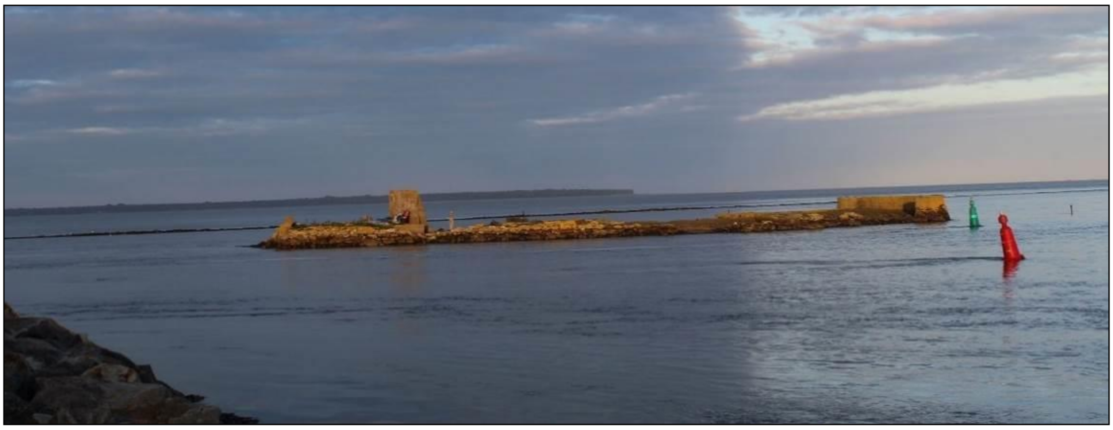


Plate 11.35 View east over harbour towards ballast bank and Raven Point

Plate 11.35 above shows there are also remarkable views to the east towards Raven Point, from the waterfront area.

Visual amenity is also remarkable from Wexford Bridge, and Ferrybank areas where scenic and panoramic views of Wexford's waterfront and townscape are obtained. Visual amenity in the medieval town is focussed on the narrow streets with dense urban form and narrow perpendicular lanes, some of which have glimpses of the sea.

11.4.3 Zone of Visual Influence

The Zone of Visual Influence (ZVI) is determined by identifying the areas where the proposed development is likely to be visible. This is then used to identify potentially sensitive visual receptors and identify locations for photomontages.

While a Zone of Theoretical Visibility (ZTV) map can be used to show theoretical visibility for certain projects, such as wind energy developments, this is less suited to urban areas, as it only includes topographical information and does not include buildings or vegetation. For developments in an urban context, these are not suitable as much of the visibility depends on the presence or absence of buildings.

The Study Area illustrated in Plate 11.1 in Section 11.3 shows a considerable area including the wider Wexford Harbour, which represents areas which are potentially within the Zone of Visual Influence. Topography and structures, such as buildings and vegetation will depend on whether the proposed development is visible or not.

Visual Receptors and Viewpoint Selection

The GLVIA (2013) Guidelines note that the types of viewers (or visual receptors) who will be affected by the development, and the places they will be affected, should be identified. People have differing responses to changes in views and visual amenity, and this is known as susceptibility. The susceptibility of a viewer, therefore, depends on the context such as the location, as well as their activity, or reason for being in a particular place. A person may be involved in recreation, or be a resident, at work, passing through a landscape, on roads or other means. Certain activities or locations in the landscape may be specifically associated with the experience and enjoyment of the landscape, such as the use of waymarked trails, tourist trails or scenic routes. Therefore, when combined with the value of the view, visual receptor sensitivity is described for all viewpoints, and is an important component of the viewpoint selection.

Table 11.3 outlines the of varying categories of visual receptor sensitivity, which range from Very High to Negligible.

Following desktop studies and a site visit, a number of potentially sensitive visual receptors were identified, and were chosen as viewpoint locations for photomontages which are used as tools to assist in the assessment of visual effects.

These include locations in the immediate environs of the site, representing residential receptors along Trinity Street, William Street, and people enjoying the amenities along the waterfront to the north or engaged in recreation in this area. Other locations include Wexford Bridge, the amenity area and public amenity walk at Ferrybank and areas of Wexford Town to the west and southwest of the site, which also have potential visibility where visual receptors may be sensitive. Elevated areas of the town, such as the Rocks amenity area, and high buildings which overlook the town, including the Wexford Opera House, and hotel buildings also have potential visibility. Visual receptors in The Rocks amenity area are also considered of High sensitivity.

More distant viewpoints with potentially sensitive visual receptors were included, and these include Raven Point, and Rosslare Point, both which are within Landscapes of Greater Sensitivity, though at some distance from the site.

A number of locations in Wexford town including the medieval centre, were also visited to assess potential visibility. These include the closest sections of the Wexford Town Wall, at Barrack Street, and at the King Street and Bride Street Car Parks. It is not expected that these locations will have visibility of the proposed development. Views from the medieval town along South Main Street tend to be restricted to the streets and to views framed by the streets, as the dense urban form restricts views to the waterfront and towards the site.

Viewpoint Locations

A wide selection of viewpoints were chosen, both in close proximity to the site, to represent potentially sensitive visual receptors such as residents, and more distant viewpoints, which represent other sensitive viewers, from public walkways, amenity areas, or important viewpoints including prominent views over the town. These viewpoints represent publicly accessible viewpoints, both in close proximity and at a distance, at various elevations, views from the town in the vicinity of the site, and views along transport routes and public amenity areas. The viewpoints also include views where the whole development is visible as well as partially visible.

A number of viewpoints from the surrounding Landscapes of Greater Sensitivity, including Raven Point, and Rosslare Point, were included at the request of the Planning Authority. A view from the junction of The Faythe and William Street Lower was also requested and included.

The views of the proposed development site include a number of locations in the town, including parts of Trinity Street, William Street Upper, the waterfront promenade north of the site and Wexford Bridge. Views are also available from Ferrybank waterfront walkway, given its waterfront location.

The site is not within the viewshed of any protected views. Figures 11.3A-11.3C in Volume 3 of the EIAR indicate the proposed photo locations.

Table 1.6 Viewpoint Locations

Viewpoint Number	Description
1	View from the steps to the waterfront path/amenity area at Ferrybank

Viewpoint Number	Description
2	View from Wexford Bridge towards development
3	View from the waterfront promenade looking south to site
4	View from Crescent Quay towards proposed development
5	View from the southern side of breakwater towards the proposed development
6	Views from along the waterfront looking south towards the site
7	View from Church of the Assumption grounds over town and towards the proposed development
8	View from Trespan Rock/Rocklands amenity area
9	View from the junction of The Faythe/William Street Lower
10	View from Harbour View/Gulbar road junction
11	View from the end of Batt Street towards Wexford Harbour and site
12	View looking along Fisher's Row from junction with The Faythe
13	View form Trinity Street south of junction with Fisher's Row
14	View from the end of the Fisher's Row terrace of dwellings which overlook the site
15	View from junction of Fisher's Row and Trinity Street
16	View opposite site entrance on Trinity Street
17	View opposite Trinity Motors on Trinity Street
18	View opposite Trinity Motors on Trinity Street
19	View south along Trinity Street
20	View from Rosslare Strand
21	View from The Raven (Raven Point) Nature Reserve

11.4.4 Photomontages

Photomontage were produced form the 21 viewpoints listed above. The technical details, including the grid co-ordinates of each viewpoint, is included in Volume 3, Figures 11.1 and 11.2.

The GLVIA 3 defines photomontages as /the superimposition of an image onto a photography for the purpose of creating a representation of potential changes to any view. It also notes that visual representations can never be the same as the real experience of the change that is to take place. The Landscape Institute (LI) guidance, currently being reviewed, notes that the two-dimensional photographic images and photomontages alone cannot capture or reflect the complexity underlying the visual experience and should be therefore be considered as an approximation of the three-dimensional experiences that an observer would receive in the field.

11.5 Description of Potential Effects

11.5.1 Proposed Development – Key Elements

Chapter 4 includes a detailed description of the proposed development. As illustrated in plate 11.36 (see also Figure 4.6 of Volume 3), the main elements include eight relatively large footprint buildings, five of which are located along the waterfront of the site. On the side facing Trinity Street, two buildings – an office block and a multi storey car park are seen, with a residential building to the southern side, which has a small frontage towards Trinity Street. Other key elements of the design are a new entrance to Trinity Street and a pedestrian and cycle path connecting Trinity Wharf to Paul Quay and a central public events plaza. A walkway runs along the southern and eastern waterfront of the site while the marina development is to the north of the site. Some planting is also proposed along Trinity Street near the vehicular site entrance.

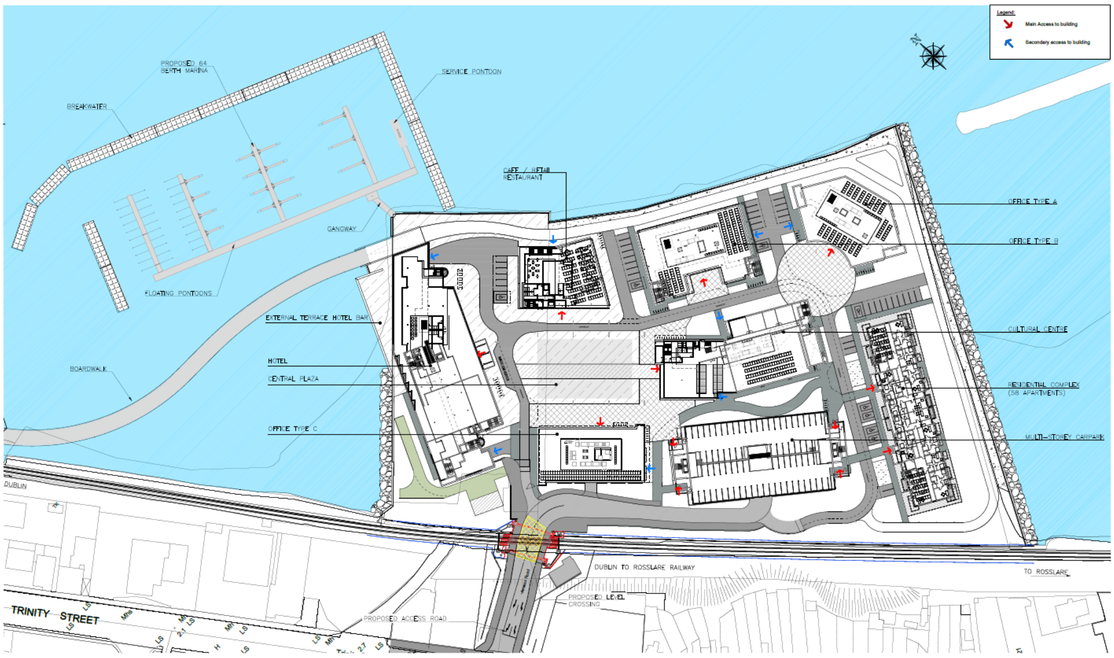


Plate 11.36 **Proposed Site Layout**

A summary of the main elements which are relevant to the LVIA are:

- A six-storey 120-bedroom hotel;
- A six-storey multi-storey car park;
- A five-storey residential building;
- Three five-storey office buildings;
- A two-storey cultural/performance centre;
- A two-storey mixed-use restaurant / café / specialist retail building;
- A single storey management building;
- A new vehicular entrance road with a signalised junction on Trinity Street, widening of Trinity Street, a new railway level crossing and associated works;
- A new sea wall around the site's perimeter comprising sheet pile along the eastern edge, concrete panels and a section of rock armour revetment on the northern edge and rock armour revetment on the southeast edge;
- Public realm and landscape including a public plaza with an open performance / events space and a coastal pathway;
- Boardwalk structure connecting with Paul Quay;
- 64 berth marina; and
- Associated landscaping.

The development is to be progressed in three phases, as outlined in Chapter 4. This chapter assesses the landscape and visual effects of the entire development.

11.5.2 Landscape Effects

The landscape effects are discussed and assessed under the headings of Site and immediate environs, and the Wider context, as per the baseline. Under each heading, the landscape sensitivity and magnitude of change are discussed, and the significance of the effect is then described. Cumulative effects are addressed in Chapter 17 of this EIAR.

Do Nothing Scenario

The site of the proposed development would remain as it is. Management of a derelict site would continue, including boundary security measures targeted at eliminating unauthorised access and anti-social behaviour. Vegetation would continue to encroach on the site.

Landscape Effects - Site and immediate environs

Landscape Sensitivity

The overall landscape sensitivity of the site and immediate environs is considered Medium-

> *Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong. The character of the landscape is such that there is some capacity for change in the form of development. These areas may be recognised in landscape policy at local or county level and the principle management objective may be to consolidate landscape character or facilitate appropriate, necessary change*

The site itself and immediate environs is considered of Low to Moderate landscape sensitivity. The landscape sensitivity of the receiving environment is a combination of landscape value, and landscape susceptibility – this is defined in the GLVIA the extent to which the landscape is considered able to respond to, and where appropriate, accommodate change arising from the proposed development.

There are no formal landscape or visual amenity designations on the site (A small part of the southern section of the site is within the SAC). Though access is unauthorised, at the time of the site visit, September 2018, observations included a number of people walking on the site. The site itself appeared at the time to have some local value as an informal recreation area (Note the site has since been completely fenced off due to safety concerns). The site's features are not remarkable, but the aesthetic qualities are greatly enhanced by the location and views over Wexford Harbour. The site also has a sense of detachment, and some sense of remoteness, from its surrounds, which may be considered a value for some. Overall the value is considered Low to Moderate. However, the surrounds contain some elements of Moderate to High landscape value, in areas such as the small scale nineteenth and twentieth century streets and terraces close to the site and along the waterfront to the north of the site.

The landscape susceptibility of the site is related to the type of development proposed and its characteristics, considered along with the characteristics of the landscape and of the site, as well as the ability of the site to accommodate the proposed development without undue consequences for the maintenance of the baseline situation, and/or the achievement of landscape planning policies and strategies.

In this regard, it should be noted that the site is zoned as part of the town centre, and that the Wexford Quays Economic Development and Spatial Implementation Plan has identified the site as a redevelopment site as part of a larger plan which also includes proposals for the other parts of the waterfront including Paul Quay and The Crescent.

It is considered that at site level, the landscape has the ability to accommodate some change in the form of this type of development. The site is zoned as part of the town centre. The site is a large and vacant brownfield site at a lower level than the surrounding townscape with few distinctive features, adjacent to Trinity Street which is of varied character and which has been identified along with Trinity Wharf as having potential to be enhanced and developed. The site itself was until relatively recently, the location of several large scale warehouse buildings which have since been demolished. Trinity Street has several residential areas to the west of the street with large scale warehousing to the east, which replaced the former railway tracks. The site itself does not have strong or highly valued characteristics. However, the nature and location of the site as surrounded by water on three sides, will result in any development having the potential to be seen as an extension of the waterfront.

The townscape in the vicinity of the site is extremely varied, ranging from low rise industrial units, to taller residential and commercial buildings as well as the historic core of narrow streets, lanes and relatively low buildings. Areas in the vicinity of the site which have a specific character, such as William Street, The Faythe, Batt Street and Fisher's Row, where the townscape is considered of Medium sensitivity to this type of large scale development at close proximity which may alter the townscape scale and character in this local area.

It is considered that the landscape sensitivity of the site and immediate environs (landscape values and susceptibility combined) at a local level, is Medium, as per the Table 11.1.

Construction Phase Effects

The Construction of the site will be carried out in phases and is expected to last approximately 80 months. Phase 1 will involve the enabling works, Phase 2 the construction of some of the buildings and the marina and Phase 3 the remaining buildings, roads and landscaping. The construction phase will involve landscape effects, which include the movement of construction vehicles and machinery in and out of the site, as well as works on the site itself.

The construction phase will involve a considerable change in the nature of the area which includes the busier Trinity Street but a number of quieter streets including Batt Street, Fisher's Row and other smaller streets including Sea View Terrace. There is and increased potential for noise and dust due to construction machinery along Trinity Street and environs.

Magnitude of Change

The magnitude of change is considered Moderate –

> *Change that is moderate in extent, resulting in introduction of elements that may be prominent but not necessarily substantially uncharacteristic in the context.*

Construction phase landscape effects on the site and immediate vicinity are expected to be Short term, and negative in quality.

Operational Phase Effects - Site and immediate environs

Magnitude of Change

The site is in an urban context, a derelict site, with few valued features, and, along with its immediate surroundings, considered of moderate sensitivity. The proposed development will be prominent, especially at the local level, and will undoubtedly result in change to the landscape character of this local area.

It is considered that the site's fabric and character will change dramatically, as a result of the proposed development – in particular, due to the construction of a number of large scale and high (five and six storey) buildings and internal roads, walkways, a proposed boardwalk connecting the site to Paul Quay, replacement of the sea wall, construction of a marina, as well as a proposed access junction and street treatment to Trinity Street.

The site character will change with the reintroduction of built form, (there was large scale built form in the form of industrial warehousing on the site prior to its demolition in the early 2000s), however, the key characteristics of the site itself, which include the setting, views and proximity to the water, will remain on the site.

Regarding the change to the character of the immediate vicinity, along Trinity Street, there are existing low-rise industrial buildings along Trinity Street. The magnitude of change will vary, and the northern part of the street will not experience a significant change in character. However, there are also small scale residential terraces, as well as laneways off Trinity Street in the vicinity of the site that will be subject to change in character due to the large scale development in close proximity to these areas. The change in landscape and townscape character will be low in some areas, and more pronounced in others. Views of the harbour from some of the streets and laneways, which contribute to the character, will be obscured or partly obscured but this will vary along the street.

The effects on the character of the surrounding residential areas, will vary. The eastern end of Batt Street, and Fisher's Row for example, will undergo more change in character than other parts. Streets such as William Street and The Faythe will in general, not experience a high magnitude of change to their character.

Landscape effects are a combination of the landscape sensitivity, and the magnitude of the change. It is considered that overall, the magnitude of change of a development of this type on the site and immediate vicinity is High -

> *Change that is moderate to large in extent, resulting in major alteration or compromise of important landscape receptors, and the introduction of large elements considered uncharacteristic in the context. Such development results in change to the character of the landscape.*

Significance of Effect

The overall landscape effect on the site and immediate environs is considered to be Moderate to Significant. The duration of the effect is considered Long Term.

The quality of this effect includes both beneficial and adverse effects. The effects at site level on the fabric of the site are largely positive or beneficial, and the development involves the removal of very few existing landscape elements on a site which is derelict and considered of Low sensitivity. The enhanced access and connectivity, provision of a mix of uses, a boardwalk connecting the site to Paul Quay, and the waterfront beyond, and enhanced public space and public events area can also be considered as having a beneficial effect on the site, which is currently almost cut off from its surrounds, and the wider area. The key characteristics of the site, which are the views and the proximity to water will be enhanced and more accessible. A derelict site will be developed into a mixed use site which includes access for pedestrians and cyclists via boardwalk to the site, and to new public spaces.

This development will result in a change to the local landscape character and aesthetics of the area around the site, through the introduction of several tall and large scale buildings on a prominent waterfront site, as well as a marina and other elements.

This change is likely to be perceived as adverse in some areas, where the character is defined by glimpses of the harbour and small scale, narrow terraced streets in the vicinity of the site such as from Fisher's Row, and the eastern end of Batt Street and Gulbar Road, where the open harbour views will change in certain directions. In other areas, such as the eastern side of Trinity Street, the change will be beneficial as the area does not have a strong or distinctive character and is an area in transition. Though the magnitude of the change is considerable, and of a character quite different to the existing context, it is considered that overall, the high design quality of the proposed development is considered to result in a neutral to beneficial effect – which will maintain and, in some cases, improve landscape quality. In most cases, the harbour views and skyline which are an important part of the area's character, though altered by the proposed development, will not be removed, as many viewing locations (Paul Quay, Batt Street, Gulbar Road, Harbour View,) have panoramic views in other directions to the harbour. Views are considered in detail under Visual Effects.

Operational Phase Effects – Wider Landscape

Sensitivity

At the wider level, that of the townscape and wider landscape, the site is part of an urban area, and also described as a sensitive coastal landscape, as described in Section 11.4. The coastal areas are considered to be more susceptible to change than the lowland landscapes, although this site is in an urban context. The landscape sensitivity varies from High to Low, depending on the location.

The wider site context of Wexford town includes some large scale and tall buildings located in the town both to the north along the waterfront and the industrial buildings somewhat south of the site, which indicate some precedent for this type of tall building and areas which are less sensitive. However, the waterfront and promenade area, Wexford Bridge and Ferrybank, and the open space south of the site at Trespan Rock, would all be considered of High sensitivity to this type of development.

Certain areas in this wider landscape, such as coastal areas to the northern and southern shores of Wexford Harbour, including The Raven, Wexford Slobs and Rosslare Point, are designated as 'Landscapes of Greater Sensitivity' and are highly valued. However, in relation to the type of development which is proposed, which is ***not located in*** these landscapes, a development of a maximum of six storeys on a brownfield, low lying waterfront site, at a distance of approximately 4km from Rosslare Point and 5km from the Raven, these are not considered to be of high susceptibility. Their landscape sensitivity to the proposed development, in Trinity Wharf, is considered Low, as the effects would be on the wider landscape character.

Landscape sensitivity in the wider context varies and is considered **High** in the areas of the town's waterfront, on both sides of the estuary (including the Wexford Bridge and Ferrycarrig area) as well as in the medieval town centre. Landscape sensitivity in the more distant areas of Wexford town and harbour, in particular the Raven Point area and Rosslare Strand area, is considered to be **Low.**

Magnitude of Change

The magnitude of change on the wider landscape and townscape, including the character of the waterfront areas, is considered to range from **Low to Medium**. The change is considered Medium in areas such as the waterfront to the north and Ferrybank areas -

> *Change that is moderate in extent, resulting in introduction of elements that may be prominent but not necessarily substantially uncharacteristic in the context.*

The change in landscape character will not affect the character of the medieval core of the town. The magnitude of change on the medieval town and the wider town and harbour is considered Low.

Significance of Effects – Wider Landscape

The landscape effects on the wider Wexford townscape, including the waterfront areas, and the Ferrybank area, are considered **Slight to Moderate**. The quality of this effect is considered neutral. Landscape effects on the wider town effects are likely to be neutral to beneficial, as the proposed development extends the town to the south, providing a boardwalk linking the development with Paul Quay will enhance connectivity, activity and footfall along the waterfront and the Crescent area also.

Landscape effects at the wider scale on the character Wexford Harbour and the coastal landscape, including the areas of Raven Point and Rosslare Point are likely to be **Imperceptible to Not Significant** and neutral in quality

11.5.3 Visual Effects

11.5.3.1 Do Nothing Scenario

The views to the site of the proposed development would remain unchanged.

11.5.3.2 Significance of Effects - Construction Phase

During construction there will be a change to the landscape and there will be negative visual impacts for residents and visitors to the areas adjacent to the site associated with construction activity.

Visual receptors in the vicinity of the site including residents, would be of High Sensitivity.

The magnitude of the change during construction is considered to be Medium to High.

Construction of the proposed development in three phases will involve visual effects/which are is considered to be Moderate, negative visual effects. These are expected to be Short term effects.

11.5.3.3 Significance of Effects - Operational Phase

The assessment of Visual Effects are assisted by the preparation of photomontages. These were taken from a variety of locations as described in Section 11.4.3. above). Maps of these locations are included in Volume 3, Figures 11.3A - 11.3C.

The existing and proposed views are provided in Volume 3 of this EIAR as Figures 11.4 – 11.45. The views are discussed below with reference to the visual receptor sensitivity (susceptibility of the visual receptor, as well as the value attached to the view). These, combined with the magnitude of the change, result in the likely visual effect. These are summarised in Table 11.7.

The objective of the photomontages is to represent the proposed development in the landscape context under consideration and are therefore focussed on the view towards the proposed development site and surrounds. It is important to note that in several viewpoints, the viewer would in reality, experience views of the harbour in several directions, with several locations having panoramic views of Wexford Harbour, depending on the direction in which the viewer is looking.

Viewpoint 1 - Figures 11.4 and 11.5

Existing View

The existing view is taken from the steps leading from the raised amenity area at Ferrybank, which lead to the waterfront path. This view looks southwest towards Trinity Wharf.

The view shows the waterfront path in the foreground, which is at a lower level than the view location. There is a considerable expanse of water in the foreground, which is an important characteristic of the view.

This view towards the southern extents of Wexford town show the topography slopes from an elevated and wooded area (Trespan Rock Park or The Rocks) to the lower lying ground along the waterfront. These trees form a pleasant backdrop to the buildings in the foreground.

The buildings that line the quayside are visible to the right and the warehouses and tall building at Trinity Street are also seen. Beyond this, the buildings along William Street and Batt Street are seen, and the larger scale industrial buildings are visible to the left of the image, somewhat higher than the waterfront. Trinity Wharf is seen in the foreground, to the centre and left of the image.

Proposed View

The proposed view shows that the buildings of Trinity Wharf occupy a considerable extent of the view, though they do not obstruct any views across the water from this location. The building height is such that they do obscure some of the existing skyline, however the industrial (Glanbia/Danone) buildings also appear behind and to the left of the proposed development and are buildings of comparative scale. The marina development and pedestrian bridge to Paul Quay are also visible in the foreground.

Visual Receptor Sensitivity

The visual receptors are those enjoying the view, which is has scenic qualities, those accessing or walking along the pathway, and accessing the caravan park and would be generally of High Sensitivity.

Magnitude of Change

The magnitude of change is considered to be Medium which is described as:

> *Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.*

Significance of the Visual Effect

The significance of the visual effect is considered Moderate. The quality of the effect is considered to be neutral.

Viewpoint 2 – Figure 11.6 and 11.7 in Volume 3

Existing View

The existing view is taken from Wexford Bridge. The bridge has extensive views both north and south over the harbour and this view to the south over the harbour to Wexford's waterfront is considered to have scenic qualities. This view shows an expanse of water in the foreground, which is a key component of this view. The nineteenth-century quayside buildings are visible to the right of the image, along the waterfront where several boats are moored. Further along Paul Quay, more recently constructed waterfront buildings are visible. Beyond this, a taller building and some warehouses along Trinity Street, are evident.

In the distance, south of Trinity Street, one can see several residential buildings which overlook the harbour, interspersed with tree clumps, while several taller industrial buildings are visible to the south.

Several boats are seen berthed along the quayside to the right of the image, which is also a waterfront promenade. A breakwater is also visible, while further south, the railway line which runs along the harbour is evident, and the Trinity Wharf site, which derelict and overgrown with vegetation, extends out into the harbour. In the distance, the land on the south side of the harbour, near Rosslare Strand, can be seen. The ballast bank in the harbour can be seen in the foreground.

Proposed View

The proposed view shows the proposed Trinity Wharf development is visible to the left of the view. The buildings range from five to six storey buildings and they considerably extend the built form out into the harbour in the foreground. Though the proposed development very slightly intrudes on the skyline, the scale and mass of the buildings do not obstruct views over the harbour and are seen against the backdrop of the industrial building to the left of the view. Though the development is a noticeable element in the view, the scale of the built form is comparable to that of the waterfront buildings to the right of the image, and the larger industrial buildings in the background. The composition of the view is altered by the development, but the overall character of the view, with the extensive harbour view, the town's setting and backdrop, which are key elements of the view, all remain.

Visual Receptor Sensitivity

Visual receptors on Wexford Bridge include pedestrians, cyclists, and motorists. The views over the harbour and to Wexford Town are panoramic and there are considerable numbers of viewers using the bridge. The pedestrians and cyclists would be the most susceptible to change, with the motorists less so. However, the view is considered to have high scenic value, and overall it is considered the viewers are of High Sensitivity.

Magnitude of Change:

The magnitude of change in the view is considered to be Medium:

> *Partial intrusion of the development in the view, resulting in change to the composition but not necessarily the character of the view or the visual amenity.*

The overall visual effect is considered to be Moderate, and neutral in quality.

Viewpoint 3 – Figures 11.8 and 11.9 in Volume 3

Existing View

The existing view shows the view along the waterfront looking south, towards the site. In the foreground, the quay and the area enclosed by the breakwater are visible, seen here at low tide. To the right of the image, the waterfront promenade and the buildings of Paul Quay are visible along with the higher buildings along Trinity Street. The trees and the buildings along Trinity Street and beyond are also visible, as well as a small information kiosk along the water's edge at the corner of the breakwater arm.

In the background, the breakwater restricts views of the open sea, but the derelict Trinity wharf site with its low vegetation is visible behind this. In the far distance, some views of the land on the south side of Wexford Harbour, at Rosslare, are just discernible. It should be noted that panoramic views of the harbour are available to the east.

Proposed View

The proposed view shows the proposed development visible behind the breakwater, in the centre of the view. The development consists of a number of large scale buildings, up to six storeys in height, along with a marina development to the left, which is relatively large in scale compared to other existing buildings. The pedestrian bridge connecting to Paul Quay is also visible. The proposed building is large in extent and appears in the centre of the view and obstructs some of the views of the to the harbour and to Rosslare Strand beyond, though some views will remain to the left of the proposed building as the Marina development allow some views.

Visual Receptor Sensitivity

Viewers at this location along the waterfront will vary in sensitivity and a high number of viewers were observed in this area. Viewers include those engaged in recreation (walking and running observed here) and enjoying the surroundings and views to the harbour, those walking or travelling through the town or to work, those working on or accessing boats, as well as those visiting the town and visiting the tourist information kiosk. The value of the view is considered to be medium, as it has some scenic qualities in the view over the water and to the land across the harbour and the water in the foreground will be visible at high tide. The overall visual receptor sensitivity at this location is considered to be Medium to High.

Magnitude of Change:

This constitutes a magnitude of change which is considered to be High as set out in Table 1.4 above:

> *Partial intrusion that obstructs valued features, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity*

Significance of visual effect

The resulting visual effect is considered to be Moderate to Significant.

The quality of the effects are considered to range from adverse to beneficial, where the buildings partially obstruct what was an open view along the waterfront, and the view towards the site is replaced by a large building. However, it should be noted there are still views to the left of the image over the marina, to the harbour and to the land in the distance. Beneficial effects result from the proposed buildings which provide activity and a focal point to the view, and are of comparable scale to the waterfront buildings to the right of the image. The quality of the proposed building, marina and boardwalks is considered of high quality and will enhance the surroundings. The overall effect is considered Neutral.

Viewpoint 4 – Figures 11.10 and 11.11 in Volume 3

Existing View

The existing view shows a view from Crescent Quay, from the artificially constructed wharf dating from the mid nineteenth century, towards the buildings which line Paul Quay. In the foreground, the silted up harbour is visible, with the road bridge seen to the left of the image. To the right of the image, nineteenth century buildings at the corner of Crescent Quay are seen adjacent to the five-storey building on the corner of Paul Quay. A tall building on Trinity Street is also visible to the right of the image. Wexford harbour is not visible from this view.

Proposed View

The proposed view shows the proposed development in the centre of the view, seen here between the information kiosk, and the buildings along Paul Quay. From this view, while the proposed development is noticeable, it is not dominant, and the buildings, while of moderate extent, do not appear higher than others in the image. The building does not obstruct views of the sea as these are not available from this view.

Visual Receptor Sensitivity

The visual receptors in this location are considered to be of Medium sensitivity. Viewers would be similar to those along the waterfront in View A, however fewer people would be engaged in recreation activities at this location. The quay itself and a number of buildings on The Crescent are on the Record of Protected Structures (RPS) in the Development Plan.

Magnitude of Change

The magnitude of change is considered Low:

> *Minor intrusion of the development into the view, resulting in minor alteration to the composition and character of the view but no change to visual amenity*

Significance of visual effect

The resulting visual effect is considered Slight.

The quality of the effect is considered Neutral.

Viewpoint 5 – Figures 11.12 and 11.13

Existing View

View 5 shows a view taken from the breakwater to the north of the development, which extends out into Wexford Harbour, giving open views across the water towards Trinity Wharf. To the right of the image, a car park is visible along the waterfront, with a 5 storey brick building to the right. Below this several warehouses are visible which are much lower, with taller buildings in the distance. Towards the centre of the view, buildings including residences overlooking the harbour, interspersed with trees, are visible on the higher ground.

In the centre and to the left of the image, the lower ground of Trinity Wharf is visible, with low growing vegetation and the quay wall visible. In the distance across the harbour, the land and vegetation near Rosslare Strand is visible.

Proposed View

The proposed view shows the Trinity Wharf development appears in the centre of the view. The buildings which in the existing view, overlook the site, are obscured from view. The proposed buildings are of a height and mass which obscures some of the views across the harbour towards Rosslare Strand, and the views over the site itself. The buildings are of a moderate to large spatial extent, and of a much larger scale than the surrounds, and appears dominant in relation to the surrounding townscape and waterfront. The existing quay wall is removed, and the open views over the harbour and the land to the south greatly restricted, but not obscured. A pedestrian walkway is seen connecting the site to Paul Quay, across the water.

Visual Receptor Sensitivity

Visual receptors at this location would be those walking along the breakwater and enjoying the views, and those accessing boats in the breakwater. This is a popular location for recreation, and the view, though not highly scenic, is considered to have some scenic qualities, and viewers are considered to be of High sensitivity.

Magnitude of Change

The magnitude of change is considered to be High, as described in Table 1.4:

> *Extensive intrusion of the development in the view, or introduction of elements that may be considered uncharacteristic in the context,*

Significance of Visual Effect

The visual effect is considered to be Significant:

The design of the building, marina and boardwalk is of a high quality, which is a beneficial effect. However, other aspects of the effect are considered to be adverse, due to the scale, height and mass of the building in the context of its surrounds and effect on the open views to the south and to the land in the distance.

Viewpoint 6 – Figures 11.14 and 11.15 in Volume 3

Existing View

This view shows the continuation of the waterfront walkway along the harbour, at Paul Quay, with a road and an area of car parking in the foreground of the view.

Several warehouse buildings are visible to the right, while beyond these clumps of trees and distant residences are visible. The land slopes down to the now vacant Trinity Wharf, seen in the centre of the view, where the quay walls and low vegetation are discernible. Some views of the land across the harbour are seen in the distance, behind Trinity Wharf and to the left of the image across the sea. The open water and harbour views are considered important elements in the view.

Proposed View

The proposed development appears in the centre of the view. The hotel building and obstructs the open views across the harbour, but some views are available beyond the marina. A pedestrian walkway which is connected to the site by concrete piers, connecting the waterfront at Paul Quay to the proposed development on Trinity Wharf, is also a conspicuous element in the view. The marina is visible to the left but intrudes upon rather than obscures views.

The existing features of the site that were visible, notably the vegetation and quay walls, and some long distance harbour views, are removed. The proposed development is considered to be dominant in the view, and the open views to the south are much reduced however distant views remain beyond the marina. (It should be noted that there are open views to the harbour to the east and north east from this location).

Visual Receptor Sensitivity

This location has some scenic qualities due to the open waterfront location and distant views, especially in clear weather. This view represents viewers would be those who are walking or cycling, and viewers were also observed sitting on the low wall and feeding birds. These would be considered viewers of High Sensitivity. Viewers would also be those parking their cars and would be considered of Medium Sensitivity.

Magnitude of Change

The magnitude of change is considered High to Very High. High is defined as

> *Extensive intrusion of the development in the view, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity*

Significance of Visual Effect

The visual effect is considered Significant. The quality of the effect is considered to have adverse effects, caused by the intrusion on the relatively open view to the south. The restriction of the open views by the building is considered to be an adverse effect, while the proposed marina does allow some views to the opposite side of the harbour, the open and expansive nature of the views to the south are changed. The beneficial visual effects include the improved appearance of the public space at the end of Paul Quay where the pedestrian walkway connects to the proposed development at Trinity Wharf, as well as the high quality of the overall design. The overall visual effect Is considered neutral.

Viewpoint 7 – Figures 11.16 And 11.17 In Volume 3

Existing View

This view shows the view from the grounds of the church, which is in an elevated location to the northwest of the proposed development. The church grounds are bounded by a wall, which is visible in the foreground of the image. The view over the town consists of the roofscape of terraced houses along King Street and Barrack Street, and the Barracks is visible to the left of the image. There is a variety of buildings types, including residential and older stone maltings buildings, and no one building, or element, appears to be dominant.

Proposed View

This view shows the proposed hotel building visible above the roofscape, near to the centre of the view. While the design of proposed development differs from the existing buildings, the form and massing do fit in well with the overall view and do not appear dominant. The proposed development does not block any important views or elements in the landscape.

Visual Receptor Sensitivity

This view represents viewers going to and from the church and surroundings. These viewers may congregate in the grounds are certain times, however, are not considered to be solely focussed on their surrounds. The visual receptor sensitivity is considered Low to Medium.

Magnitude of Change

The magnitude of change is considered Low –

> *Minor intrusion of the development into the view, resulting in minor alteration to the composition and character of the view but no change to visual amenity.*

Significance of Visual Effect

The overall visual effect is considered to be Not Significant, Neutral effect.

Viewpoint 8 – Figures 11.18 and 11.19 of Volume 3

Existing View

This view shows the view from the grounds of Trespan Rock Park (also known as The Rocks), which is an important large semi-natural area of open space around the rock escarpment which forms the edge of the plateau above the town. This area is recognised in policy as an important open space. The area is a well-known and well used amenity area, with walkers encountered on the site visit.

This view is taken from the top of the rock outcrop located southwest of the playing pitch, where there are extensive views of the town and the harbour. The views over the harbour are panoramic, and this view captures the view looking across the playing field and trees below, over the harbour to the northeast, with views as far as The Raven nature reserve, from this location.

(It should be noted that views are also available to the Ferrybank area to the northeast, and to Rosslare Strand to the southeast but not shown in the photomontage.)

Proposed View

The proposed view shows the development visible in the middle ground, partly hidden by the trees, with the upper storeys visible. While the buildings are higher than the buildings in the vicinity, and of a greater scale and design to the buildings in the surrounds, they are prominent but do not obstruct the view to the water or across the harbour. The plant storage areas on the rooftops are conspicuous and the green roof planting may not be discernible from this distance. The hotel and office block buildings to the left are more visible, but the other buildings are considerably screened by the intervening vegetation. However, in wintertime glimpses of the buildings are likely through the trees. The overall open and expansive view to the harbour and land beyond, remains.

Visual Receptor Sensitivity

The park is noted in the Development Plan and the semi-natural quality and extensive views indicate a valued view. The viewers would be those involved in walking the trails and enjoying the views and considered highly susceptible to change and therefore the visual receptors are considered of High sensitivity.

Magnitude of Change

The magnitude of change is considered to be Medium:

> *Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.*

Significance of Visual Effect

The significance of the visual effect is considered Slight. The quality is considered adverse.

Viewpoint 9 – Figures 11.20 and 11.21 in Volume 3

Existing View

This view shows the view from junction of The Faythe with William Street Lower, looking down William Street. This view was one of several views requested by the Planning Authority.

To the right of the image is a grassed area with railings with several tree, with a warehouse building in the backdrop. William Street Lower is lined by buildings, ranging from two storey to three-storey. There are no views of the sea from this location.

Proposed View

The proposed view shows that the development is largely hidden by the intervening buildings, as indicated by the white outline. A relatively small proportion of the development is visible above the row of terraced houses in the distance. Though it does appear of a different scale and form to the buildings in the foreground, it does not dominate.

Visual Receptor Sensitivity

Visual receptor sensitivity is considered Low to Medium – this view is taken from outside a cluster of several shops and businesses, shop, and viewers would be those walking and driving along the street. There are no indications that the value of the view is high.

Magnitude of Change

The magnitude of change is considered Low –

> *Minor intrusion of the development into the view, resulting in minor alteration to the composition and character of the view but no change to visual amenity*

Significance of Visual Effect

The visual effect is considered Imperceptible to Not Significant, Neutral effect.

Viewpoint 10 – Figures 11.22 and 11.23 of Volume 3

Existing View

This view shows the view from the end of Gulbar Place/Harbour View. Harbour View is a street that overlooks Wexford Harbour, and this view is taken from the edge of this road. The road is elevated, and the area has panoramic views overlooking the harbour. This view shows the view to the north over Trinity Wharf. To the left to the view is an industrial fence dividing the road from the large adjacent factory. The land slopes to the left, down to the railway line and to the Trinity Wharf site in the middle ground. Several boats are moored in the harbour. In the background, the Wexford town waterfront, promenade and fishing boats are seen, while the Wexford Bridge Ferrybank area is also visible. In the far distance, hills are visible.

Proposed View

The proposed view shows the Trinity Wharf development is visible as a large-scale element in the view, which obstructs a large proportion of the existing view to the waterfront and Wexford bridge to the north, and the view to the distant hills and landscape extending the built form out into the water. There are no comparable elements of built form of this scale in the view. The design proposed is of high quality, which is a positive element, while the staggered roofline breaks up the massing of the building, the plant elements on the rooftops are quite noticeable and contrast with the rest of the building.

Visual Receptor Sensitivity

Residential receptors are located behind the viewing location. However, these are two storey houses but are mainly facing out over the harbour as opposed to the direction of the proposed development. The area is also to be used by locals walking. At the southern end of harbour view, a small harbour known as the Cot Safe or Goodtide harbour is visible, and some boats are moored in this area. The panoramic qualities of the open and extensive views over the harbour in all directions are notable. The value of the view is considered Medium. Viewers are considered of Medium to High sensitivity.

Magnitude of Change

The magnitude of change is considered High:

> *Partial intrusion that obstructs valued features, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.*

Significance of Visual Effect

The significance of the visual effect is considered to be Significant.

The development blocks open views to the north and changes the skyline dramatically, which is considered an adverse effect. However, views to the right of the image to the land across the harbour, remain open. The building design is of a high quality, which is considered to be a beneficial effect.

It should also be noted that in this location, there are extensive panoramic views to the east and south across Wexford Harbour, which will not be affected. The overall effect is considered however to be adverse.

Viewpoint 11 – Figures 11.24 and 11.25 of Volume 3

Existing View

The existing view shows part of an open and extensive view from the end of Batt Street, a cul-de-sac, which has views over the harbour. It should be noted that views are panoramic, and the image above shows the views in the direction of the development to the northeast. In reality the views are also to the east, as one travels along Batt Street, where the Cot Safe harbour is visible, as well as distant views to The Raven, across the water. Views are also to the southeast over the harbour.

The existing view shows the residences of (Goodtide Harbour) to the left of the view, which look over the harbour. A narrow and informal track runs adjacent to these houses which is used for walking by locals. A fence separates this from an overgrown area which slopes to the railway line and the water. To the right of the image, beyond the dwelling in the foreground, the low lying land of Trinity Wharf is visible, while in the distance, there are views to across the water to the land at Ferrybank, across Wexford Harbour, and the coastline to the east.

Proposed View

The proposed views show the closest building, the residential block, and the office building on the corner, appearing as large scale structures in the view. The buildings obstruct much of the views over the harbour towards Ferrybank but allow views towards the coastline to the east. While they appear at a lower level to the existing residential buildings, they will significantly alter the views and context from this location and the buildings in the image.

Visual Receptor Sensitivity

This view represents a number of residential receptors, where dwellings are facing the sea. This area is also used as a route by small numbers of walkers, as they can access a path to the railway line and across to the land below. The view though not designated has panoramic views of the harbour. Therefore, visual receptors are considered of Medium to High sensitivity.

Magnitude of Change

The magnitude of the change is considered to be High -

> *Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.*

Significance of Visual Effect

The resulting visual effect is considered to be Significant.

The partial obstruction of the harbour views by a building of large scale and mass, is considered to be an adverse effect, however there are still views available across the harbour, and panoramic views to the east and southeast, which are not shown in the image. The design quality of the building is considered high, but the overall effect is considered adverse.

Viewpoint 12 – Figures 11.26 and 11.27 of Volume 3

Existing View

This view shows the view along Fisher's Row, taken from the junction with Fisher's Row and The Faythe. This street is relatively narrow, composed of terraced houses of varying lengths on both sides, and slopes down towards Trinity Street. The narrow street frames a view over the empty site on Trinity Street, across the sea to the land on the opposite side of the harbour.

Proposed View

The proposed view indicates an office block with 5 storeys, visible in the centre of the view. This building blocks the sea views and changes the character of this street somewhat enclosing the vista with a tall building, of a different scale and mass to the buildings, roofscape and urban form in the foreground.

Visual Receptor Sensitivity

Visual receptors would include those walking and driving along the street, and some residential receptors, such as those in the dwellings at this junction on The Faythe, who have a view directly down this street. Some views may also be available from gable windows along Fisher's Row, but these numbers would be low. The visual receptor sensitivity is therefore considered High.

Magnitude of Change

The magnitude of change is considered Medium to High:

> *Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context.*

Significance of Visual Effect

The significance of the effect is considered Moderate.

The quality of the effect is considered to be adverse as the framed view of the harbour is completely obstructed. The view which is focussed on the proposed development, is occupied by a large scale building which does not enhance the character of the street or the view.

Viewpoint 13 – Figures 11.28 and 11.19 of Volume 3

Existing View

The existing view is taken from a street corner, and shows a view looking down Trinity Street, with a two storey house and adjacent lower buildings in the foreground, while a fenced vacant site occupies a large proportion of the view. Beyond this, some warehouses are visible. In the distance, in the centre of the view, a glimpse of the sea and the land on the opposite side of the harbour, is seen.

Proposed View

The photomontage shows a partial view of the proposed hotel building, which is largely screened by the buildings in the foreground. The building is higher than the surrounds, but as only a small proportion is visible, and at this angle, it does not appear dominant. Proposals also include planting along Trinity Street, and the proposed entrance to the site.

Visual Receptor Sensitivity

Viewers in this location are those walking and driving along the street, and this view in close proximity to a residential view. The view does not have a high value. Visual Receptor sensitivity would be Medium to High.

Magnitude of Change

The magnitude of the change is considered Low:

Significance of Visual Effects

The overall visual effect is considered Not Significant.

The proposed development does not obstruct any sea views or affect any high quality elements in the view. It is considered that while of a different scale to the foreground buildings, the quality of the visual effect is neutral. The proposed planting is likely to have a positive visual effect on the street.

Viewpoint 14 –Figures 11.30 and 11.31 of Volume 3

Existing View

The existing view is taken from the corner of Fisher's Row, and the view shows a yard and the road in the foreground, with an open view over the fenced site across Trinity Street. Between the ware house building to the left and the other building to the right of the image, a yard enclosed by a steel fence allows views of Wexford Harbour and the Raven nature reserve in the distance.

Proposed View

The proposed view shows several buildings are visible in the centre and left of the image. These buildings are considerably higher and of a larger scale and massing than the surrounds and obstruct large sections of the view to the harbour. However, some views between the buildings still remain to the left of the image. The proposed planting of a hedge and trees along Trinity Street is a positive change to the current view.

Visual Receptor Sensitivity

The view is taken directly adjacent to the terrace on Fisher's Row and would represent viewers similar to that from the house to the left, and they are considered of Medium to High sensitivity. Viewers would also be those walking and driving along the street. The views of the harbour are not as extensive as from View 15. The view has some scenic qualities but is not seen as of high value.

Magnitude of Change

The magnitude of change is considered High -

> *Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context.*

Significance of Visual Effects

The significance is considered to be Significant.

Regarding the quality of the effect –this ranges from adverse to beneficial. Though the removal of the harbour view is adverse, some positive aspects include the improved and more enclosed street frontage along Trinity Street- as the proposed hedge and trees will improve the streetscape. However, the overall effect is considered Beneficial.

Viewpoint 15 – Figures 11.32 and 11.33 of Volume 3

Existing View

The existing view shows the view from an elevated terrace of houses, at the junction of Fisher's Row and Trinity Street. The houses are at some level above Trinity Street, and the view is taken from the open space just in front of the houses. The view shows a terraced open space in the foreground, sloping down to the street. There is a lane, Seaview Avenue, to the left, but across the road is a warehouse as well as a fenced site which is vacant (a warehouse on the site was demolished). There are extensive views to the sea and across the harbour to the lands at Raven's Point, which extends out into Wexford Harbour.

Proposed View

The proposed view shows the entrance to the development off Trinity Street, and the buildings appearing prominent and in the centre of the view. The buildings almost completely obstruct the view over the harbour, but a glimpse of the sea is visible between the hotel building on the left, and the proposed low retail and café building which is visible along the Trinity Wharf waterfront. The multi-storey car park is visible to the right of the view. Seaview Avenue is slightly widened to allow for a turning area while a junction and railway crossing is also visible.

Visual Receptor Sensitivity

The visual receptors are residential viewers and the view is an extensive view over the harbour. Visual receptors and are therefore considered of High sensitivity.

Magnitude of Change

The magnitude of change is considered Very High:

> *Full or extensive intrusion of the development in the view, or partial intrusion that obstructs valued features or characteristics, or introduction of elements that are completely out of character in the context, to the extent that the development becomes the dominant the composition and defines the character of the view and the visual amenity.*

Significance of Visual Effects

The visual effect is considered Significant.

While certain aspects of the change are considered adverse, such as the obstruction of the harbour views, glimpses of the harbour will be available, and will be greater when the trees are not in leaf. The buildings, while of a greater scale and massing than the surrounds, constitute an improved design quality when compared to the shed-like structure on the view to the left. The removal of the steel fencing is a positive effect, as is the proposed planting and improved street frontage. The overall effect is neutral.

Viewpoint 16 – Figures 11.34 and 11.35 of Volume 3

Existing View

Existing view shows a view along Trinity Street, where a large fenced site along the street shows a considerable gap in the streetscape. Behind the fence, trees and shrubs are visible, but there are no views beyond. The quality of the streetscape in this location is not high. To the right of the view, terraced houses along the end of William Street are just visible.

Proposed View

Proposed views show the development occupying a considerable extent of the view, in between the warehouse to the left of the view, and extending in the distance. The office block building appears in close proximity to the street frontage, and the buildings serve to enclose the street and the view, though they are set back some distance from the street. The scale of the proposed development is considerably larger than the surrounding buildings, and the massing and form contrast with the small scale vernacular terrace buildings in the right of the image. The proposed entrance treatment, green space and vegetation serves to improve the streetscape, and the removal of the steel industrial style fencing is a positive effect.

Visual Receptor Sensitivity

Visual Receptor Sensitivity is considered Medium. Though some dwellings are located along this (west side of the street) they are not oriented to face the development directly.

Magnitude of Change

The magnitude of change is considered Very High –

> *Full or extensive intrusion of the development in the view, to the extent that the development becomes the dominant the composition and defines the character of the view and the visual amenity*

Significance of Visual Effects

The visual effect is considered Significant. As noted above, the development does not obscure views, and it is considered that the proposed development is an improvement in this view. The visual effect is considered beneficial.

Viewpoint 17 – Figures 11.36 and 11.37 of Volume 3

Existing View

The existing view shows a view to several warehouses, Trinity Motors to the left of the image, and another warehouse to the right. In the centre are conspicuous signs above a low wall which encloses a car park belonging to Trinity Motors. Fencing to the rear of this area reduces views to the harbour beyond. To the right of the image, an access road is visible. The streetscape on this side of Trinity Street is of low quality, and the scale and type of buildings are very different to the residential elements on the opposite side of the street.

Proposed View

The proposed view shows the proposed buildings clearly visible in the centre of the view to the rear of the existing signage and warehouse buildings. The buildings, though large scale, do not block sea views as these are already obstructed. The six storey hotel building appears as a significantly taller building than the warehouses, but the lack of any defined streetscape and the relatively large scale and footprint of the warehouses means that the change is somewhat less dramatic.

Visual Receptor Sensitivity

Visual receptors are those walking and driving along the street, but also those residences on the street opposite the Trinity Motors site, which are two storey and will have views similar to this view. The view does not seem to be of high value. Therefore, viewers are considered to be of Medium to High sensitivity.

Magnitude of Change

The magnitude of the change is considered Medium –

> *Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.*

Significance of Visual Effects

The visual effect is considered to be Moderate.

The quality of the visual effect is considered neutral to beneficial.

Viewpoint 18 – Figures 11.38 and 11.39 of Volume 3

Existing View

The existing view shows the streetscape in the foreground composed of a variety of large industrial warehouse units interspersed with large signs. As the street rises in level, a terrace of two storey houses along William Street, is visible. This section of the street has a distinctive and a very different character to the large scale units in the foreground. The quality of the streetscape is considered low.

Proposed View

The proposed view shows the proposed office block visible to the rear of the existing signage. The remaining buildings are largely screened by the intervening buildings and structures.

The scale and extent of the proposed development, while large, does not appear unduly obtrusive in the context of the existing streetscape. Some improvements to the street in the form of planting and street trees at the site entrance are also visible.

Visual Receptor Sensitivity

The value of the view is not considered to be high. Visual receptors would include are those in residences, which are considered to have High Sensitivity, which are located along the western side of the street, from where this view is taken. Visual receptors would also include those walking and driving along the street, who would be of Medium sensitivity.

Magnitude of Change

The magnitude of change is considered to be Low–

> *Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity.*

Significance of Visual Effects

The overall visual effect is considered to be Imperceptible to Not Significant.

The quality of the effect is considered neutral, to beneficial.

Viewpoint 19 – Figures 11.40 and 11.41 of Volume 3

Existing View

The existing view shows the streetscape in the foreground and middle ground composed of a variety of large industrial warehouse units and a filling station. As the street rises in level, a terrace of two storey houses along William Street, is visible. To the right of the image, rows of coloured terraced two storey dwellings appear of a completely different scale, form and character when compared with the opposite (eastern) side of the street. The appearance of the warehouse type buildings in the foreground creates a somewhat chaotic effect, compared to the residential terraces on the street.

Proposed View

The proposed view shows the proposed hotel and office block are partly visible to the rear of the existing warehousing. The remaining buildings and lower storeys are largely screened by the intervening buildings and structures.

The scale and extent of the proposed development, while large, does not appear unduly obtrusive in the context of the existing warehousing and signage to the left of the image. It does however appear to be of quite a different scale and height, then the residential terraces on the opposite side and far end of the street.

Visual Receptor Sensitivity

This view represents the street at a vehicular entrance, rather than an area of residential receptors. Therefore, viewers are those driving and walking along Trinity Street, and those accessing the supermarket or fuel station at this location. The visual receptor sensitivity there is considered to be Low to Medium.

Magnitude of Change

The magnitude of change is considered to be Medium –

> *Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.*

Significance of Visual Effects

The overall visual effect is considered to be Slight.

The quality of the effect is considered neutral.

Viewpoint 20 – Figures 11.42 and 11.43 of Volume 3

Existing View

The existing view from Rosslare Strand shows an open view from the strand across the harbour to Wexford own. The town is set against a backdrop of an elevated plateau, which has a high proportion of tree cover. The town's two church spires are distinctive, as is the large industrial building on the waterfront to the left of the image. To the left of the image, a landscape of trees and fields is seen, while to the right and in the distance behind the town, views of distant hills are available.

Proposed View

The proposed view shows the development is seen along the waterfront, and views to the town's skyline, with the distinctive church spires, and backdrop of hills, are maintained. The development is of some extent but is comparable with the extent of the industrial buildings to the left, and the building does not intrude on the skyline.

Visual Receptor Sensitivity

This view is taken from Rosslare Strand, which is a Landscape of High Sensitivity. This is a strand and an area where viewers would be walkers and those enjoying the amenities and the scenery and views across the harbour. Visual receptor sensitivity is therefore considered High.

Magnitude of Change

The magnitude of the change is considered Low:

> *Low - Minor intrusion of the development into the view, resulting in minor alteration to the composition and character of the view but no change to visual amenity.*

Significance of Visual Effects

The visual effect is considered Not Significant, neutral visual effect.

Viewpoint 21 – Figures 11.44 and 11.45 of Volume 3

Existing View

The view from the Raven Point shows an open and extensive view across the harbour to Wexford Town, and the townscape is visible in its setting on the water's edge, with the higher land behind. Several larger buildings are discernible, including the industrial buildings to the left, and the more recent waterfront buildings along Paul Quay to the right.

Proposed View

The proposed view shows the development visible along the waterfront, against the backdrop of the town. The proposed development is of a scale and extent comparable with the industrial buildings to the left, but is lower and less prominent than these. The buildings do not obstruct views or the skyline from this view. The magnitude of change is considered Low.

Visual Receptor Sensitivity

This view is from Raven Point, which is the tip of the peninsula which is part of The Raven nature reserve, a wooded peninsula which extends into Wexford Harbour. This is visible in many views from Wexford Town. It is a Landscape of Greater Sensitivity and this view was requested by the Planning Authority. The viewers would be walkers, joggers, and those interested in the nature reserve area, and those enjoying the amenities. It is expected that viewers would highly focused on their surroundings, so visual receptors are considered Highly sensitive.

Magnitude of Change

> *Low - Minor* **intrusion** *of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity*

The visual effect is considered Not Significant, that is -

> *An effect which causes noticeable changes in the character of the environment but without affecting its sensitivities*

The quality of the effect is considered neutral.

Table 11.7 below summarises the visual receptor sensitivity, magnitude of change and significance of effect for each of the viewpoints.

Table 11.7 Summary of effects on Viewpoints

Viewpoint Number	Visual Receptor Sensitivity	Magnitude of Change	Significance of Effect	Quality of Effect
1	High	Medium	Moderate	Neutral
2	High	Medium	Moderate	Neutral
3	Medium/High	High	Moderate/Significant	Neutral
4	Medium	Low	Slight	Neutral
5	High	High	Significant	Adverse
6	Medium/High	High/Very High	Significant	Neutral
7	Low/Medium	Low	Not Significant	Neutral
8	High	Medium	Slight	Adverse
9	Low/Medium	Low	Not Significant	Neutral
10	Medium/High	High	Significant	Adverse
11	Medium/High	High	Significant	Adverse
12	High	High	Moderate	Adverse
13	Medium/High	Low	Not Significant	Beneficial
14	Medium/High	High	Significant	Beneficial

Viewpoint Number	Visual Receptor Sensitivity	Magnitude of Change	Significance of Effect	Quality of Effect
15	High	Very High	Significant	Neutral
16	Medium	Very High	Significant	Beneficial
17	Medium/High	Medium	Moderate	Neutral/Beneficial
18	Medium/High	Low	Not Significant	Neutral/Beneficial
19	Low/Medium	Medium	Slight	Neutral
20	High	Low	Not Significant	Neutral
21	High	Low	Not Significant	Neutral

Visual Effects – Summary

The majority of the above photomontages are taken from locations, which represent visual receptors of High sensitivity. These include residents in close proximity to the site, viewers engaged in recreation along the waterfront walkways in the town, or in recreation areas with views such as The Rock amenity area or the open space at Ferrybank. Sensitive visual receptors also include viewers at more distant locations including The Raven and Rosslare Point.

The photomontages show both close up and distant views. A number of the views in close proximity to the site show a considerable magnitude of change, which results in a Medium to Very High magnitude of change. Other viewpoints such as the distant viewpoints across the harbour, have a much lower magnitude of change due to the distance and the setting of the proposed development. Certain viewpoints on Trinity Street will also experience a less dramatic change in visual effect than may be expected. The visual effects range from Not Significant, as shown in views 7,9,13,18,20,21, to Significant, as in views 3,5,6,10,11,14,15, and 16. The visual effects on the different areas of the site and surrounds are discussed below.

The quality of the effect ranges from adverse to neutral and beneficial. Adverse visual effects are likely in the case of the views to the water being obstructed or enclosed by the development, including views which will be experienced by residents, or where the proposed development appears of a greater scale and size than its surroundings.

Beneficial visual effects are likely where the development creates a positive change, such as certain parts of Trinity Street. where the view is considered to be improved, and where the high quality of the built form improves the view.

Neutral effects are likely from the views across from Ferrybank, across the harbour, and Wexford Bridge, where the development sits in well with the existing townscape and backdrop.

Waterfront Views

Wexford's location on the harbour creates its distinctive setting, and its expansive waterfront views are important characteristics of the town.

Views to the water are frequent and range from open and expansive views across the harbour, as shown in Views 1,2,5,6,8,10,11, as well as views where there are smaller glimpses of the sea, from the surrounding urban areas, as shown in View 12 looking along Fisher's Row, and these are also experienced along Parnell Street and Batt Street.

The views to and from the water, acknowledged as important in the Development Plan policy, will undergo a degree of change, as a result of the proposed development. The views looking across the water from Ferrybank and from Wexford Bridge, will experience change, and although the proposed development will be a noticeable element, as it extends into the harbour, it is largely seen against the backdrop of the existing townscape. Additionally, although the development will change the skyline to some degree, these views (Views 1 and 2) show the development to be of a scale and height which is comparable to the other waterfront buildings from these locations, which are at some distance. The magnitude of change is considered Medium, and the visual effects are considered to be neutral. Viewers from the waterfront path at Ferrybank which is at a lower level than the surrounds, are likely to experience greater magnitude of change than those viewing from elevated locations, and from here the development may intrude more upon the skyline. Views further north of Ferrybank, along the waterfront at Crosstown, were considered, but while the proposed development is likely to be visible, Wexford Bridge partly obstructs the view. Viewers are likely to experience a lesser magnitude of change than Views 1 and 2.

A number of views were taken to represent Wexford's waterfront area. This is a popular area which has a promenade, and is popular for recreation, as well as for berthing of fishing vessels and other boats, which gives it a vibrant atmosphere, and the views to Wexford harbour are also an important element of the view. Viewers at these locations, looking south, particularly around Paul Quay, are likely to experience significant changes in the view, as viewers looking south towards the proposed development will experience a 'shortening' of the existing view to the harbour as the proposed development will be viewed large scale building directly in the line of view. The visual effects range from neutral to adverse.

From Paul Quay to Commercial Quay, it is noted the open views to the east over the harbour towards Ferrybank and Raven Point, will remain. These views are illustrated in Plates 11.31-33. It should be noted that night time views, especially those along the waterfront and the immediate vicinity of the site, will change as more lighting will be evident as a result of the proposed development.

Trinity Street and Environs

The proposed development on Trinity Wharf will result in visual effects on the local areas of Trinity Street, and to a lesser extent, the streets leading off Trinity Street, including Fisher's Row, Sea View Avenue and Trinity Place.

Viewpoints 13 - 19 are taken from various locations along Trinity Street. This is a high proportion of views, but these give an indication of the variation in the visual effects along the different parts of Trinity Street.

Approaching from the north, Trinity Street has a mixture of some nineteenth and twentieth century buildings, including terraced buildings with a distinctive character, interspersed with a hotel, and a modern six storey residential development. There is a high proportion of recent warehouse buildings, creating a varied streetscape, and one which has little active frontage along much of the eastern side. The proposed development will have some visual effect on the lower northern part of the street, as shown in View 18, and 19, and while noticeable, this is not considered significant as the buildings are set back somewhat from the street behind the existing warehouse buildings.

As one moves closer to the proposed development, such as in views 14-17, the buildings, while still set back from Trinity Street to some extent, appear more noticeable and create a larger magnitude of change in the view. The development is considerably higher, and larger in scale and mass than the surrounding buildings, though the industrial warehouse type buildings can also be described as large in scale, but these are not of comparable height. Some views to the harbour which are currently available, will be lost, mainly from the terrace of houses on Fisher's Row. Some glimpses of the harbour will be available but are greatly restricted.

The visual receptors which will experience the greatest magnitude of change, some of which is considered to have significant visual effects, will be the residents on Fisher's Row, on the terrace which faces Trinity Street and currently has sea views as it is somewhat elevated from the surroundings and lies opposite a vacant site (which was the site of a warehouse until 2008). It is considered that there are both negative and positive aspects to the change, and while the streetscape is improved with vegetation and tree planting, and some of the steel fencing removed, the large scale buildings will obstruct much of the harbour views and introduce a considerably larger scale and mass to the view. Viewers looking towards Trinity Street along Fisher's Row will also experience a degree of change as the view of the sea is lost, however views to the sea will be maintained along Batt Street. Some views, such as View 16, show where there are no existing sea views form Trinity Street, that the proposed development will have a positive visual effect by removing the steel fencing and concrete yard, and improving the street with vegetation and trees.

Views from the end of Batt Street and Gulbar Road/Harbour view will have views of the proposed development to the north, and this will result in a reduced view of the harbour, to the northeast. However, views to the east and south will still be available.

A view was taken from the junction of The Faythe and William Street, View 9, and this shows the development be largely screened by foreground buildings, having a minimal visual effect on the area.

Views from the Southwest

Further southwest, an area where the development is considered to be visible but not giving rise to significant visual effects are the views from Trespan Rock/The Rocks, where the proposed development is partly visible but the important and panoramic harbour views are maintained.

Views from the Northwest

A view representing the more elevated areas of the town, at the Church of the Assumption on Bride Street, is included and illustrates that the development, while partially visible from this elevated area, will blend in with the roofscape and not have a significant visual effect.

Medieval Town

As discussed in Section 11.4, views are unlikely from the streets in the medieval core of South Main Street and North Main Street, and the perpendicular lanes and streets, due to the intervening dense built form. Views south along South Main Street are restricted by the Barracks building which is seen at the end of South Main Street as shown in Plate 11.26. The upper storeys of several taller buildings such as White's Hotel and the Opera House may have views of the proposed development.

Landscapes of Greater Sensitivity – Rosslare Strand and The Raven/Raven Point

The areas of Rosslare Strand and The Raven were visited, and photomontages prepared, in order to assess visual effects of the proposed development. It is considered that while the proposed development is likely to be visible from these areas, in good weather conditions. However, both these locations have views of the other parts of the harbour, and in particular at Raven Point, where views are in all directions, not just in the direction of the proposed development, and the site is not the main focus of the view. The development, while visible is not considered likely to give rise to significant visual effects.

Conclusion – Visual Effects

In conclusion, the proposed development introduces several large scale, 5 and 6 storey buildings, proposed marina and pedestrian boardwalk to a prominent, vacant waterfront site on Trinity Wharf, in Wexford Harbour just south of the town centre. The site was previously the location of a number of industrial and warehouse buildings until recent demolition in the 1990s and have remained undeveloped. As a result of this demolition, and the removal of the built form, several views to the harbour have been opened up as is now reflected in the baseline but which in the past 100 years may have been enclosed.

In terms of visual effects, the views of the harbour are considered characteristic of this area, and are noted in the Development Plan. The proposed development will re-introduce built form on the site, in the form of large scale buildings on this prominent site. Visual effects range from Not Significant, in cases where the development is barely visible, or visible but not in any way dominant, to Significant, where the development is clearly visible and will cause a considerable change in the visual character and amenity of the area.

Some Significant visual effects are likely, in particular in the immediate vicinity of the site, and the waterfront to the north, however visual effects are not considered significant in relation to the wider town including the historic medieval core and the wider Wexford harbour area, including the areas of Raven point and Rosslare Harbour.

The quality of the visual effects, range from adverse to beneficial.

The adverse visual effects are mainly localised, occurring in the vicinity of the site and some views along the waterfront to the north of the site. While the majority of the adverse effects relate to the restriction of long views by a large scale built form, in most cases, views are available in other directions to the harbour, as from the waterfront locations north of the site, and also the end of Batt Street and Gulbar Road/Harbour view. There are very few views where the proposed development will obstruct the only view to the harbour. Some residential views are likely to be affected in the vicinity of the site. Beneficial effects are likely along parts of Trinity Street where the proposed development will improve the streetscape and character. Visual effects on the wider townscape and harbour tend to be neutral in quality.

11.6 Mitigation & Monitoring Measures

Mitigation Measures – Construction Phase

The measures proposed revolve around the implementation of appropriate site management procedures – such as the control of site lighting, storage of materials, placement of compounds, delivery of materials, car parking, etc. Visual impact during the construction phase will be mitigated somewhat through appropriate site management measures and work practices to ensure the site is kept tidy, dust is kept to a minimum, and that any locations close to public areas are kept free from building material and site rubbish.

Site hoarding will be appropriately scaled, finished and maintained for the period of construction of each section of the works as appropriate. To reduce the potential negative impacts during the construction phase, good site management and housekeeping practices will be adhered to. The visual impact of the site compound(s) and scaffolding visible during the construction phase are of a temporary nature only and therefore require no remedial action other than as stated above.

General construction measures are outlined in the Outline Construction Environmental Management Plan and Outline Environmental Operating Plan as per Appendices 4.1 and 4.2 of this EIAR which must be undertaken by all contractors.

Mitigation Measures – Operational Phase

Mitigation measures were largely included in the design of the project. The design statement refers to the design rationale, and extensive analysis was undertaken to arrive at the proposed design. The design process analysed the buildings and streetscape in the vicinity of the site and design responses took into account the following;

- The proposed development is in the context of the Wexford Quays Economic Action and Spatial Implementation Plan which aims to connect the site to the Crescent and Paul Quay area and has a number of aims for the surrounding town.
- The scale and height of the buildings (5-6 storeys) were designed to relate to the existing buildings along Paul Quay, particularly when seen from the Ferrybank and Wexford Bridge areas. It was decided that buildings taller than this would have a greater visual effect on the overall harbour. A previous application on the site had proposed taller buildings and a larger marina development. Analysis concluded that buildings of a smaller scale would be better suited to meet the objectives of Wexford County Council for the site. In addition, the Development Plan policy recommends buildings of 5-6 storeys along Trinity Street, so the proposed development is compatible with this.
- The scheme creates connectivity to the town centre and allows for public access by linking Trinity Wharf to Paul Quay via a boardwalk, and also proposed public realm improvements in the Paul Quay area. Other options which connected to the Trinity Wharf site along the railway line were considered but this would have required security fencing and barriers for the railway line, so the connection of a boardwalk at Paul Quay is considered to be preferable and results in a more visually attractive connection that maximises the positive benefit of the waterfront location.
- The design of the proposed hotel building was amended and re-oriented to maximise public access to the waterfront in the location with the most remarkable views from the site.
- The proposed design includes provision of public spaces and walkways including a boardwalk connecting the site to Paul Quay, a coastal walkway and viewpoints, to enhance the views from the site and thus enhance a key characteristic of the site. The proposed boardwalk will provide a new viewing location for views out to the harbour and along the waterfront, as well as addressing the policy for a coastal walkway.
- The landscape plan proposed to enhance the site's character with tree and shrub planting to emphasise the natural character and setting of the site and create a buffer of suitable and robust vegetation along the railway line to integrate development into the wider landscape. The landscape design strategy included in Appendix 4.6 of the EIAR will be implemented as part of the design.

11.7 Residual Effects

The residual effects are expected to be as set out in Section 11.5 above for Landscape and Visual Effects.

11.8 Difficulties Encountered

No difficulties were encountered.

Chapter 12:
Noise & Vibration

ROUGHAN & O'DONOVAN

Chapter 12 Noise & Vibration

12.1 Introduction

This chapter of the EIAR has been carried out by Gary Duffy of Enfonic Noise and Vibration Solutions and assesses the impact of noise and vibration associated with the proposed Trinity Wharf development.

12.2 Methodology

In order to assess the noise impact of the proposed development, the methodology in the following section was adopted.

Baseline

The first stage is to assess and quantify the existing noise environment close to sensitive receptors that may be affected by the proposed development. The noise-sensitive locations were selected as those in closest proximity to the proposed development. Attended noise surveys were conducted at several locations.

Construction Phase

The noise levels resulting from the construction phase of the proposed development are calculated using established prediction techniques.

The noise levels are predicted in accordance with guidance set out in BS5228:2009 Code of practice for noise and vibration control on construction and open sites. The results of the predicted assessment are compared against the baseline conditions and the differences are related to the likely impact of the development. Where predicted noise levels are in excess of adopted criteria or to control any risks associated with the uncertainty of the results, mitigation measures are proposed.

Operational Phase

Noise levels from operations associated with the development are estimated and their impact assessed. Operational sources considered are:

- Road traffic including changes to traffic flows on the existing road network as a result of the development and the proposed access road;
- Operations associated with the arts and cultural centre and;
- Items of mechanical and electrical plant associated with the hotel and office buildings.

These are expected to be the predominant noise sources with the potential to affect nearby Noise Sensitive Locations (NSLs) but other operations include the marina and café/restaurant. However, it is not possible to accurately predict the environmental noise impact associated with such facilities. A general noise management strategy should be developed as part of the development and management of the marina and café/ restaurant uses including hours of operation, training for staff and signage to notify the public of the potential effect their activities, particularly at night, may have on nearby residents.

Potentials for noise 'break-out' from a typical café/restaurant may include extractor fans from kitchens and leaving doors open. The design of an extractor system should consider the potential noise impact and doors should include lobby areas with automatic closing mechanisms fitted.

As the marina is expected to operate as a typical leisure facility, its operations are unlikely to adversely affect the nearby residents which are in excess of 200 metres from the proposed marina. However, large motor yachts may need to be curtailed either by limiting their arrival/departure times, enforcing the use of shore-power and/or considering their berthing location to minimise any potential impact. In addition, on-board parties should be strictly controlled to adhere with legislation to minimise the likelihood of noise complaints.

Noise from passing trains was also measured for information purposes and to add context to the existing acoustic environment.

Further details of each phase of the assessment are set out in the individual sections of this chapter.

12.3 Assessment Criteria

12.3.1 Baseline Conditions

Attended noise measurements were taken during the day and evening periods at two locations close to the site of the proposed development. Being representative of the closest residential dwellings, the impact assessment at these locations will be greater than for other dwellings located further from the site. A map of the survey locations and other relevant details is presented in Appendix 12.2.

The following parameters were recorded during each monitoring period:

- **L_{Aeq}**

  The continuous equivalent A-weighted sound pressure level. This is an "average" of the sound pressure level.

- **L_{AF10}**

  This is the A-weighted sound level that is exceeded for noise for 10% of the sample period. Used as an indicator of traffic noise.

- **L_{AF90}**

  This is the A-weighted sound level that is exceeded for 90% of the sample period. Referred to the "background" noise level in some standards.

A glossary of Acoustic Terminology is in Appendix 12.1.

A series of three non-consecutive 30minute noise measurements were taken in calm, dry conditions on Sept 29, 2018 using a B&K Type 2250 Sound Level Meter which was calibrated before and checked after the survey.

Due to access restrictions two suitable survey locations were available however these represent the nearest NSLs to the development. So, the impact assessment at the survey locations can be considered representative of the NSLs. The 'Additional Survey Location' is used for train noise measurement only and referenced under Train Noise.

Survey results are presented in Table 12.1 and identified in Plate 12.1.

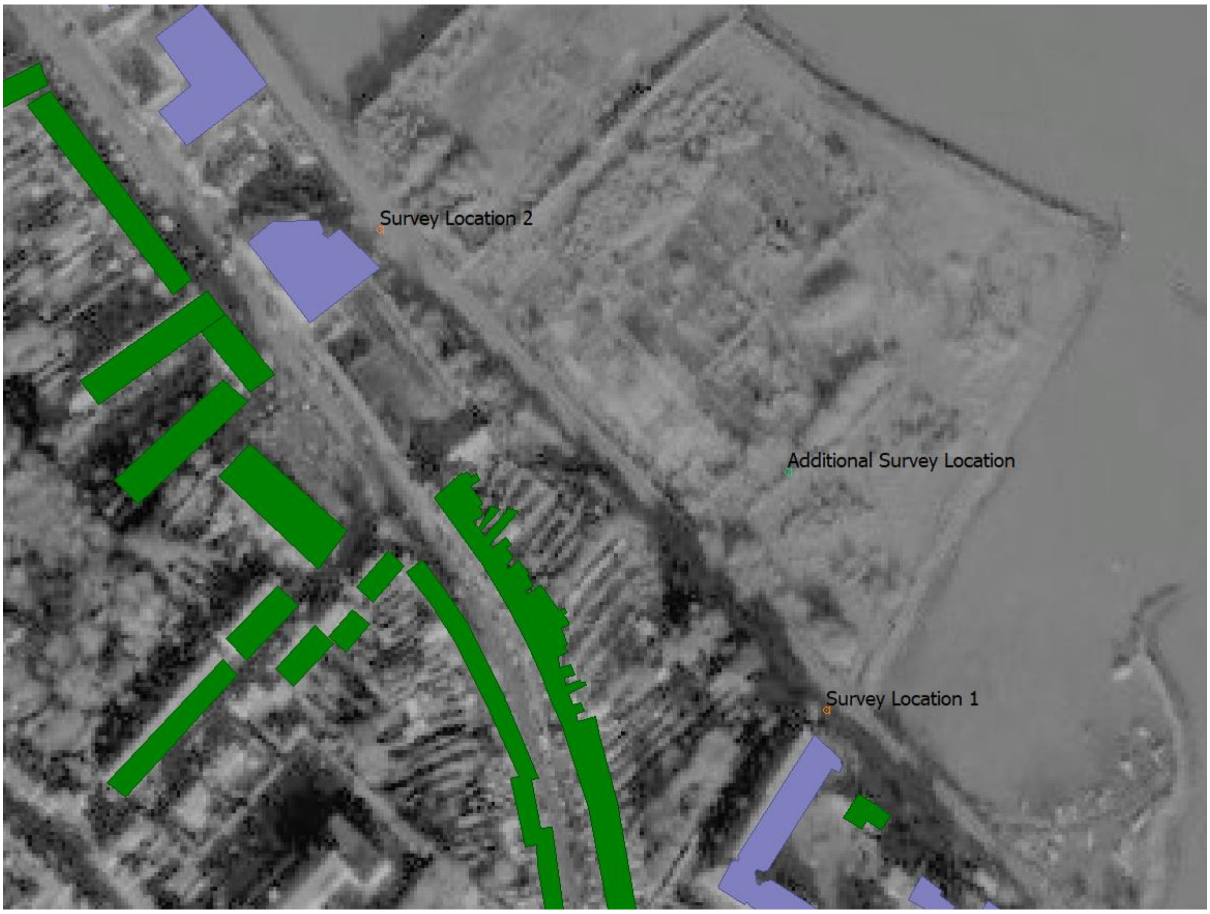


Plate 12.1 **Attended Noise Survey Locations**

Table 12.1 **Noise Survey Results**

Survey Location	Start Time	Elapsed Time	L_{Aeq}	$L_{AF90.0}$	Comments
Day-time			**(dB re. 2x10^{-5}Pa)**		
1a	21/09/2018 10:25	00:30:00	48.5	44.5	Soft ground, dense vegetation. Brid song. Road Traffic Noise (RTN) – distant. Distant dog bark. School yard noises @ 10:50
1b	21/09/2018 11:44	00:30:00	48.5	44.0	RTN. Bird song. Lawn mower nearby @ 12:02.
1c	21/09/2018 13:00	00:30:00	53.1	45.0	School yard noises from 13:05. Train @ 13:10. RTN – local. Brid song. Light drizzle 13:15-13:25
		Mean Values:	50.0	44.5	
2a	21/09/2018 11:08	00:30:00	53.7	46.0	RTN – continuous and dominant. Car turning @11:34
2b	21/09/2018 12:21	00:30:00	53.2	45.7	RTN – continuous and dominant. Car turning @12:48

Survey Location	Start Time	Elapsed Time	L_{Aeq}	$L_{AF90.0}$	Comments
2c	21/09/2018 14:00	00:30:00	53.4	45.5	RTN – continuous and dominant.
		Mean Values:	**53.5**	**45.7**	
Evening-Time					
1d	21/09/2018 19:05	00:30:00	47.5	42.6	Road Traffic Noise (RTN) – distant. Train @19:25
1e	21/09/2018 20:24	00:30:00	47.2	42.6	Road Traffic Noise (RTN) – distant. Kids playing in distance. Car @ 20:40
1f	21/09/2018 21:40	00:30:00	46.1	41.3	Road Traffic Noise (RTN) – distant
		Mean Values:	**46.9**	**42.2**	
2d	21/09/2018 19:43	00:30:00	53.0	46.0	RTN – continuous and dominant.
2e	21/09/2018 21:01	00:30:00	54.1	44.4	RTN – continuous and dominant.
2f	21/09/2018 22:17	00:30:00	53.2	43.0	RTN – continuous and dominant.
		Mean Values:	**53.4**	**44.5**	

The Mean Values of the L_{Aeq} parameter is considered representative of the Ambient noise level under the measurement conditions.

The Mean Value of the LAF90 parameter is considered representative of the Background noise level under the measurement conditions.

A night-time survey was not required as neither construction works nor significant operational activities will occur at night (23:00 to 07:00 Hrs).

Train Noise

In addition, the noise level of a passing train event was measured as L_{Aeq}, 32sec = 60.6dB. This was measured approximately. 30metres from the track in free-field conditions on the existing site, identified as 'Additional Survey Location' in Plate 12.1. The result therefore represents typical train event noise levels at the rear of the dwellings closest to the site on Trinity Street.

According to the current Irish Rail schedule, there are 8 trains (arrivals & departures) Monday to Friday during the day time period and one during the early morning/ night time period (departure from Rosslare 05:35). Six trains occur on Saturdays and Sundays during the day-period only.

12.3.2 Construction Phase

Relevant Noise Guidance Documents

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a development. Local authorities may control construction activities by imposing limits on the hours of operation and/or may consider noise limits at their discretion. In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the following guidance:

- Transport Infrastructure Ireland (TII): Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes – 2014

The document represents guidance for the assessment of road traffic noise, but it also presents maximum permissible noise levels at dwelling facades during construction activities as set out in Table 12.2.

Table 12.2 Limits of Construction Noise in TII Guidance Document

Days & Times	**$L_{Aeq\ (1\ hour)}$**	**$L_{AS,\ Max}$**
Monday - Friday 07:00 to 19:00 hrs	70	80
Monday - Friday 19:00 to 07:00 hrs	60	65
Saturday 08:00 to 16:30 hrs	65	75
Sundays & Bank-holidays 08:00 to 16:30 hrs	60	65

The guidance also recommends that: "*In the absence of an Irish or international standard relevant to construction noise, reference can be made to BS 5228*".

BS5228:2009 *Code of practice for noise and vibration control on construction and open sites*. The guidance adopted in this standard designates noise sensitive locations into a specific category; A, B or C as presented in Table 12.3, based on existing ambient noise levels i.e. in the absence of construction noise. This then sets threshold noise values for construction related noise that if exceeded, indicates a significant noise impact is associated with the construction activities.

Table 12.3 sets out the values which, when exceeded, indicate a significant effect at the facades of residential receptors as recommended by the above standard. Please note that these are cumulative levels, i.e. the sum of both ambient and construction noise levels.

Table 12.3 Example Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A	**Category B**	**Category C**
Night-time (23.00−07.00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)	65	70	75
NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. *NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.* *NOTE 3 Applied to residential receptors only.*			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			

Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

Category D: 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Vibration Guidelines

There is likely to be no adverse vibration levels as a result of the operation of the development. The most likely potential vibration effects are associated with the construction phase of the development.

Vibration threshold values discussed below are therefore presented in the context of potential vibration effects from the construction phase.

Limits of transient vibration, above which cosmetic damage could occur, are given in Table 12.4.

Table 12.4 Transient Vibration Guide Values for Cosmetic Damage (Ref BS5228-2:2009)

Type of Building	**Peak Particle Velocity (PPV) (mms^{-1}) in Frequency Range of Predominant Pulse**	
	4Hz to 15Hz	**15Hz and above**
Reinforced of framed structure. Industrial and heavy commercial buildings.	50mms^{-1} at 4Hz and above	50mms^{-1} at 4Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15mms^{-1} at 4Hz increasing to 20mms^{-1} at 15Hz	20mms^{-1} at 15Hz increasing to 50mms^{-1} at 40Hz and above

Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 12.4, and major damage to a building structure can occur at values greater than four times the tabulated values (definitions of the damage categories are presented in BS 7385-2:1993).

These guidelines refer to relatively modern buildings and therefore, these values should be reduced to 50% or less for more sensitive buildings.

People can generally perceive vibration at levels which are substantially lower than those required to cause building damage. The human body is most sensitive to vibration in the vertical direction. The effect of vibration on humans is guided by *BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*. This standard does not give guidance on the limit of perceptibility, but it is generally accepted that vibration becomes perceptible at levels of approximately 0.15 to 0.3 mms^{-1}.

The *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes – 2014* also includes a discussion of vibration levels in relation to construction activities. While the document relates to national road schemes, the advice on construction vibration is relevant to all construction activities. Table 12.5 includes allowable vibration levels during construction activities which would minimise the risk of building damage. This is the reference to be applied to the assessment of vibration in the Republic of Ireland.

Table 12.5 Allowable Vibration During Construction in Order to Minimise the Risk of Building Damage

Allowable Vibration (Peak Particle Velocity) at the Closest Park of Any Sensitive Property to the Source of Vibration, at a Frequency of		
Less than 10Hz	10Hz to 50Hz	50Hz to 100Hz and above
8mms^{-1}	12.5mms^{-1}	20mms^{-1}

Prediction of vibration levels at nearby buildings as a result of the development of the Trinity Wharf scheme is not possible without detailed analysis of the ground substrate (this is typical of most construction sites). Vibration is generally only a concern at locations close to the construction site which a number of buildings are in the case of this scheme. Therefore, a vibration monitoring programme should be adopted at the nearest building(s) during the most critical phase(s) of construction e.g. rock-breaking, pile driving (if applicable) etc.

Construction Plant, Noise Levels

A variety of items of plant will be in use during the construction works. Typical items of plant used will include rock breakers, excavators, pilling operations, dump trucks, compressors and generators in addition to general concreting plant, road surfacing and levelling equipment.

The BS5228 standard sets out sound power levels for plant items normally encountered during key phases on construction sites, which in turn enables the prediction of noise levels at selected locations.

Likely construction noise calculations have been conducted at the nearest properties to the works during the demolition and site preparation works stages. These phases are likely to produce the highest impact as therefore represent a 'worse-case' scenario.

Best practice also requires that appropriate mitigation measures be considered, and these are discussed also.

12.4 Noise Model

A computer-based prediction model has been prepared in order to quantify the noise level associated with the construction phase of the proposed development. This section discusses the methodology behind the noise modelling process and presents the results of the modelling exercise.

Noise Prediction Software

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, Brüel & Kjær Type 7810 Predictor, calculates traffic noise levels in accordance with *ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation* and NRA guidance.

The software predicts noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of sound power and for moving sources, average velocity and flow;
- the distance between the source and receiver;

- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces, and;
- the hardness of the ground between the source and receiver.

Input to the Noise Model

The noise model was prepared using the following data:

- Scaled map of the area around the site including 3D topographical data;
- Nearby buildings including Residential and Commercial properties;
- Sound power data of the major noise sources expected to operate during the construction phase(s) being considered.

A list of the major items of plant to be used was provided by Roughan & O'Donovan (ROD) and the equivalent sound power values of each are listed in BS 5228 tables. Where an exact size/power equivalent wasn't available, the next largest item was used as the input data to the model.

Various assumptions about the operation of the items were required and a conservative approach which over-estimates the likely noise impact has been adopted. For instance; all major plant is mobile so a larger number of movements of each than is likely during a typical day has been assumed in the model. This approach produces a higher level of predicted noise which compensate for the uncertainties associated with the assumptions.

The details of the items of plant used in the model which are presented in Table 12.6.

Table 12.6 Plant Details Used as Input into Model

Item	Model	BS 5228				Modelling Assumptions	
		Description	Ref	Power (Kw) / Size (t)	L_{Aw}	Source Height	Flow (per-day)
Tracked Excavator	JCB JS300	Tracked Excavator	C.2/2	300/71	104.9	3m	25
Piling Rig	Soilmec SR70 Continuous Flight Auger Piling Rig	Tracked drilling rig with hydraulic drifter	C.3/15	104/12.5	110.7	5m	10
Dumper Truck	Volvo A45G	Articulated dump truck	C.6/26	287/40	107.2	2m	25
Rock Breaker	TBC	Breaker mounted on wheeled backhoe	C.1/1	59	120.5	0.75m	10
Tandem Vibratory Roller	CB44B/CB54B	Vibratory roller	C.5/21	95/12	108.4	1.5m	10

Each noise source above was modelled as moving across the site at a velocity of 10kmh^{-1} except for the rock breaker which if required, is likely to be confined to specific areas of the site.

For the purposes of modelling, it has also been assumed that all sources, subject to their assumed operations above, are working simultaneously over the course of the day period. This is unlikely to occur under practical conditions therefore the actual noise levels at the locations indicated in Table 12.7 are likely to be less than those predicted.

Output of the Noise Model

The Predictor software calculates noise levels for a set of receiver locations specified by the user. The results are presented in terms of L_{Aeq} which can then be compared to the threshold criteria set out in Table 12.3.

Choice of Receiver Locations

In the first instance, the construction noise levels are predicted at the same locations as the attended noise survey locations (illustrated in Plate 12.1) with results detailed in Table 12.7. A full construction noise impact assessment can only be made at these locations as existing ambient noise levels are known only here. However, these locations were chosen to serve as proxy locations for the closest NSLs, so the greatest likely impact is applicable to these. Other NLSs are further from the construction activity and therefore the impact at these will be less.

At some properties noise levels were predicted at different heights to represent ground, first floor levels etc. and to the front and rear of some properties. At the Talbot hotel, levels were predicted at 6 floors. In total, free-field construction noise levels have been predicted at 26 properties and 2 survey locations. The Survey and Impact Assessment locations are presented in Appendix 12.2 and the predicted construction noise levels in Appendix 12.3.

12.5 Construction Impact Assessment

The impact assessment is made by first comparing the sum of the ambient and predicted noise levels at the survey locations with the limits from the TII guidance. Secondly, the levels are compared with the Categories of BS 5228. Table 12.7 below is a summary of the results.

Table 12.7 Construction Noise Impact Assessment Results (Day-time)

	L_{Aeq} values			TII Guidance		BS 5228 Guidance		
Survey Location	**Ambient**	**Predicted**	**Sum**	**Limit**	**Exceeded?**	**Category**	**Limit**	**exceeded?**
1	50.0	56.3	57.2	70	No	A	65	No
2	53.5	56.9	58.5	70	No	A	65	No

As can be seen, the predicted noise levels are less than the TII maximum recommended limit and the lowest Category A limit of BS 5228. Assessment is made for the day-period only as construction will not take place, except in the case of emergencies, at other times.

Lower limits of 65dB (TII Guidance) / 55dB (BS5228 Guidance) apply for weekend works (see Tables 12.2 & 12.3). The Sum of the Predicted and Ambient levels above would, in the absence of mitigation, therefore be exceeded under such circumstances. As the Predicted levels above are based on all plant in Table 12.6 operating simultaneously, care should be taken that this does not occur during weekends so as not to exceed these reduced limits.

Modelling exercises to include the hoarding have concluded that the reductions as per Table 12.8 at the Survey locations can be expected:

Table 12.8 Possible Noise Reductions from Perimeter Hoarding

Hoarding Height	Noise Reductions	
	Survey Loc 1	Survey Loc 2
3m	-2.7dB	-4.6dB
4m	-3.5dB	-5.4dB

The location as modelled in shown in Plate 12.2.

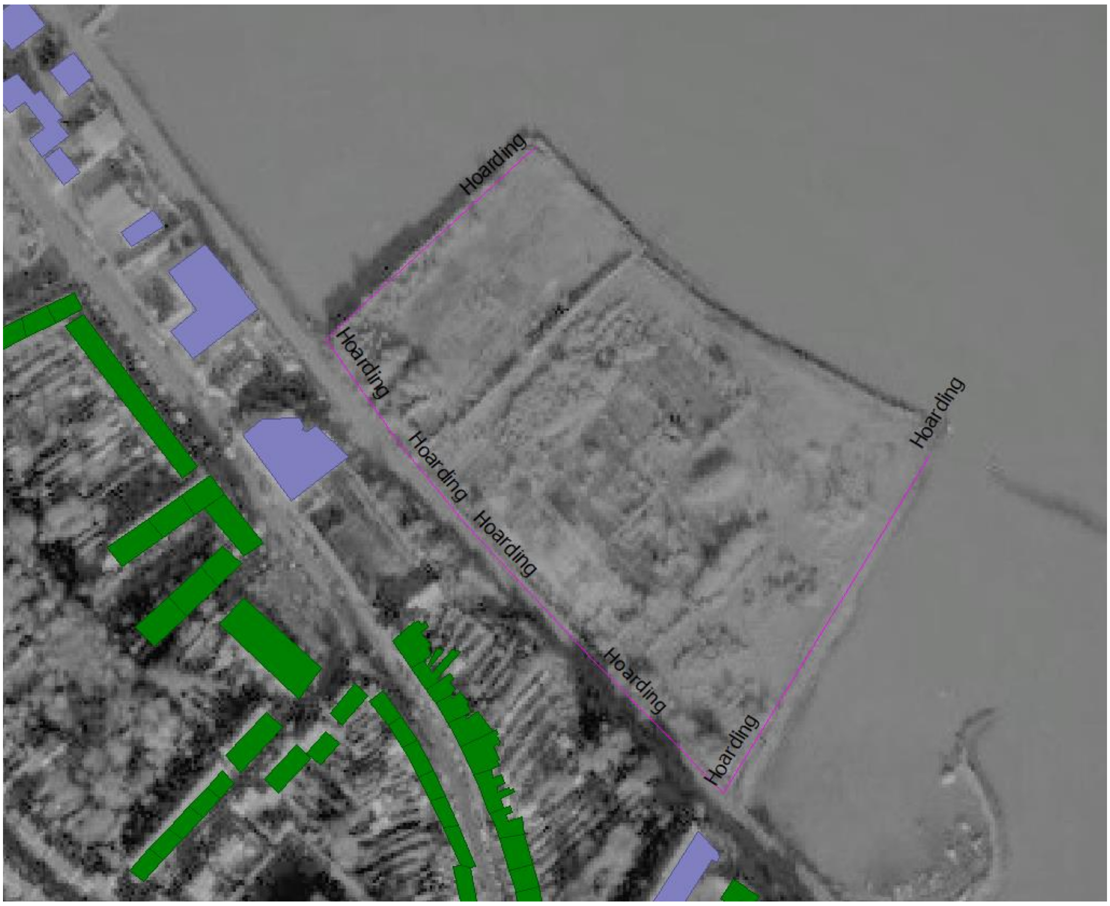


Plate 12.2 Modelled hoarding around three sides of the main construction site

The modelled hoarding described above is considered to be ideal as it is continuous with no gap along the bottom. A practical hoarding however is likely to compromise the above as a result of gaps, openings and materials. Therefore, the maximum possible attenuation figures in Table 12.8 may be at least 3dB less in reality.

Other noise amelioration strategies for individual items of plant etc may be available.

12.6 Construction Impact Assessment Conclusion

The noise assessment has indicated that construction activities can operate within the adopted noise limits for daytime periods (Monday to Friday) at the nearest properties to the works. The application of the proposed noise limits and restricted hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to within acceptable standards.

Lower limits of 65dB (TII Guidance) / 55dB (BS5228 Guidance) apply for weekend works and care should be taken to ensure that only select less noisy activities are undertaken during weekends so as not to exceed these reduced limits.

Vibration

A vibration monitoring programme will be required to be adopted at a select number of the nearest buildings during the most critical phase(s) of construction e.g. pile driving, etc.

12.7 Operational Phase

Should the proposed development proceed, increased levels of traffic noise in the vicinity is expected as well as on-site traffic accessing the car-park and circulating within the site. In addition, items of mechanical and electrical plant associated with the hotel and office blocks will be operating in the vicinity and may have an impact. Finally, operations from the cultural and performance centre may also have an impact.

All these likely noise sources are discussed, and their individual impacts are assessed in this section. The noise levels are expressed in term of L_{day}, L_{eveing}, L_{night} to show these specific periods but the L_{den} is the parameter applicable for impact assessment.

12.7.1 Traffic Noise

Baseline and Post-Development traffic figures in terms of Annual Average Daily Traffic (AADT) were provided by ROD which are shown in Table 12.9.

Table 12.9 Existing (Baseline) and Predicted Post-Development Traffic Flows

	Baseline		Post-Development		Average Speed, kph
	AADT	HGV	AADT	HGV	
Trinity Street	10154	157	11826	169	38
William Street Lower	10208	510	11494	558	38
Fisher's Row	1380	14	1476	14	30
Parnell Street	2918	12	3605	12	32
King Street	4129	41	4793	53	24
Paul Quay	12437	249	12697	249	30
Site's Access Road	N/A	N/A	3217	30	30
Site's Circulatory Rd	N/A	N/A	322	30	20

The noise and vibration assessment for the Baseline and Post-Development schemes was undertaken with reference to the following standards and guidance documents:

- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Rev 1 2004* and *Good Practice Guidelines for the Treatment of Noise and Vibration during the Planning of National Road Schemes 2014*, Transport Infrastructure Ireland (TII, formally NRA) – the "Guidelines"

A similar noise model to that used for the prediction of noise levels in the construction phase was used to predict noise levels from traffic flow data. The Predictor software used previously implements various prediction standards including Calculation of Road Traffic Noise (CRTN) which is recommended by the *Guidelines*.

CRTN is an empirically derived noise prediction standard and predicts noise levels based on traffic volumes and velocities.

To provide hourly input data to the models, which would allow the L_{den} parameter to be calculated as recommended by the Guidelines, each AADT value was distributed using TII's Diurnal Profile as set out in Table 12.10.

Table 12.10 TII Diurnal Profile

Hour	%	Hour	%	Hour	%
1	0.84	9	5.83	17	8.02
2	0.53	10	5.26	18	8.54
3	0.38	11	5.17	19	7.34
4	0.33	12	5.72	20	5.68
5	0.37	13	6.33	21	4.35
6	0.73	14	6.63	22	3.23
7	2.20	15	6.82	23	2.25
8	4.68	16	7.32	24	1.45

The resultant hourly traffic flows for some roads were less than 200 vehicles/hour. CRTN recommended that appropriate corrections are made for such low-flow periods which have been applied.

The *Guidelines* are primarily concerned with the impact assessment of new road schemes and generally give a design goal of L_{den} <60dBA however, applying such a limit is not applicable here so a comparison between the Existing (Baseline) and Post-Development scenarios is made.

The resultant noise levels at the measurement locations are presented in Appendix D.

12.7.2 Plant Noise

Currently details on the items of plant associated with the operations of the various building in the development are available only in general terms with no specific details regarding models or installation.

Sketches of the plant rooms for each applicable building were provided in the *D1815 Environmental Analysis Report 2018-11-20 DRAFT ONLY FI (003)* document by ROD. From there the following was derived:

Table 12:11 Details of Plant Room Noise Sources

Building	Major Plant	Location	Operation duty cycles	Sound Level
Hotel	VRF condensers x15 Chiller Unit	Roof	Day: 100% Evening: 100% Night: 50%	SWL=80dBA ea* SWL=83dBA
Hotel	Combined Heath & Power (CPH) Unit	Ground	Day: 100% Evening: 100% Night: 50%	SPL=75dBA @1m
Cultural Centre	Chiller Units	Roof	Day: 100% Evening: 100% Night: 0%	SWL=83dBA
Café, Retail, Restaurant	None	N/A	N/A	N/A
Office Blocks A, B & C	VRF condensers x15 Chiller Unit	Roof	Day: 100% Evening: 0% Night: 0%	SWL=80dBA ea* SWL=83dBA
	**Total SWL: 15x 80dBA = 91.8dBA.*			

The Operation Duty Cycle parameter is used to represent when the plant will be operational over the course of a 24-hour period. For example, the offices are unlikely to occupied and the hotels' demand's will likely reduce at night with a commensurate reduction in noise.

Each of the items on the roof of the buildings are to be contained inside a 2.2m high louvered structure with no roof. Each plant 'room' is essentially identical in terms of its noise levels.

The noise levels provided in Table 12.11 are overall levels, but octave band levels are required for the purposes of noise modelling. As a result, the levels above are assumed to be in the 500Hz octave band, as is the norm[1]. The reduction due to the louver at this frequency band was assumed to be – 11dB[1].

For the purposed of noise modelling, sound power levels (SWL) are required but the sound pressure level (SPL) was given for the CHP unit. It's SWL level was calculated as follows:

$$L_w = L_p + 20\log_{10} r + C - R$$

Where:

Lw = SWL

Lp = SPL

r = distance

C^1 = Constant to account for enclosure internal acoustic condition. C has been assumed to be +9dB @500Hz or 'fairly live'. Fairly Live: all surfaces generally hard but some panel construction

R^1 = Reduction of louvered door. Assumed to be -11dB @500Hz

So,

$$L_w = 75 + 20\log_{10} 1 + 9 - 11$$
$$L_w = 73dB$$

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[1] *Engineering Noise Control, Bies Hansen*

The ground-based plant room noise level is significantly less than the roof-based levels. All sources were modelled as single point-sources with the roof sources having a vertical radiation pattern.

Plate 12.3 is a 3D illustration of their positions – shown as white markers.

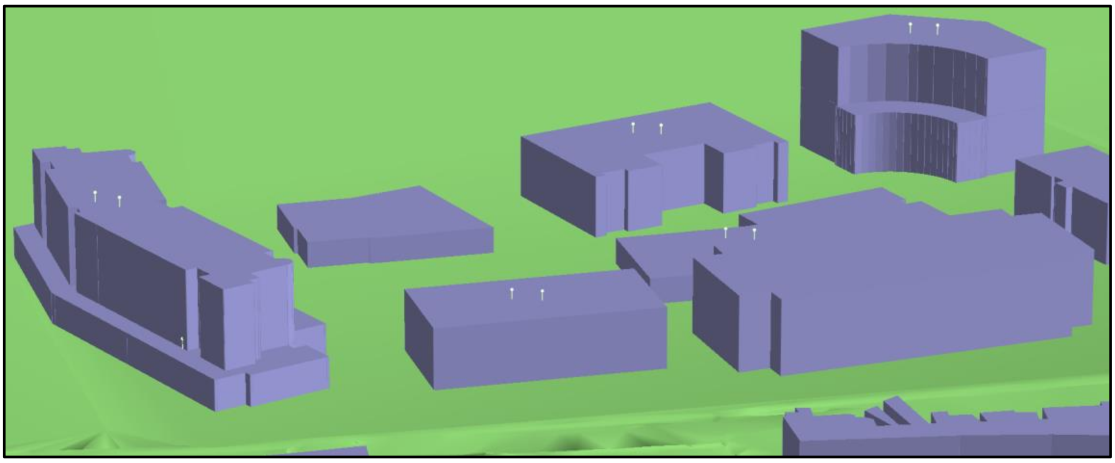

Plate 12.3 Plant room noise modelled sources

The calculated noise levels at the NSLs are presented in Appendix 12.4.

12.7.3 Cultural & Performance Centre

The programme of events for the Cultural & Performance Centre are not yet defined but it has been assumed that typical in-door events such as plays, moderate amplified music, shows etc take place inside the auditoria.

The construction build-up of the building's façade is assumed to be a 280mm cavity wall (420kg/m^2) – the final construction is likely to be denser and offer greater reduction to noise transmission, so this is considered as conservative.

Typical measured noise levels within a similar auditorium are available to Enfonic. To model the noise break-out, an indoor-outdoor calculation using these noise levels and the Sound Reduction Index (R) of the wall facing sound towards Trinity Street was used and these are presented in Table 12.12.

Table 12.12 Noise break-out Calculation for the Arts Centre's Auditoria

	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	Total
L_{Ap} dB	90	88	86	84	82	82	76	76	90
R (dB)	36	41	46	53	59	64	64	64	
Lw (dBA/m^2)	48	41	34	25	17	12	6	0	49

Plate 12.4 is a 3D illustration of the position of the emitting façade of the Arts Centre.

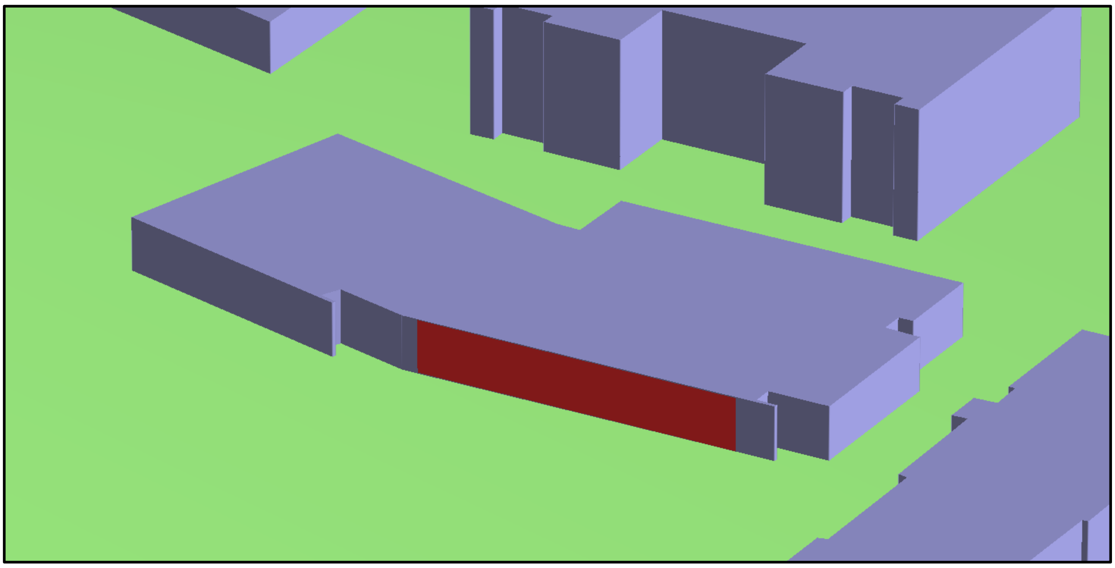

Plate 12.4 **Emitting façade of the Arts Centre – shown in red**

The calculated noise levels at the NSLs are presented in Appendix 12.4.

12.7.4 Total Operational Noise

The totals of the above Traffic, Plant and Arts Centre noise levels at the NSLs is presented in Appendix 12.5.

12.8 Operational Impact Assessment

As can be seen from the results, almost all locations will see an increase in noise level as a result of the development. Suitable guidance on environmental noise for planning purposes can be found in the standard *BS 4142:2014 Methods for rating and assessing industrial and commercial sound*.

Notwithstanding that *BS 4142* compares L_{AF90} and L_{Aeq} parameters and not L_{den}, generally it recommends that an increase of around 10dB or more 'indicates a significant adverse impact'. A difference of around 5dB 'indicates an adverse impact' and below 0dB indicates 'low adverse impact likely'. This however is dependent on the 'context' of the site and its environs e.g. time of day, nature of the neighbourhood, local attitudes to the development etc.

The NSLs with the most significant impact are presented in Table 12.13.

Table 12.13 **NSLs with Impact Lden >5dB**

			Impact Level Differences from Table 12.5			
Name	**Description**	**Height (m)**	**L_{day}**	**$L_{evening}$**	**L_{night}**	**L_{den}**
House1_A	21 William Street Lwr - Rear	1.5	7.0	7.1	6.3	6.9
House1_B	21 William Street Lwr - Rear	4.0	5.9	5.5	4.5	5.5
House5_B	Batt Street Apartments S - front1	4.0	5.0	5.1	5.0	5.1

Site-related traffic is the most significant contributor from the development at the locations in Table 12.13. It should be noted that the front of the property at 21 William

Street already experiences significantly higher levels as a result of the existing traffic on William Street than from the proposed development: existing Lden = 81.2dB (see Appendix 12.5). These residents are therefore likely be conditioned to high levels of urban traffic noise.

Following the guidance of BS4142; the *Context* that the development is to take place in is a key issue for noise assessment. It is difficult to numerically assess the matter of context, but experience suggests that considering the nature of the neighbourhood and the existing ambient noise levels including existing high levels of noise from traffic, passing trains and the existing coastal environment including mussel dredging vessels that a conservative adjustment value of -3dB is applicable to the Impact Differences in Table 12.13.

The resultant level differences with the context added are presented in Table 12.14

Table 12.14 Impact level differences with BS4142 Context correction applied

Name	Description	Height (m)	Impact Level Differences from Table 12.5		
			L_{den} Impact Level Difference from Table 12.13	BS4142 Context correction	Resultant L_{den}
House1_A	21 William Street Lwr - Rear	1.5	6.9	-3dB	3.9
House1_B	21 William Street Lwr - Rear	4.0	5.5	-3dB	2.5
House5_B	Batt Street Apartments S - front1	4.0	5.1	-3dB	2.1

As can be seen in Table 12.14 a maximum impact of 3.9dB occurs at House1_A. This and the impact at all other locations, are below the adverse impact levels identified by BS4142.

A general noise management strategy should be developed as part of the development and management of the marina and café/ restaurant uses including hours of operation, training for staff and signage to notify the public of the potential effect their activities, particularly at night, may have on nearby residents.

12.9 Noise and Human Health

There are three established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise from a proposed development.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is the conclusion of this impact assessment that this development falls within the LOAEL – Lowest Observed Adverse Effect Level i.e. that some impact is likely to be detectable but is not considered significant. This is supported by the results of the described in Section 10.10 (BS4142) assessment.

12.10 Mitigation Measures

12.10.1 Construction Stage Mitigation Measures

Notwithstanding that there is little likelihood of a significant adverse impact from the construction works, a comprehensive Construction Environmental Management Plan (CEMP) which includes adopting appropriate mitigation measures will manage the risk of noise impacting the community.

It is recommended that the contract documents should clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS5228-1 2009. These measures will typically include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
- Location of plant shall consider the likely noise propagation to nearby sensitive receptors.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 2 using methods outlined in BS5228:2009 Part 1.
- Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:00 Saturday. Works other than the pumping out of excavations, security and emergency works should be avoided outside of these periods.
- The emergency work may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.
- A suitable perimeter hoarding (as described in Table 12.8) around the site on three sides will provide an effective method of reducing noise propagation from the site. This hoarding will need to be phased as it can only be constructed along

the northern and southern boundaries once the sea wall and anchors in those locations have been constructed. It shall be erected along the railway boundary as soon as practicable during site setup. The hoarding shall be regularly inspected by the Site Environmental Manager and a Site Engineer to ensure the adequacy of the hoarding from a noise and visual perspective. Technical specifications on the acoustic performance of suitable hoardings can be found the UK's Design Manual for Roads and Bridges HA 66/95 which gives guidance on acoustic performance, forms of construction and physical properties of materials.

Vibration

- A vibration monitoring programme will be required to be adopted at a select number of the nearest buildings during the most critical phase(s) of construction e.g. pile driving, etc.

12.10.2 Operational Stage Mitigation Measures

A general noise management strategy will be required to be developed as part of the development and management of the marina and café/ restaurant uses including hours of operation, training for staff and signage to notify the public of the potential effect their activities, particularly at night, may have on nearby residents.

12.11 Residual Impacts

The overall noise impact from the proposed development on the closest properties will be of low significance from an acoustic standpoint.

12.12 Difficulties Encountered

No particular difficulties were encountered in preparing the noise and vibration assessment.

12.13 Conclusion

The noise assessment has indicated that construction activities can operate within the adopted noise limits for daytime periods (Monday to Friday) at the nearest properties to the works. The application of the proposed noise limits and restricted hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to within acceptable standards.

Lower limits of 65dB (TII Guidance) / 55dB (BS5228 Guidance) apply for weekend works and care should be taken to ensure that only select less noisy activities are undertaken during weekends so as not to exceed these reduced limits.

It is the conclusion of this impact assessment that this development falls within the LOAEL – Lowest Observed Adverse Effect Level i.e. that some impact is likely to be detectable but is not considered significant. This is supported by the results of the described in Section 10.10 (BS4142) assessment.

Appendix 12.1 Acoustic Terminology

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Acoustic Terminology

Ambient	Encompassing sound, at a given place. Usually a composite of sounds from many sources near and far.
A-weighting	Frequency weighting scale to account for non-linear response of the human ear. Used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. Denoted by suffix A in parameters such as L_{Aeq}, L_{AF10}, etc.
Background Level	A-weighted noise level of exceeded for 90% of the measurement time. Denoted L_{AF90}.
Broadband	Noise which contains roughly equal energy across the audible frequency spectrum with no tonal component.
Decibel (dB)	Unit of noise measurement scale relative to 20 µPa. The scale is logarithmic therefore dBs cannot be arithmetically added or subtracted.
Fast response	0.125 seconds response time of the Sound Level Meter to changing noise levels. Denoted by suffix F in parameters such as LAF10 T, LAF90 T, etc.
Free-field	Noise environment free from reflections from vertical surfaces.
Frequency	Number of cycles per second of a sound or vibration wave. The range of human hearing is c20-20,000 Hertz.
Hertz (Hz)	Unit of frequency measurement.
Impulse	A category of short duration, almost instantaneous sounds, typically less than one second.
$L_{Aeq, T}$	Equivalent continuous A-weighted sound pressure level. The value of the sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time.
L_{AF} / SPL	The RMS (root mean square) of the instantaneous Sound Pressure Level (SPL) over a given period of time (T). T is usually Fast (0.125sec) or Slow (1sec)
L_{AF10}	The noise level just exceeded for 10% of the measurement period, A-weighted and calculated by Statistical Analysis.
L_{AF90}	The noise level exceeded for 90% of the measurement period, A-weighted and calculated by Statistical Analysis.
$L_{Ar,T}$	The Rated noise level. The A-weighted, Leq, Sound Pressure Level of an industrial noise during a specified time period, adjusted for Tonal, Impulsiveness and other characteristics.
Near Field	Sound field near a sound source, usually within about two wavelengths of the source noise.
Noise Sensitive Location	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.
1/3 octave band	Frequency spectrum may be divided into octave bands. Upper limit of each octave is twice lower limit. Each octave may be subdivided into thirds, allowing greater analysis of tones.
Residual level	Noise level remaining when specific source is absent or does not contribute to ambient.
Reverberant Field	Sound field near reflecting surfaces where reflected waves contribute to the measured noise level.

Sound Level Meter	A sound level meter is commonly a hand-held instrument with a microphone used for acoustic measurements. The diaphragm of the microphone responds to changes in air pressure caused by sound waves and converted into an electrical signal measured by the instrument. The current international standard that specifies sound level meter functionality and performances is the IEC 61672-1:2013.
Specific level	Noise from the source under investigation as defined in BS 4142 Method for rating industrial noise affecting mixed residential and industrial areas. The specific noise is compared to the Background Noise for impact assessment.
Tone	Character of noise caused by dominance of one or more frequencies. The noise under investigation may be penalised when assessing industrial and environmental noise.
Z-weighting	Z for 'Zero' frequency weighting i.e. no frequency weighting applied to the measured noise level. Denoted by suffix Z in parameters such as L_{Zeq}, L_{ZF90}, etc.
mms^{-1}	Vibration velocity measured as mm/second.
L_{Aw} / SWL	Sound Power Level expressed in dB ref 1pW.
L_{day}	The L_{Aeq} noise level from 07:00-19:00.
$L_{evening}$	The L_{Aeq} noise level from 19:00-23:00.
L_{night}	The L_{Aeq} noise level from 23:00-07:00.
L_{den}	The logarithmic sum of L_{day} + $L_{evening}$ + 5dB + L_{night} +10dB.

Appendix 12.2 Survey and Impact Assessment Locations

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Survey and Impact Assessment Locations

Appendix 12.3 Construction Noise – Predicted Levels at Receptors

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Construction Noise – Predicted Levels at Receptors

Name	Description	Height (m)	Construction Noise L_{day}
Hotel_A	Talbot Hotel	1.5	36.6
Hotel_B	Talbot Hotel	4.0	37.6
Hotel_C	Talbot Hotel	6.5	37.5
Hotel_D	Talbot Hotel	9.0	39.6
Hotel_E	Talbot Hotel	11.5	41.3
Hotel_F	Talbot Hotel	14.0	41.7
House1_A	1 William Street Lower - Front	1.5	40.8
House1_A	1 William Street Lower - Rear	1.5	57.8
House1_B	1 William Street Lower - Front	4.0	43.1
House1_B	1 William Street Lower - Rear	4.0	58.8
House10_A	1-15 Emmet Pl - front	1.5	30.2
House10_A	1-15 Emmet Pl - rear	1.5	39.7
House10_B	1-15 Emmet Pl - front	4.0	37.5
House10_B	1-15 Emmet Pl - rear	4.0	43.1
House11_A	Trinity Close - front	1.5	27.8
House11_A	Trinity Close - rear	1.5	46.7
House11_B	Trinity Close - front	4.0	31.2
House11_B	Trinity Close - rear	4.0	45.8
House11_C	Trinity Close - front	6.5	37.6
House11_C	Trinity Close - rear	6.5	44.9
House12_A	19 Trinity St	1.5	36
House12_B	19 Trinity St	4.0	37.5
House2_A	31 William Street Lower - front	1.5	35.8
House2_A	31 William Street Lower - rear	1.5	54.4
House2_B	31 William Street Lower - front	4.0	41.4
House2_B	31 William Street Lower - rear	4.0	54.5
House3_A	51 William Street Lower - front	1.5	33.5
House3_A	51 William Street Lower - rear	1.5	52
House3_B	51 William Street Lower - front	4.0	39.3
House3_B	51 William Street Lower - rear	4.0	51.8
House4_A	Carmeleen William Street Lower - front	1.5	39.7
House4_A	Carmeleen William Street Lower - rear	1.5	46.8
House4_B	Carmeleen William Street Lower - front	4.0	43.1
House4_B	Carmeleen William Street Lower - rear	4.0	47.5
House5_A	Batt Street Apartments N - front	1.5	32.6
House5_A	Bath Street Apartments N - rear	1.5	53.2
House5_A	Bath Street Apartments S - front1	1.5	49.8
House5_A	Bath Street Apartments S - front2	1.5	39.2
House5_A	Bath Street Apartments W - front	1.5	51.7

Name	Description	Height (m)	Construction Noise L_{day}
House5_B	Bath Street Apartments N - front	4.0	35.1
House5_B	Bath Street Apartments N - rear	4.0	53.2
House5_B	Bath Street Apartments S - front1	4.0	49.9
House5_B	Bath Street Apartments S - front2	4.0	40.3
House5_B	Bath Street Apartments W - front	4.0	50.8
House6_A	Harbour View	1.5	44.5
House6_B	Harbour View	4.0	44.2
House7_A	21 Trinity St	1.5	53
House7_A	Fisher's Row	1.5	52.5
House7_B	21 Trinity St	4.0	53.2
House7_B	Fisher's Row	4.0	52.3
House8_A	21 Trinity St	1.5	52
House8_B	21 Trinity St	4.0	51.6
House9_A	7 Trinity St - front	1.5	47.1
House9_A	7 Trinity St - rear	1.5	34
House9_B	7 Trinity St - front	4.0	49.4
House9_B	7 Trinity St - rear	4.0	40.1

Appendix 12.4 Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels at Receptors

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Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels at Receptors

Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels (dB) at Receptors														
Name	**Description**	**Height**	**Traffic Noise**				**Plant Room**				**Cultural & Performance Centre**			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
Hotel_A	Talbot Hotel	1.5	78.3	70.9	65.1	77.1	23.7	21.6	19.1	26.6	0.4	0.4	--	0.6
Hotel_B	Talbot Hotel	4	78.4	70.9	65.0	77.1	25.5	22.7	19.5	27.5	1.6	1.6	--	1.7
Hotel_C	Talbot Hotel	6.5	77.8	70.3	64.3	76.5	26.0	23.6	20.6	28.5	1.6	1.6	--	1.8
Hotel_D	Talbot Hotel	9	77.0	69.5	63.5	75.7	26.5	24.4	21.5	29.2	2.3	2.3	--	2.4
Hotel_E	Talbot Hotel	11.5	76.3	68.7	62.8	75.0	26.3	24.6	21.9	29.5	0.8	0.8	--	0.9
Hotel_F	Talbot Hotel	14	75.6	68.0	62.0	74.3	26.6	24.9	22.5	29.9	--	--	--	--
House0_A	1 William Street Lower - Front	1.5	80.4	72.9	67.3	79.2	24.6	15.7	10.0	23.0	4.7	4.7	1.6	9.0
House0_A	1 William Street Lower - Rear	1.5	68.0	60.8	55.6	67.0	33.8	26.8	21.6	32.9	11.0	11.0	7.9	15.3
House0_B	1 William Street Lower - Front	4	80.4	72.9	67.2	79.2	25.4	16.8	11.0	23.8	5.3	5.3	2.2	9.5
House0_B	1 William Street Lower - Rear	4	69.3	61.8	56.0	68.1	34.2	27.1	21.7	33.2	11.0	11.0	7.9	15.3
House1_A	21 William Street Lwr - Front	1.5	82.4	74.9	69.2	81.2	20.9	16.4	11.6	21.3	3.7	3.7	0.6	8.0
House1_A	21 William Street Lwr - Rear	1.5	52.8	45.7	40.6	51.8	32.4	24.8	20.2	31.4	12.3	12.3	9.2	16.5
House1_B	21 William Street Lwr - Front	4	82.3	74.8	68.9	81.0	23.7	19.0	14.7	24.1	4.8	4.8	1.7	9.1
House1_B	21 William Street Lwr - Rear	4	54.9	48.2	43.4	54.2	33.1	25.2	20.4	31.9	10.7	10.7	7.6	15.0
House10_A	7 Trinity St - front	1.5	77.1	69.7	63.9	75.9	32.7	31.0	29.8	36.8	11.9	11.9	8.8	16.2
House10_A	7 Trinity St - rear	1.5	52.7	45.7	40.5	51.7	25.3	21.6	18.8	27.0	3.4	3.4	0.3	7.7
House10_B	7 Trinity St - front	4	77.4	69.9	64.0	76.1	32.9	31.1	29.8	36.9	11.3	11.3	8.2	15.6

Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels (dB) at Receptors														
Name	Description	Height	Traffic Noise				Plant Room				Cultural & Performance Centre			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House10_B	7 Trinity St - rear	4	58.9	52.4	48.0	58.4	28.6	25.2	22.7	30.6	3.6	3.6	0.5	7.8
House11_A	1-15 Emmet Pl - front	1.5	65.3	58.3	53.1	64.4	24.0	22.0	19.1	26.8	2.8	2.8	--	2.9
House11_A	1-15 Emmet Pl - rear	1.5	55.2	48.2	43.0	54.3	27.8	24.2	21.4	29.6	4.1	4.1	1.0	8.4
House11_B	1-15 Emmet Pl - front	4	67.3	60.1	54.7	66.3	26.7	24.0	21.4	29.2	3.7	3.7	0.6	8.0
House11_B	1-15 Emmet Pl - rear	4	58.4	51.6	46.7	57.6	28.7	25.7	22.6	30.7	10.0	10.0	6.9	14.3
House12_A	Trinity Close - front	1.5	75.9	68.5	62.8	74.7	23.5	20.9	18.3	26.1	4.0	4.0	0.9	8.3
House12_A	Trinity Close - rear	1.5	61.4	54.9	50.5	60.9	29.8	28.5	26.0	33.4	1.7	1.7	--	1.8
House12_B	Trinity Close - front	4	76.7	69.1	63.1	75.3	25.5	22.9	20.5	28.1	3.5	3.5	0.4	7.7
House12_B	Trinity Close - rear	4	61.9	55.3	50.5	61.3	29.6	28.1	26.1	33.3	1.3	1.3	--	1.4
House12_C	Trinity Close - front	6.5	76.6	69.0	62.9	75.2	27.2	24.5	22.2	29.9	2.9	2.9	--	3.0
House12_C	Trinity Close - rear	6.5	64.2	57.3	52.4	63.4	29.9	28.4	26.3	33.5	0.9	0.9	--	1.0
House13_A	19 Trinity St	1.5	79.0	71.6	65.8	77.8	25.8	24.1	20.5	28.5	--	--	--	--
House13_B	19 Trinity St	4	79.0	71.5	65.6	77.7	24.8	21.6	19.0	26.9	--	--	--	--
House2_A	31 William Street Lower - front	1.5	81.7	74.3	68.7	80.5	20.2	15.9	11.1	20.6	3.4	3.4	0.3	7.6
House2_A	31 William Street Lower - rear	1.5	55.2	48.1	42.9	54.2	30.3	24.6	20.4	30.2	10.0	10.0	6.9	14.2
House2_B	31 William Street Lower - front	4	81.6	74.1	68.3	80.3	23.8	19.4	15.1	24.4	4.3	4.3	1.2	8.5
House2_B	31 William Street Lower - rear	4	57.0	50.1	45.1	56.2	30.7	24.9	20.6	30.6	9.7	9.7	6.6	13.9
House3_A	51 William Street Lower - front	1.5	82.6	75.1	69.4	81.4	23.6	19.3	15.3	24.4	3.5	3.5	0.4	7.7
House3_A	51 William Street Lower - rear	1.5	53.9	46.9	41.8	53.0	27.9	21.5	16.4	27.2	10.8	10.8	7.7	15.1
House3_B	51 William Street Lower - front	4	82.5	75.0	69.1	81.2	26.5	20.2	15.7	26.1	3.1	3.1	--	3.2

Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels (dB) at Receptors														
Name	**Description**	**Height**	**Traffic Noise**				**Plant Room**				**Cultural & Performance Centre**			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House3_B	51 William Street Lower - rear	4	56.2	49.4	44.6	55.5	28.0	21.8	16.7	27.4	9.8	9.8	6.7	14.0
House4_A	Carmeleen William Street Lower - front	1.5	80.2	72.7	67.0	79.0	25.3	19.0	14.6	24.9	7.1	7.1	4.0	11.3
House4_A	Carmeleen William Street Lower - rear	1.5	57.5	50.5	45.5	56.6	26.6	20.8	15.6	26.1	11.5	11.5	8.4	15.7
House5_A	Batt Street Apartments N - front	1.5	47.3	40.3	35.2	46.4	24.8	16.2	9.7	23.1	6.0	6.0	2.9	10.2
House5_A	Bath Street Apartments N - rear	1.5	55.0	48.4	43.8	54.4	29.8	23.3	18.4	29.1	15.7	15.7	12.6	19.9
House5_A	Bath Street Apartments S - front1	1.5	44.7	37.6	32.5	43.8	29.1	23.1	15.6	28.1	13.1	13.1	10.0	17.3
House5_A	Bath Street Apartments S - front2	1.5	49.1	42.3	37.5	48.4	23.7	19.1	15.5	24.5	5.1	5.1	2.0	9.4
House5_A	Bath Street Apartments W - front	1.5	48.4	42.0	37.5	47.9	29.3	22.8	16.0	28.2	14.2	14.2	11.1	18.4
House5_B	Bath Street Apartments N - front	4	49.2	42.3	37.4	48.4	25.6	19.3	13.8	24.9	8.2	8.2	5.1	12.4
House5_B	Bath Street Apartments N - rear	4	57.5	50.9	46.4	56.9	29.7	23.8	18.8	29.2	15.1	15.1	12.0	19.3
House5_B	Bath Street Apartments S - front1	4	47.2	40.6	35.9	46.5	29.1	23.6	16.0	28.2	12.9	12.9	9.8	17.1
House5_B	Bath Street Apartments S - front2	4	53.7	47.2	42.7	53.1	25.7	19.7	15.0	25.3	8.5	8.5	5.4	12.8
House5_B	Bath Street Apartments W - front	4	49.7	43.2	38.7	49.1	29.1	23.4	16.3	28.2	13.4	13.4	10.3	17.7
House6_A	Harbour View	1.5	44.9	38.6	34.2	44.5	24.1	18.8	11.5	23.3	9.6	9.6	6.5	13.8
House6_B	Harbour View	4	47.5	41.3	37.1	47.2	23.4	18.7	11.7	22.9	9.0	9.0	5.9	13.3

Traffic, Plant and Cultural & Performance Centre - Predicted Noise Levels (dB) at Receptors														
Name	**Description**	**Height**	**Traffic Noise**				**Plant Room**				**Cultural & Performance Centre**			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House7_A	Fisher's Row	1.5	74.4	67.1	61.7	73.3	33.1	27.6	23.3	33.1	9.2	9.2	6.1	13.4
House7_B	Fisher's Row	4	74.6	67.1	61.4	73.3	33.5	27.7	23.4	33.3	8.5	8.5	5.4	12.7
House8_A	21 Trinity St	1.5	71.0	63.7	58.2	69.9	31.6	27.2	22.0	31.9	9.5	9.5	6.4	13.7
House8_B	21 Trinity St	4	71.6	64.1	58.5	70.4	32.3	28.1	23.6	32.9	9.2	9.2	6.1	13.4
House9_A	21 Trinity St	1.5	78.1	70.7	65.0	76.9	34.1	29.1	26.5	35.1	11.6	11.6	8.5	15.8
House9_B	21 Trinity St	4	78.3	70.8	65.0	77.1	34.6	30.2	28.4	36.3	10.7	10.7	7.6	14.9

Appendix 12.5 Total Noise Impact Assessment – Baseline and Post-Development Comparisons

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Total Noise Impact Assessment – Baseline and Post-Development Comparisons

Total Noise Impact Assessment - Baseline and Post-Development Comparisons														
Name	**Description**	**Height (m)**					**Development's associated noise levels**							
			Existing Traffic Noise (L1)				**Traffic + Plant + Cultural (L2)**				**Level Difference (L2-L1)**			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
Hotel_A	Talbot Hotel	1.5	78.3	70.9	65.1	77.1	80.0	72.5	66.9	78.8	1.7	1.6	1.8	1.7
Hotel_B	Talbot Hotel	4.0	78.4	70.9	65	77.1	79.8	72.3	66.5	78.6	1.4	1.4	1.5	1.5
Hotel_C	Talbot Hotel	6.5	77.8	70.3	64.3	76.5	79.0	71.5	65.7	77.8	1.2	1.2	1.4	1.3
Hotel_D	Talbot Hotel	9.0	77	69.5	63.5	75.7	78.1	70.6	64.8	76.9	1.1	1.1	1.3	1.2
Hotel_E	Talbot Hotel	11.5	76.3	68.7	62.8	75	77.3	69.8	63.9	76.0	1.0	1.1	1.1	1.0
Hotel_F	Talbot Hotel	14.0	75.6	68	62	74.3	76.5	69.0	63.1	75.2	0.9	1.0	1.1	0.9
House0_A	1 William Street Lower - Front	1.5	80.4	72.9	67.3	79.2	81.0	73.6	67.8	79.8	0.6	0.7	0.5	0.6
House0_A	1 William Street Lower - Rear	1.5	68	60.8	55.6	67	69.5	62.4	57.2	68.5	1.5	1.6	1.6	1.5
House0_B	1 William Street Lower - Front	4.0	80.4	72.9	67.2	79.2	81.0	73.5	67.6	79.7	0.6	0.6	0.4	0.5
House0_B	1 William Street Lower - Rear	4.0	69.3	61.8	56	68.1	70.8	63.3	57.4	69.5	1.5	1.5	1.4	1.4
House1_A	21 William Street Lwr - Front	1.5	82.4	74.9	69.2	81.2	82.7	75.2	69.4	81.4	0.3	0.3	0.2	0.2
House1_A	21 William Street Lwr - Rear	1.5	52.7	45.7	40.5	51.8	59.8	52.8	46.9	58.7	7.0	7.1	6.3	6.9
House1_B	21 William Street Lwr - Front	4.0	82.3	74.8	68.9	81	82.6	75.1	69.2	81.3	0.3	0.3	0.3	0.3
House1_B	21 William Street Lwr - Rear	4.0	54.9	48.1	43.4	54.2	60.8	53.7	47.9	59.7	5.9	5.5	4.5	5.5
House10_A	7 Trinity St - front	1.5	77.1	69.7	63.9	75.9	77.5	70.1	64.5	76.3	0.4	0.4	0.6	0.4

Total Noise Impact Assessment - Baseline and Post-Development Comparisons														
Name	Description	Height (m)					Development's associated noise levels							
			Existing Traffic Noise (L1)				Traffic + Plant + Cultural (L2)				Level Difference (L2-L1)			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House10_A	7 Trinity St - rear	1.5	52.7	45.7	40.5	51.7	53.3	46.3	41.1	52.3	0.6	0.6	0.6	0.6
House10_B	7 Trinity St - front	4.0	77.4	69.9	64	76.1	78.0	70.4	64.6	76.7	0.6	0.5	0.6	0.6
House10_B	7 Trinity St - rear	4.0	58.9	52.4	48	58.4	59.2	52.8	48.3	58.7	0.3	0.4	0.3	0.3
House11_A	1-15 Emmet Pl - front	1.5	65.3	58.3	53.1	64.4	66.0	58.9	53.8	65.0	0.7	0.6	0.7	0.6
House11_A	1-15 Emmet Pl - rear	1.5	55.2	48.2	43	54.3	56.3	49.4	44.4	55.4	1.1	1.2	1.4	1.1
House11_B	1-15 Emmet Pl - front	4.0	67.3	60.1	54.7	66.3	67.9	60.7	55.4	66.9	0.6	0.6	0.7	0.6
House11_B	1-15 Emmet Pl - rear	4.0	58.4	51.6	46.7	57.6	59.9	53.3	48.5	59.2	1.5	1.7	1.8	1.6
House12_A	Trinity Close - front	1.5	75.9	68.5	62.8	74.7	76.6	69.2	63.6	75.5	0.7	0.7	0.8	0.8
House12_A	Trinity Close - rear	1.5	61.4	54.9	50.5	60.9	61.5	55.1	50.6	61.0	0.1	0.2	0.1	0.1
House12_B	Trinity Close - front	4.0	76.7	69.1	63.1	75.3	77.4	69.8	63.9	76.1	0.7	0.7	0.8	0.8
House12_B	Trinity Close - rear	4.0	61.9	55.3	50.5	61.3	62.2	55.5	50.7	61.5	0.3	0.2	0.2	0.2
House12_C	Trinity Close - front	6.5	76.6	69	62.9	75.2	77.4	69.8	63.8	76.0	0.8	0.8	0.9	0.8
House12_C	Trinity Close - rear	6.5	64.2	57.3	52.4	63.4	63.8	56.8	51.8	62.9	-0.4	-0.5	-0.6	-0.5
House13_A	19 Trinity St	1.5	79	71.6	65.8	77.8	79.8	72.4	66.6	78.6	0.8	0.8	0.8	0.8
House13_B	19 Trinity St	4.0	79	71.5	65.6	77.7	80.0	72.4	66.5	78.7	1.0	0.9	0.9	1.0
House2_A	31 William Street Lower - front	1.5	81.7	74.3	68.7	80.5	81.9	74.5	68.7	80.7	0.2	0.2	0.0	0.2
House2_A	31 William Street Lower - rear	1.5	55.2	48.1	42.9	54.2	58.3	51.5	46.1	57.4	3.1	3.4	3.2	3.2
House2_B	31 William Street Lower - front	4.0	81.6	74.1	68.3	80.3	81.7	74.3	68.4	80.5	0.1	0.2	0.1	0.2
House2_B	31 William Street Lower - rear	4.0	57	50.1	45.1	56.2	59.4	52.4	46.8	58.3	2.4	2.3	1.7	2.1

Total Noise Impact Assessment - Baseline and Post-Development Comparisons

Name	Description	Height (m)					Development's associated noise levels							
			Existing Traffic Noise (L1)				Traffic + Plant + Cultural (L2)				Level Difference (L2-L1)			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House3_A	51 William Street Lower - front	1.5	82.6	75.1	69.4	81.4	81.7	74.3	68.5	80.5	-0.9	-0.8	-0.9	-0.9
House3_A	51 William Street Lower - rear	1.5	53.9	46.9	41.8	53	56.6	50.0	44.9	55.8	2.7	3.1	3.1	2.8
House3_B	51 William Street Lower - front	4.0	82.5	75	69.1	81.2	81.5	74.1	68.2	80.3	-1.0	-0.9	-0.9	-0.9
House3_B	51 William Street Lower - rear	4.0	56.2	49.4	44.6	55.5	57.7	50.9	45.7	56.8	1.5	1.5	1.1	1.3
House4_A	Carmeleen William Street Lower - front	1.5	80.2	72.7	67	79	80.0	72.6	66.8	78.8	-0.2	-0.1	-0.2	-0.2
House4_A	Carmeleen William Street Lower - rear	1.5	57.5	50.5	45.5	56.6	58.3	51.4	46.3	57.4	0.8	0.9	0.8	0.8
House5_A	Batt Street Apartments N - front	1.5	47.3	40.3	35.2	46.4	48.1	41.1	35.8	47.1	0.8	0.8	0.6	0.7
House5_A	Bath Street Apartments N - rear	1.5	55	48.4	43.8	54.4	58.1	51.6	46.6	57.4	3.1	3.2	2.8	3.0
House5_A	Bath Street Apartments S - front1	1.5	44.7	37.6	32.5	43.8	49.2	42.5	36.9	48.3	4.5	4.9	4.4	4.5
House5_A	Bath Street Apartments S - front2	1.5	49.1	42.3	37.5	48.4	49.5	42.7	37.8	48.7	0.4	0.4	0.3	0.3
House5_A	Bath Street Apartments W - front	1.5	48.4	42	37.5	47.9	52.1	45.2	39.2	51.0	3.7	3.2	1.7	3.1
House5_B	Bath Street Apartments N - front	4.0	49.2	42.3	37.4	48.4	50.4	43.6	38.6	49.6	1.2	1.3	1.2	1.2
House5_B	Bath Street Apartments N - rear	4.0	57.5	50.9	46.4	56.9	59.8	53.2	48.4	59.1	2.3	2.3	2.0	2.2

Total Noise Impact Assessment - Baseline and Post-Development Comparisons														
Name	Description	Height (m)					Development's associated noise levels							
			Existing Traffic Noise (L1)				Traffic + Plant + Cultural (L2)				Level Difference (L2-L1)			
			L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{day}	$L_{evening}$	L_{night}	L_{den}
House5_B	Bath Street Apartments S - front1	4.0	47.2	40.6	35.9	46.5	52.2	45.7	40.9	51.6	5.0	5.1	5.0	5.1
House5_B	Bath Street Apartments S - front2	4.0	53.7	47.2	42.7	53.1	54.7	48.3	43.8	54.2	1.0	1.1	1.1	1.1
House5_B	Bath Street Apartments W - front	4.0	49.7	43.2	38.7	49.1	53.4	46.4	40.5	52.3	3.7	3.2	1.8	3.2
House6_A	Harbour View	1.5	44.9	38.6	34.2	44.5	46.4	40.1	35.6	46.0	1.5	1.5	1.4	1.5
House6_B	Harbour View	4.0	47.5	41.3	37.1	47.2	48.9	42.7	38.4	48.6	1.4	1.4	1.3	1.4
House7_A	Fisher's Row	1.5	74.4	67.1	61.7	73.3	74.8	67.4	61.8	73.6	0.4	0.3	0.1	0.3
House7_B	Fisher's Row	4.0	74.6	67.1	61.4	73.3	75.2	67.8	62.0	74.0	0.6	0.7	0.6	0.7
House8_A	21 Trinity St	1.5	71	63.7	58.2	69.9	71.9	64.6	59.0	70.8	0.9	0.9	0.8	0.9
House8_B	21 Trinity St	4.0	71.6	64.1	58.5	70.4	72.4	65.0	59.2	71.2	0.8	0.9	0.7	0.8
House9_A	21 Trinity St	1.5	78.2	70.7	65	76.9	78.7	71.3	65.6	77.5	0.6	0.6	0.6	0.6
House9_B	21 Trinity St	4.0	78.3	70.8	65	77.1	79.0	71.5	65.6	77.7	0.7	0.7	0.6	0.6

Chapter 13:
Air Quality & Climate

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Chapter 13 Air Quality & Climate

13.1 Introduction

This Air Quality and Climate chapter has been prepared by Ciara Nolan of AWN, and assesses the likely air quality and climate impacts, if any, associated with the Trinity Wharf mixed use development, Co. Wexford. The site is circa 3.6 ha in area and is located on the southern end of Wexford Town's quay-front.

13.1.1 Background Information

Ambient Air Quality Standards

In order to reduce the risk to human health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 13.1 and Appendix 13.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), benzene and Carbon Monoxide (CO) (see Table 13.1). Although the European Union (EU) Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 13.1).

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 13.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust)(1) sets a maximum permissible emission level for dust deposition of 350mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government(2) apply the Bergerhoff limit of 350mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction activities associated with the proposed development.

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002(3,4). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to

2012(5,6). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP23) took place in Bonn, Germany from the 6th to the 17th of November 2017 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris in 2015 and is an important milestone in terms of international climate change agreements. The Paris Agreement, agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23rd/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework"(7). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the Emission Tradings Sectors (ETS) and non-Emission Tradings Sectors (non-ETS) amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% on 2005 levels), 65 kt for NO_X (49% reduction on 2005 levels), 43 kt for VOCs (25% reduction on 2005 levels), 108 kt for NH_3 (1% reduction on 2005 levels) and 10 kt for $PM_{2.5}$ (18% reduction on 2005 levels).

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD)(8), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005(9,10). Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X(11). Directive (EU) 2016/2284 "*On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC*" was published in December 2016. The Directive will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49%

reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (85% below 2005 levels), for NO_X (69% reduction), for VOCs (32% reduction), for NH_3 (5% reduction) and for $PM_{2.5}$ (41% reduction).

Table 13.1 Air Quality Standards Regulations

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
		Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3
Benzene	2008/50/EC	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide (CO)	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

13.2 Methodology

13.2.1 Local Air Quality Assessment

The air quality assessment has been carried out following procedures described in the publications by the EPA(12-15) and using the methodology outlined in the guidance documents published by the UK DEFRA(16-18). The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA(19). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "*hot-spots*" identified. An examination of recent EPA and Local Authority data in Ireland(20,21) has indicated that SO_2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential issues in regards to nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ at busy junctions in urban centres(20,21). Benzene, although previously reported at quite high levels in urban centres, has recently been measured at several city centre locations to be well below the EU limit value(20,21). Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres(21). The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5}$, benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations will be predicted for nearby sensitive receptors for the following scenarios:

- The Existing Baseline scenario, for model verification;
- Post Development Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place; and
- Post Development Year Do-Something scenario (DS), which assumes the proposed development in place.

The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model(19) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet(22) (Version 6.1, October 2017), and followed guidance issued by the TII(23), UK Highways Agency(19), UK DEFRA(16-18) and the EPA(12-15).

The TII guidance(30) states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK DMRB guidance(19), on which the TII guidance was based, states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGV flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors that have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200m of the chosen sensitive receptors, inputs to the air dispersion model consist of: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles, annual average traffic speeds and background concentrations. The UK DMRB guidance states that road links at a distance of greater than 200m from a sensitive receptor will not influence pollutant concentrations at the receptor.

Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The DMRB model uses conservative emission factors, the formulae for which are outlined in the DMRB Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the proposed development with these ambient air quality standards. The TII *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*(23) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any project that causes a change in traffic flows. The degree of impact is determined based on both the absolute and relative impact of the proposed development. The TII significance criteria have been adopted for the proposed development and are detailed in Appendix 13.2 Table A1 to Table A3. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

13.2.2 Regional Impact Assessment (including Climate)

The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland(23) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges(19). The assessment focused on determining the resulting change in emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) and carbon dioxide (CO_2). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes and can be applied to any development that causes a change in traffic flows. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

13.2.3 Conversion of NO_X to NO_2

NO_x (NO + NO_2) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGV's the proportion of NOx emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NO_x to NO_2 in "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*"(23). The TII guidelines recommend the use of DEFRAs NO_x to NO_2 calculator(22) which was originally published in 2009 and is currently on version 6.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NO_x emitted as NO for each local authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and the TII guidance recommends the use of 'Armagh, Banbridge and Craigavon' as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO_2 and NO_x for Ireland. The "*All other Urban UK Traffic*" traffic mix option was used.

13.2.4 Ecological Sites

For routes that pass within 2km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an Ecologist(23). However, in practice the potential for impact to an ecological site is highest within 200m of the proposed development and when significant changes in AADT (>5%) occur.

Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Schemes*(24) and *Appropriate Assessment of Plans and Projects in*

Ireland – Guidance for Planning Authorities$^{(25)}$ provide details regarding the legal protection of designated conservation areas.

If both of the following assessment criteria are met, an assessment of the potential for impact due to nitrogen deposition should be conducted:

- A designated area of conservation is located within 200 m of the proposed development; and
- A significant change in AADT flows (>5%) will occur.

The Slaney River Valley SAC (site code 000781), Wexford Harbour and Slobs SPA (site code 004076) and Wexford Slobs and Harbour pNHA (site code 000712) are directly adjacent to the proposed development site and as such an assessment of the impact with regards to nitrogen deposition was conducted. Dispersion modelling and prediction was carried out at typical traffic speeds at this location. Ambient NO_x concentrations were predicted for the post development year along a transect of up to 200 m within the SAC / SPA / pNHA. The road contribution to dry deposition along the transect was also calculated using the methodology outlined in Appendix 9 of the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*$^{(23)}$.

13.3 Baseline Environment

13.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)$^{(26)}$. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Johnstown Castle, which is located approximately 5.5km south of the site. Johnstown Castle meteorological data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Plate 13.1). For data collated during five representative years (2012 - 2016), the predominant wind direction is south-westerly with predominately moderate wind speeds.

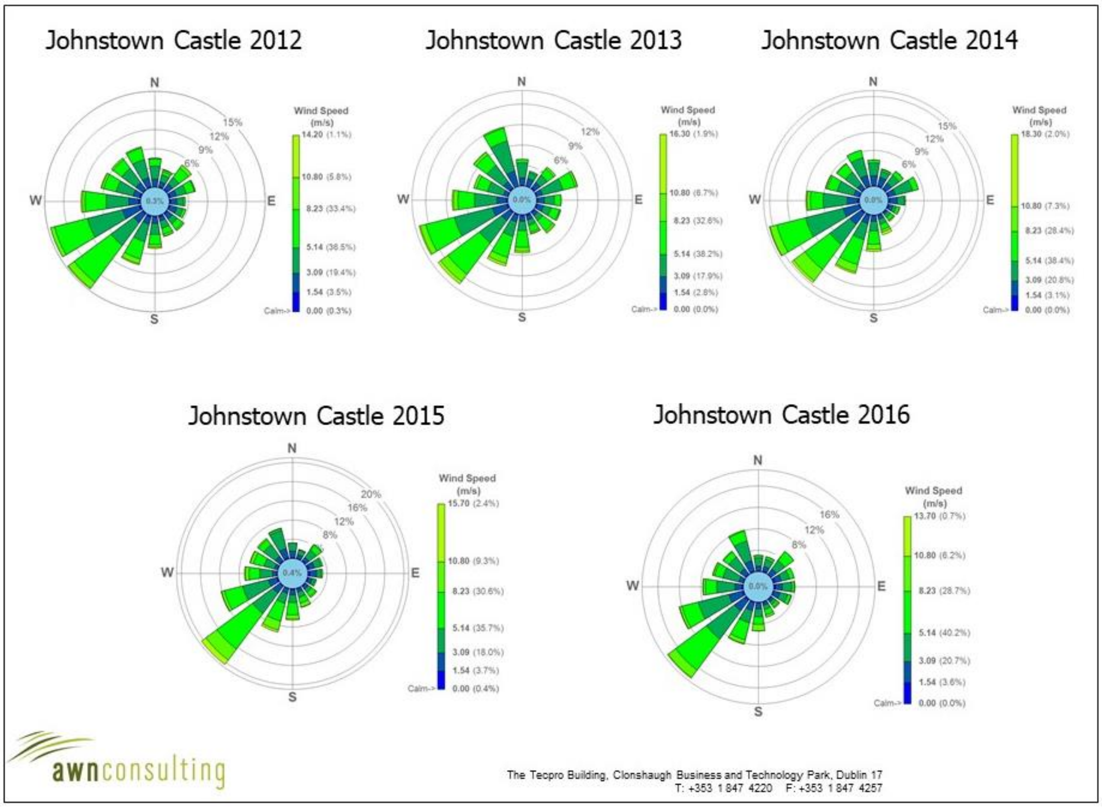

Plate 13.1 Johnstown Castle Windrose 2012 – 2016

13.3.2 Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources(19). Thus, residential exposure is determined by the location of sensitive receptors relative to major road sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In assessing baseline air quality, two tools are generally used: ambient air monitoring and air dispersion modelling. In order to adequately characterise the current baseline environment through monitoring, comprehensive measurements would be required at a number of key receptors for PM_{10}, NO_2 and benzene. In addition, two of the key pollutants identified in the scoping study (PM_{10} and NO_2) have limit values which require assessment over time periods varying from one hour to one year. Thus, continuous monitoring over at least a one-year period at a number of locations would be necessary in order to fully determine compliance for these pollutants. Although this study would provide information on current air quality, it would not be able to provide predictive information on baseline conditions(18), which are the conditions which prevail just prior to opening in the absence of the development. Hence the impacts of the development were fully assessed by air dispersion modelling(18) which is the most practical tool for this purpose. The baseline environment has also been assessed using modelling, since the use of the same predictive technique for both the 'do-nothing' and 'do-something' scenario will minimise errors and allow an accurate determination of the relative impact of the development.

In 2011 the UK DEFRA published research(27) on the long term trends in NO_2 and NO_X for roadside monitoring sites in the UK. This study marked a decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO_2 concentrations with UK DEFRA previously published and monitored concentrations. The impact of this 'gap' is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency (HA) published an Interim Advice Note (IAN 170/12) in order to correct the DMRB results for future years.

13.3.3 Baseline Air Quality – Review of Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2016 – Indicators of Air Quality*"(20). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments(21).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes(20). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development site is within Zone C(21). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA(20,21) at the Zone C locations of Kilkenny, Portlaoise and Mullingar show that levels of NO_2 are below both the annual and 1-hour limit values (see Table 13.2). Average long-term concentrations range from 4 – 16µg/m^3 for the period 2012 – 2016; suggesting an upper average over the five year period of no more than 13µg/m^3. There were no exceedances of the maximum 1 hour limit of 200µg/m^3 in any year (18 exceedances are allowed per year). Based on these results a conservative estimate of the current background NO_2 concentration in the region of the proposed development is 15µg/m^3.

Long term NO_X monitoring has been carried out at a two Zone C locations in recent years, Kilkenny and Portlaoise. Annual mean concentrations of NO_X at the monitoring sites over the period 2012 – 2016 ranged from 6 - 27 µg/m^3. A conservative estimate for the current background NO_X concentration in the region of the proposed scheme is 20 µg/m^3.

Table 13.2 Trends In Zone C Air Quality - Nitrogen Dioxide (NO2)

Station	Averaging Period Notes 1,2	Year				
		2012	2013	2014	2015	2016
Kilkenny	Annual Mean NO_2 (µg/m^3)	4	4	5	5	7
	Max 1-hr NO_2 (µg/m^3)	62	90	57	70	51
Portlaoise	Annual Mean NO_2 (µg/m^3)	-	-	16	10	11
	Max 1-hr NO_2 (µg/m^3)	-	-	74	84	86
Mullingar	Annual Mean NO_2 (µg/m^3)	7	6	4	-	-
	Max 1-hr NO_2 (µg/m^3)	62	68	53	-	-

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 1-hour limit value - 200 µg/m^3 as a 99.8th%ile, i.e. not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Continuous PM_{10} monitoring carried out at the locations in Galway, Ennis, Mullingar and Portlaoise showed 2016 annual mean concentrations of 12 – 17µg/m^3 (Table 13.3), with at most 12 exceedances (in Ennis) of the 24-hour limit value of 50 µg/m^3 (35 exceedances are permitted per year)$^{(20)}$. Long-term data for the period 2012 – 2016 show concentrations ranging from 12 – 21µg/m^3; suggesting an upper average concentration over the five year period of no more than 19µg/m^3. Based on the EPA data (Table 13.3) a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 20 µg/m^3.

Table 13.3 Trends In Trends In Zone C Air Quality - PM10

Station	Averaging Period Notes 1,2	Year				
		2012	2013	2014	2015	2016
Galway	Annual Mean PM_{10} (µg/m^3)	16	21	15	15	15
	24-hr Mean > 50 µg/m^3 (days)	1	11	0	2	3
Ennis	Annual Mean PM_{10} (µg/m^3)	19	20	21	18	17
	24-hr Mean > 50 µg/m^3 (days)	8	8	8	10	12
Mullingar	Annual Mean PM_{10} (µg/m^3)	16	15	11	-	-
	24-hr Mean > 50 µg/m^3 (days)	0	0	0	-	-
Portlaoise	Annual Mean PM_{10} (µg/m^3)	-	-	-	12	12
	24-hr Mean > 50 µg/m^3 (days)	-	-	-	1	1

Note1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 24-hour limit value - 50 µg/m^3 as a 90.4th%ile, i.e. not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

Continuous $PM_{2.5}$ monitoring carried out at the Zone C locations of Ennis and Bray showed average levels of 7 - 16 µg/m^3 over the 2012 - 2016 period, with a $PM_{2.5}/PM_{10}$ ratio in Ennis ranging from 0.59 – 0.76. Based on this information, a conservative ratio of 0.8 was used to generate a background $PM_{2.5}$ concentration in the region of the proposed development of 16 µg/m^3.
In terms of benzene, the annual mean concentration in the Zone C monitoring location of Kilkenny for 2016 was 0.2 µg/m^3. This is well below the limit value of 5 µg/m^3. Between 2012 – 2016, annual mean concentrations at Zone C sites ranged from 0.09 – 0.5 µg/m^3. Based on this EPA data, a conservative estimate of the current background benzene concentration in the region of the proposed development is 0.5 µg/m^3.

With regard to CO, annual averages at the Zone C locations of Mullingar and Portlaoise over the 2012 – 2016 period are low, peaking at 4% of the limit value (10 mg/m^3)$^{(20)}$. Based on this EPA data, a conservative estimate of the current background CO concentration in the region of the proposed development is 0.4mg/m^3.

Background concentrations for the post development year have been calculated using the predicted current background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16)$^{(17)}$.

13.3.4 Characteristics of the Proposed Development

The site is located on the southern extent of Wexford Town's quay-front. The proposed development will provide a number of different land uses including; commercial leisure activities such as a hotel, marina, restaurants and bars, office space, residential housing and public realm including pedestrian & cycling facilities and a cultural centre across the c.3.6 ha site. Further details of the proposed development can be found in Chapter 4 Description of the Proposed Development in this EIAR.

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

(a) construction phase, and;

(b) operational phase.

During the construction stage the main source of air quality impacts will be as a result of fugitive dust emissions from site activities. Emissions from construction vehicles and machinery have the potential to impact climate. The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows or congestion in the local areas which are associated with the development.

The following describes the primary sources of potential air quality and climate impacts which have been assessed as part of this EIAR.

13.4 Predicted Impacts

13.4.1 Do-Nothing Scenario

The Do Nothing scenario includes retention of the current site without the proposed mixed-use development in place. In this scenario, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc).

13.4.2 Construction Phase

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and $PM_{10}/PM_{2.5}$ emissions. The proposed development can be considered major in scale as the total site area is circa 5.47 ha. However, there is likely to be limited use of haul roads. It is calculated that there is the potential for significant dust soiling 100m from the source(23) (Table 13.4). While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. There are a number of sensitive receptors, predominantly residential and commercial properties in close proximity to the site, along the western site boundary. Both Wexford Inner and Outer harbour areas are designated EU Shellfish areas which can be susceptible to increased sediment levels. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Provided the dust minimisation measures outlined in the plan (see Appendix 13.3 of this EIAR) are adhered to, the air quality impacts during the construction phase will not be significant. These measures are summarised in Section 13.5.1 of this chapter.

Table 13.4 Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance From Source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads	25m	10m	10m

Climate

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. However, the impact on the climate is considered to be imperceptible in the long and short term.

Human Health

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the impact of construction of the proposed development is likely to be short-term and imperceptible with respect to human health.

A preliminary survey of the site found asbestos containing materials and asbestos containing soils to be present on site. During any investigative and remedial works there is the potential for asbestos fibres to be released and to impact air quality, and subsequently, human health. Any remedial works will be carried out by a certified contractor and air monitoring will be conducted during any disturbance of the asbestos containing materials or soils to ensure concentrations are within the acceptable thresholds. Standard mitigation measures will be implemented for the duration of any remedial works to avoid any significant impacts to air quality or human health. As a result, impacts are predicted to be temporary and insignificant with regards to human health.

13.4.3 Operational Phase

Local Air Quality

There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}.

Traffic flow information was obtained from Roughan & O'Donovan Consulting Engineers and has been used to model pollutant levels under various traffic scenarios and under sufficient spatial resolution to assess whether any significant air quality impact on sensitive receptors may occur.

Cumulative effects have been assessed, as recommended in the EU Directive on EIA (Council Directive 97/11/EC as amended) and using the methodology of the UK DEFRA(16,17). Firstly, background concentrations(20) have been included in the modelling study. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern(20). Appropriate background levels were selected based on the available monitoring data provided by the EPA(20) (see Section 13.3.3 of this chapter).

The impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. The impact of CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for the baseline and post development years was predicted at the nearest sensitive receptors to the development. This assessment allows the significance of the development, with respect to both relative and absolute impact, to be determined.

The receptors modelled represent the worst-case locations close to the proposed development and were chosen due to their close proximity (within 200 m) to the road links impacted by the proposed development. The worst-case traffic data which satisfied the assessment criteria detailed in Section 13.2.1 is shown in Table 13.5, with the percentage of HGVs shown in parenthesis beside the AADT. Six sensitive residential receptors in the vicinity of the proposed development have been assessed. Sensitive receptors have been chosen as they have the potential to be adversely impacted by the development. These receptors are shown in Plate 13.2.

Table 13.5 Traffic Data used in Air Modelling Assessment

Link Number	Road Name	Base Year	Do-Nothing	Do-Something	Speed (kph)
		2018	2023	2023	
1	Trinity Street	10154 - AADT (1.5%) HGV	10154 (1.5%)	11826 (1.4%)	38
2	William Street Lower	10208 (5%)	10208 (5%)	11494 (4.9%)	38
3	Fisher's Row	1380 (1%)	1380 (1%)	1476 (0.9%)	30
4	Parnell Street	2918 (0.4%)	2918 (0.4%)	3605 (0.3%)	32
5	King Street	4129 (1%)	4129 (1%)	4793 (1.1%)	24
6	Paul Quay	12437 (2%)	12437 (2%)	12694 (2%)	30
7	Access Road	0 (0%)	0 (0%)	3217 (0%)	30

Plate 13.2 Approximate Location of Sensitive Receptors used in Air Modelling Assessment

Modelling Assessment

Transport Infrastructure Ireland *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*(23) detail a methodology for determining the air quality impact significance criteria for road schemes and has been adopted for this assessment, as is best practice. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Results are compared against the 'Do-Nothing' scenario, which assumes that the proposed development is not in place in future years, in order to determine the degree of impact.

NO_2

The results of the assessment of the impact of the proposed development on NO_2 in the opening and design years are shown **Table 13.6** for the Highways Agency IAN 170/12 and Table 13.7 using the UK Department for Environment, Food and Rural Affairs technique respectively. The annual average concentration is within the limit value at all worst-case receptors using both techniques. Levels of NO_2 are 44% of the annual limit value in the post development year using the more conservative IAN technique, while concentrations are 40% of the annual limit value in the post development year using the UK Department for Environment, Food and Rural Affairs technique. The hourly limit value for NO_2 is $200µg/m^3$ and is expressed as a 99.8^{th} percentile (i.e. it must not be exceeded more than 18 times per year). The maximum 1-hour NO_2 concentration is not predicted to be exceeded using either technique (**Table 13.8**).

The impact of the proposed development on annual mean NO_2 levels can be assessed relative to "Do Nothing (DN)" levels in the post development year. Relative to baseline levels, some small increases in pollutant levels are predicted as a result of the proposed development. With regard to impacts at individual receptors, the greatest impact on NO_2 concentrations will be an increase of 1.9% of the annual limit value at Receptor 1. Thus, using the assessment criteria outlined in Appendix 13.2 Tables A1 – A2, the impact of the proposed development in terms of NO_2 is negligible. Therefore, the overall impact of NO_2 concentrations as a result of the proposed development is long-term and imperceptible at all of the receptors assessed.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} in the opening and design years are shown in **Table 13.9**. Predicted annual average concentrations at the worst-case receptor in the region of the development are at most 52% of the limit value in the post development year. It is predicted that the worst-case receptors will have at most four exceedances of the $50\mu g/m^3$ 24-hour mean value with the proposed development in place. This is the same number as baseline levels (**Table 13.10**), however 35 exceedances are permitted per year.

Relative to baseline levels, some imperceptible increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on PM_{10} concentrations in the region of the proposed development will be an increase of 0.46% of the annual limit value at Receptor 1. Thus the magnitude of the changes in air quality are negligible at all receptors based on the criteria outlined in Appendix 13.2, Tables A1 – A3. Therefore, the overall impact of PM_{10} concentrations as a result of the proposed development is long-term and imperceptible.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ are shown in **Table 13.11**. Predicted annual average concentrations in the region of the proposed development are 54% of the limit value in the post development year at all worst-case receptors.

Relative to baseline levels, imperceptible increases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed development. None of the six receptors assessed will experience an increase in concentrations of over 0.48% of the limit value. Therefore, using the assessment criteria outlined in Appendix 13.2, Tables A1 – A2, the impact of the proposed development with regard to $PM_{2.5}$ is negligible at all of the receptors assessed. Overall, the impact of increased $PM_{2.5}$ concentrations as a result of the proposed development is long-term and imperceptible.

CO and Benzene

The results of the modelled impact of CO and benzene are shown in **Table 13.12** and **Table 13.13** respectively. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of CO are 24% of the limit value in the post development year; with levels of benzene reaching 12% of the limit value.

Relative to baseline levels, some imperceptible increases in pollutant levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on CO and benzene concentrations will be an increase of 0.66% of their respective limit values at Receptor 1. Thus, using the assessment criteria for NO_2 and PM_{10} outlined in Appendix 13.2 and applying these criteria to CO and benzene, the impact of the proposed development in terms of CO and benzene is negligible, long-term and imperceptible.

Table 13.6 Annual Mean NO_2 Concentrations (μg/m3) (using Interim Advice Note 170/12 V3 Long Term NO_2 Trend Projections)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	16.7	17.5	0.75	Small	Small Increase
2	13.0	13.0	0.02	Imperceptible	Negligible Increase
3	15.2	15.7	0.55	Small	Small Increase
4	16.3	16.9	0.66	Small	Small Increase
5	15.6	15.8	0.26	Imperceptible	Negligible Increase
6	16.5	16.6	0.08	Imperceptible	Negligible Increase

Table 13.7 Annual Mean NO_2 Concentrations (μg/m^3) (using UK Department for Environment, Food and Rural Affairs Technical Guidance)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	15.4	16.1	0.69	Small	Small Increase
2	11.7	11.7	0.02	Imperceptible	Negligible Increase
3	13.9	14.4	0.50	Small	Small Increase
4	14.9	15.6	0.61	Small	Small Increase
5	14.3	14.5	0.24	Imperceptible	Negligible Increase
6	15.2	15.2	0.07	Imperceptible	Negligible Increase

Table 13.8 99.8th percentile of daily maximum 1-hour for NO_2 concentrations (μg/m^3)

Receptor	IAN 170/12 V3 Long Term NO_2 Trend Projections Technique		Defra's Technical Guidance Technique	
	Impact Post Development Year		Impact Post Development Year	
	DN	DS	DN	DS
1	58.6	61.2	58.6	61.2
2	45.6	45.6	45.6	45.6
3	53.1	55.1	53.1	55.1
4	56.9	59.2	56.9	59.2
5	54.5	55.4	54.5	55.4
6	57.8	58	57.8	58

Table 13.9 Annual Mean PM_{10} Concentrations (μg/m^3)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	20.4	20.6	0.18	Imperceptible	Negligible Increase
2	19.6	19.7	0.01	Imperceptible	Negligible Increase
3	20.2	20.3	0.14	Imperceptible	Negligible Increase
4	20.5	20.7	0.17	Imperceptible	Negligible Increase
5	20.4	20.5	0.07	Imperceptible	Negligible Increase

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
6	20.6	20.6	0.02	Imperceptible	Negligible Increase

Table 13.10 Number of days with PM_{10} concentration > 50 µg/m^3

Receptor	Impact Post Development Year	
	DN	DS
1	4	4
2	3	3
3	4	4
4	4	4
5	4	4
6	4	4

Table 13.11 Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	13.3	13.4	0.12	Imperceptible	Negligible Increase
2	12.8	12.8	0.00	Imperceptible	Negligible Increase
3	13.1	13.2	0.09	Imperceptible	Negligible Increase
4	13.3	13.4	0.11	Imperceptible	Negligible Increase
5	13.3	13.3	0.05	Imperceptible	Negligible Increase
6	13.4	13.4	0.01	Imperceptible	Negligible Increase

Table 13.12 Maximum 8-hour CO Concentrations (mg/m^3)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	2.30	2.36	0.066	Imperceptible	Negligible Increase
2	2.04	2.04	0.003	Imperceptible	Negligible Increase
3	2.23	2.28	0.053	Imperceptible	Negligible Increase
4	2.35	2.41	0.064	Imperceptible	Negligible Increase
5	2.33	2.35	0.028	Imperceptible	Negligible Increase
6	2.39	2.40	0.008	Imperceptible	Negligible Increase

Table 13.13 Annual Mean Benzene Concentrations (µg/m^3)

Receptor	Impact Post Development Year				
	DN	DS	DS-DN	Magnitude	Description
1	0.57	0.58	0.015	Imperceptible	Negligible Increase
2	0.51	0.51	0.001	Imperceptible	Negligible Increase
3	0.55	0.57	0.012	Imperceptible	Negligible Increase
4	0.58	0.60	0.015	Imperceptible	Negligible Increase
5	0.57	0.58	0.006	Imperceptible	Negligible Increase

Receptor	**Impact Post Development Year**				
	DN	**DS**	**DS-DN**	**Magnitude**	**Description**
6	0.59	0.59	0.002	Imperceptible	Negligible Increase

Table 13.14 Regional Air Quality & Climate Assessment

Year	**Scenario**	**VOC**	**NO_X**	**CO_2**
		(kg/annum)	**(kg/annum)**	**(tonnes/annum)**
Post Development Year	Do Nothing	568	1257	898
	Do Something	646	1420	1021
Increment in 2020		78.1 kg	162.9 kg	122.4 Tonnes
Emission Ceiling (kilo Tonnes) 2020 Note 1,2		**56.8**	**66.2**	**37,943**
Impact (%)		0.00014 %	0.00025 %	0.00032%

Note 1 Targets under Directive EU 2016/2284 "*On the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*"

Note 2 20-20-20 Climate and Energy Package

Summary of Local Air Quality Modelling Assessment

Levels of traffic-derived air pollutants for the development will not exceed the ambient air quality standards either with or without the proposed development in place. Using the assessment criteria outlined in Appendix 13.2, Table A1 – A3, the impact of the development in terms of PM_{10}, $PM_{2.5}$, CO, NO_2 and benzene is negligible, long-term, negative and imperceptible.

Regional Air Quality Impact

The regional impact of the proposed development on emissions of NO_X and VOCs has been assessed using the procedures of Transport Infrastructure Ireland(23) and the UK Department for Environment, Food and Rural Affairs(17). The results (see **Table 13.14**) show that the likely impact of the proposed development on Ireland's obligations under the Targets set out by Directive EU 2016/2284 "*On the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*" are imperceptible and long-term. For the post development year, the predicted impact of the changes in AADT is to increase NO_x levels by 0.00025% of the NO_x emissions ceiling and increase VOC levels by 0.00014% of the VOC emissions ceiling to be complied with in 2020.

Therefore, the likely overall magnitude of the changes on air quality in the operational stage is ***imperceptible***, ***long-term*** and ***not significant***.

Air Quality Impact to Sensitive Ecosystems

The impact of NO_X (i.e. NO and NO_2) emissions resulting from the traffic associated with the proposed development at the Slaney River Valley SAC, Wexford Harbour and Slobs SPA and Wexford Slobs and Harbour pNHA was assessed. Ambient NO_X concentrations were predicted for the post development year along a transect of up to 200m and are given in **Table 13.15** for the SAC and **Table 13.16** for the SPA and pNHA. The road contribution to dry deposition along the transect is also given and was calculated using the methodology of TII(23).

The predicted annual average NO_X level in the Slaney River Valley SAC adjacent to the proposed development is below the limit value of 30μg/m^3 for the "Do Something" scenario with the proposed development in place with NO_X concentrations reaching 57% of this limit, including background levels.

The predicted annual average NO_X level in the Wexford Harbour & Slobs SPA and pNHA is also below the limit value with the proposed development in place; NO_X concentrations reach 53% of the limit (including background levels).

The impact of the proposed development can be assessed relative to "Do Nothing" levels, the impact of the proposed development leads to an increase in NO_X concentrations of at most 0.58µg/m^3 within the Slaney River Valley SAC and by 0.39µg/m^3 within the Wexford Harbour & Slobs SPA & pNHA. Appendix 9 of the TII guidelines(23) state that where the scheme or development is expected to cause an increase of more than 2µg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_X should be assessed by the project ecologist. Concentrations are not predicted to increase by 2µg/m^3 or more and the predicted concentrations are well below the standard. Therefore, as such it was not necessary for the sensitivity of the habitat to NO_X to be assessed by an ecologist.

The contribution to the NO_2 dry deposition rate along the 200m transect within the SAC is also detailed in **Table 13.15**. The maximum increase in the NO_2 dry deposition rate is 0.032 Kg(N)/ha/yr. The maximum increase in the NO_2 dry deposition rate within the SPA/pNHA is 0.021Kg(N)/ha/yr (**Table 13.16**). In both cases this reaches only 0.1% of the critical load for marine habitats of 30 – 40Kg(N)/ha/yr(23).

Table 13.15 Assessment of NO_X Concentrations and NO_2 Dry Deposition Impact in the Slaney River Valley SAC

Distance to Road (m)	NO_X Conc. (µg/m^3)			NO_2 Dry Deposition Rate Impact
	Do Nothing	Do Something	Impact	Kg N ha^{-1} yr^{-1}
58.7	16.65	17.23	0.58	0.032
68.7	16.34	16.80	0.46	0.024
78.7	16.10	16.46	0.36	0.019
88.7	15.91	16.19	0.28	0.015
98.7	15.76	15.98	0.22	0.012
108.7	15.64	15.81	0.17	0.009
118.7	15.54	15.68	0.13	0.007
128.7	15.47	15.58	0.11	0.006
138.7	15.42	15.51	0.09	0.004
148.7	15.39	15.46	0.07	0.004
158.7	15.37	15.44	0.07	0.003
168.7	15.36	15.42	0.06	0.004
178.7	15.34	15.39	0.05	0.003
188.7	15.31	15.36	0.04	0.002
198.7	15.29	15.32	0.03	0.002

Table 13.16 Assessment of NO_X Concentrations and NO_2 Dry Deposition Impact in the Wexford Harbour & Slobs SPA / pNHA

Distance to Road (m)	NO_X Conc. (µg/m^3)			NO_2 Dry Deposition Rate Impact (Kg (N)/ha/yr)
	Do Nothing	Do Something	Impact	
62.7	15.61	16.00	0.39	0.021
72.7	15.53	15.83	0.30	0.017
82.7	15.47	15.71	0.24	0.013
92.7	15.43	15.62	0.19	0.01
102.7	15.41	15.56	0.15	0.008
112.7	15.40	15.52	0.12	0.007
122.7	15.37	15.46	0.09	0.005
132.7	15.34	15.41	0.07	0.004
142.7	15.31	15.36	0.06	0.003
152.7	15.21	15.26	0.05	0.003
162.7	15.21	15.25	0.04	0.002
172.7	15.21	15.25	0.04	0.002
182.7	15.21	15.24	0.03	0.002

Climate

The impact of traffic related to the proposed development on emissions of CO_2 impacting climate was also assessed using the Design Manual for Roads and Bridges screening model (see **Table 13.14**). The results show that the impact of the proposed development in the post development year will be to increase CO_2 emissions by 0.00032% of Ireland's EU 2020 Target. Thus, the impact of the proposed development on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the EU 2020 Target(29).

In addition, the impact of the proposed development on climate has been considered in the design and operation of the buildings on site. The proposed development will achieve compliance with the Technical Guidance Document Part L 2017 of the Building Regulations. These regulations ensure that all new buildings are designed in accordance with the Near Zero Energy Building (NZEB) Directive which encourages greater use of renewable energy sources, thus greatly reducing their impact on climate.

As well as complying with the NZEB Directive, the proposed development is also aiming to achieve an LEED Gold rating. Leadership in Energy and Environmental Design (LEED) is a rating system devised by the United States Green Building Council (USGBC) to evaluate the environmental performance of buildings and encourage market transformation towards sustainable design. A gold rating is the second highest rating achievable next to platinum. The environmental strategy for the proposed development should help in achieving a gold rating. Overall, the impact of the additional energy usage associated with the proposed development on climate has been minimised and is not predicted to significantly impact climate.

Therefore, the likely overall magnitude of the changes on climate in the operational stage is ***imperceptible***, ***long-term*** and ***not significant***.

Human Health

Air dispersion modelling of operational traffic emissions was undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated by the modelling results, emissions as a result of the proposed development are compliant with all national and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health.

Remedial measures will be undertaken during the construction phase of the proposed development to remove asbestos containing materials and therefore there is no impact to human health predicted for the operational phase.

Cumulative Impacts

Should the construction phase of the proposed development coincide with the construction of any other proposed or permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors. The dust mitigation measures outlined in Appendix 13.3 of this EIAR should be applied throughout the construction phase of the proposed development, with similar mitigation measures applied for other proposed or permitted developments which will avoid significant cumulative impacts on air quality. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality and climate associated with the construction phase of the proposed development are deemed short-term and not significant.

If additional residential or commercial developments are proposed in the future in the vicinity of the proposed development, this has the potential to add further additional vehicles to the local road network. However, due to the town centre location of the proposed development and as the traffic impact for the proposed development has an imperceptible impact on air quality, it is unlikely that other future developments of similar scale would give rise to a significant impact during the construction and operational stages of those projects. Future projects of a large scale would need to conduct an EIA to ensure that no significant impacts on air quality will occur as a result of those developments.

13.5 Mitigation Measures

13.5.1 Construction Phase

Air Quality

The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 13.3 and includes the following:

- The specification and circulation of a dust management plan for the site and the identification of persons responsible for managing dust control and any potential issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust management plan can be monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

At all times, the procedures within the plan will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

Climate

Construction traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works, the impact on climate will not be significant.

Nevertheless, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular, on-site or delivery vehicles will be prevented from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

13.5.2 Operational Phase

No additional mitigation measures are required at the operational phase of the proposed development as it is predicted to have an imperceptible impact on ambient air quality and climate.

There are a number of potential flooding impacts due to increased rainfall as a result of climate change as Wexford Harbour bounds the site to the north, south and east. Any potential impacts as result of climate change have been assessed and mitigated during the design process and it is predicted that flooding will have an imperceptible impact.

13.6 Residual Impacts

13.6.1 Construction Phase

Air Quality

When the dust minimisation measures detailed in the mitigation section of this Chapter and in Appendix 13.3 are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Climate

Impacts to climate during the construction phase are considered imperceptible and therefore residual impacts are not predicted.

13.6.2 Operational Phase

The results of the air dispersion modelling study indicate that the impacts of the proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase for the long and short term.

13.7 Monitoring

Monitoring of construction dust deposition at nearby sensitive receptors (residential dwellings) during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the

German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

There is no monitoring recommended for the operational phase of the development as impacts to air quality and climate are predicted to be imperceptible.

13.8 Difficulties Encountered

There were no difficulties encountered while carrying out this assessment.

13.9 References

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(24) Transport Infrastructure Ireland (2009) Guidelines for Assessment of Ecological Impacts of National Roads Schemes (Rev. 2, Transport Infrastructure Ireland, 2009)

(25) Department of the Environment, Heritage and Local Government (2010) Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities

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(30) BRE (2003) Controlling Particles, Vapours & Noise Pollution From Construction Sites

(31) The Scottish Office (1996) Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings

(32) UK Office of Deputy Prime Minister (2002) Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance

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Appendix 13.1 Ambient Air Quality Standards

ROUGHAN & O'DONOVAN

Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002) and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002 and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ was to establish a target value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2010) and a limit value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5$\mu g/m^3$ to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22$\mu g/m^3$). Where the AEI is currently greater than 22$\mu g/m^3$ all appropriate measures should be employed to reduce this level to 18$\mu g/m^3$ by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 $\mu g/m^3$ was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5km from the nearest motorway or dual carriageway
- 5km from the nearest major industrial installation
- 20km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations(15). Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise(16) as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK

DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_X, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations$^{(16)}$.

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_X showing that the over-prediction is due to NO_X calculations rather than the NO_X:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict $PM_{10.}$ Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable$^{(16)}$.

Appendix 13.2 Transport Infrastructure Ireland Significance Criteria

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Transport Infrastructure Ireland Significance Criteria

Table A1 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 50 µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥4 µg/m^3	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m^3
Medium	Increase / decrease 2 - <4 µg/m^3	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m^3
Small	Increase / decrease 0.4 - <2 µg/m^3	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase / decrease <0.4 µg/m^3	Increase / decrease <1 day	Increase / decrease <0.25 µg/m^3

Table A2 Air Quality Impact Significance Criteria For Annual Mean NO_2 and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration Note 1		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Note 1 Well Below Standard = <75% of limit value.

Table A3 Air Quality Impact Significance Criteria For Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration Note 1		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Appendix 13.3 Dust Minimisation Plan

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Dust Minimisation Plan

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK(28,30,31,32) and the USA(33).

Site Management

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Plate 12.1 for the windrose for Casement Aerodrome). As the prevailing wind is predominantly south-westerly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed(30,32). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials(34). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
- At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80%(32).

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible;
- Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50%(33). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing / Earth Moving

Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions.

- Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency(32);
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the

site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

Summary of Dust Mitigation Measures

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

Chapter 14:
Archaeological & Cultural Heritage

ROUGHAN & O'DONOVAN

Chapter 14 Archaeological & Cultural Heritage

14.1 Introduction

The following chapter was prepared by Aislinn Collins of CRDS Ltd to assess the impact that the Proposed Development will have on the archaeological and cultural heritage sites within the existing site and within the surrounding study area. It is supplemented by a stage 1 Underwater Archaeological Impact Assessment of the site by the Archaeological Dive Company (ADCO).

14.2 Methodology

14.2.1 Record of Monuments and Places

The Record of Monuments and Places (RMP), comprising the results of the Archaeological Survey of Ireland, is a statutory list of all recorded archaeological monuments known to the National Monuments Service. The relevant files for these sites contain details of documentary sources and aerial photographs, early maps, OS memoirs, the field notes of the Archaeological Survey of Ireland and other relevant publications. Sites recorded on the Record of Monuments and Places all receive statutory protection under the National Monuments Act 1994. The information contained within the RMP is derived from the earlier non-statutory Sites and Monuments Record (SMR); some entries, however, were not transferred to the statutory record as they refer to features that on inspection by the Archaeological Survey were found not to merit inclusion in that record or could not be located with sufficient accuracy to be included. Such sites however remain part of the SMR. The record is a dynamic one and is updated to take account of on-going research. The Record of Monuments and Places was consulted in the Archives of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. The Recorded Monuments and Places within c. 500m of the proposed development are listed in Appendix 14.1 at the end of this chapter and identified in Plate 14.1 (See also Figure 14.1 in Volume 3 of this EIAR).

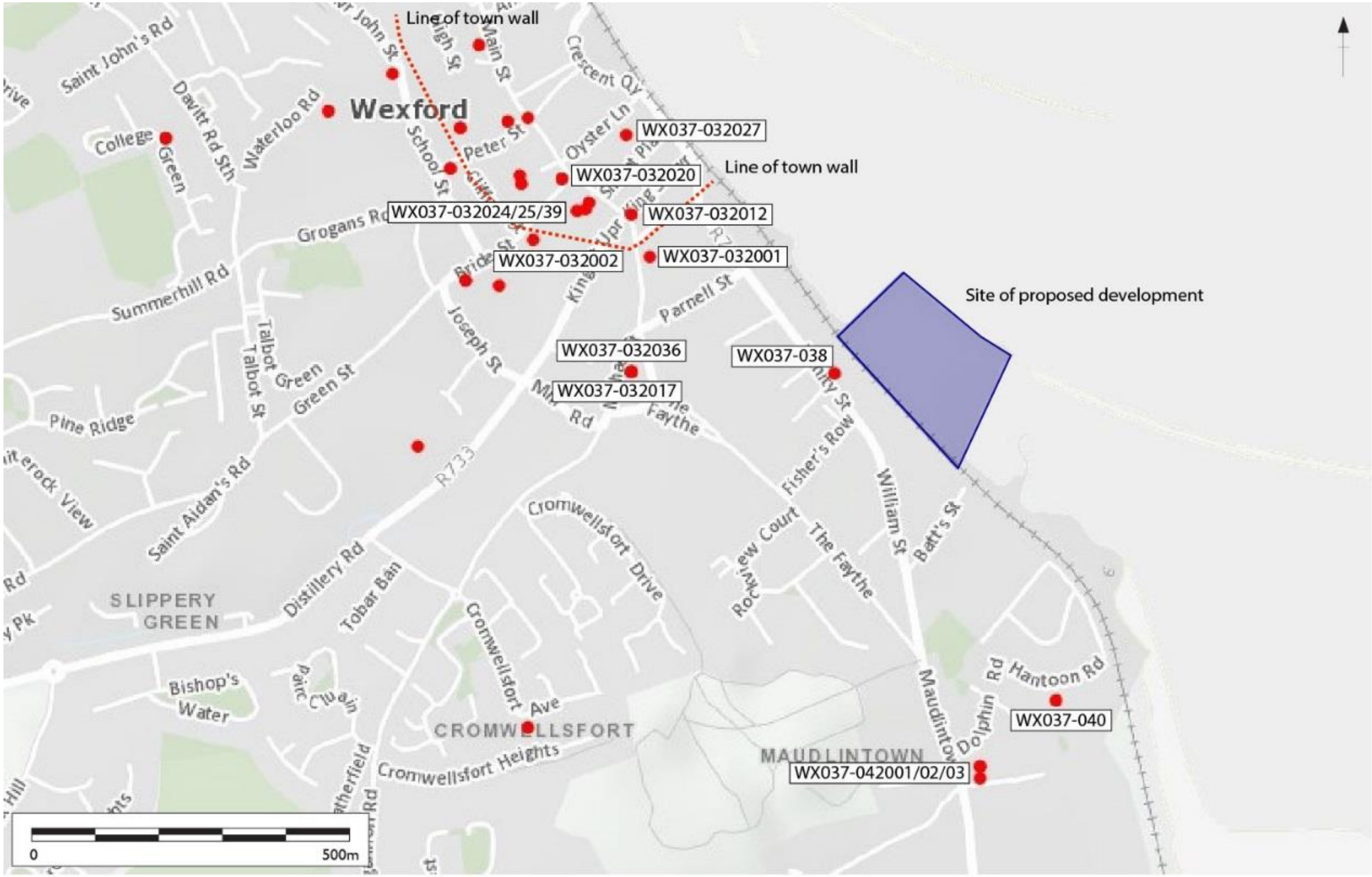

Plate 14.1 **Recorded archaeological monuments and places within c. 500m of the proposed development (source www.archaeology.ie; Alastair Coey Architects, 2008).**

14.2.2 Topographic Finds

The National Museum of Ireland's (NMI) topographical files are a national archive of all known archaeological finds from Ireland. They relate primarily to artefacts but also include references to monuments and contain a unique archive of records of previous excavations. The topographical files were consulted to determine if any archaeological artefacts had been recorded from the site. Other published catalogues of prehistoric material were also studied: Bradley and King (Urban Archaeological Survey 1990), Raftery (1983 - Iron Age antiquities), Eogan (1965; 1983; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers). No topographical finds are recorded from the site of the proposed development.

14.2.3 Cartographic Sources

Cartographic sources were used to identify additional potential archaeological and cultural heritage constraints. Primary cartographic sources consulted consisted of the Ordnance Survey 6" (see Plate 14.2) and 25" maps, and large-scale town plans (T.C.D. Map Library, www.osi.ie, Colfer 2008). Manuscript map sources included the Down Survey map of 'The Barony of Forth in ye County of Wexford, 1654-56 (http://downsurvey.tcd.ie/down-survey-maps.php#bm=Forth&c=Wexford).

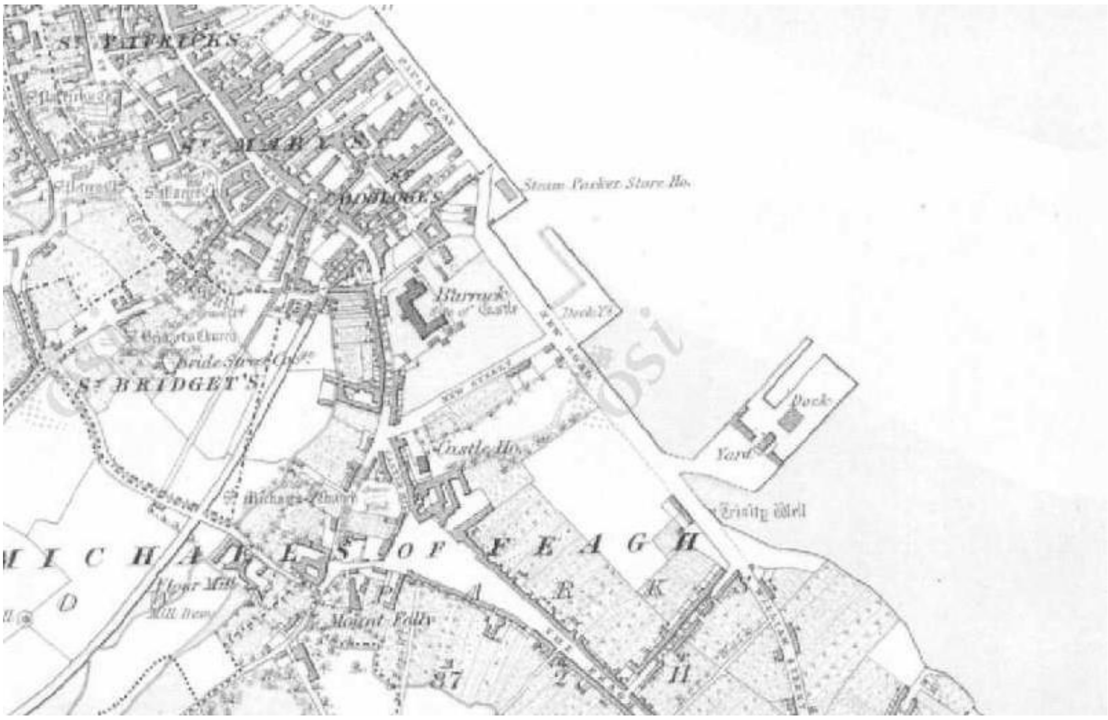

Plate 14.2 **Extract from First Edition Ordnance Survey 6" map of Wexford, showing site of Wexford Dockyard (source www.osi.ie).**

14.2.4 Previous Excavations

The excavation bulletin website (www.excavations.ie) was consulted to identify previous excavations that have been carried out within the study area. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2017 (see Appendix 14.2).

14.2.5 Local Authority Development Plan

The Wexford County Development Plan 2013 - 2019 and the Wexford Town and Environs Development Plan 2009 – 2015 (extended to 2019) were consulted. The plans include policy objectives for the protection of the town and county's archaeological and cultural heritage. The proposed development is located outside the Zone of Archaeological Potential identified for Wexford Town.

14.2.6 Historical Research

Sources consulted included A History of the Town and County of Wexford (Hore 1900-11), the Journal of the Old Wexford Society, the Urban Archaeological Survey of Wexford Town (Bradley and King 1990) and Wexford: A Town and Its Landscape (Colfer 2008) (see Bibliography for full list of references).

14.2.7 Underwater Archaeological Impact Assessment

A stage 1 underwater archaeological impact assessment of the site was undertaken by ADCO Ltd. The assessment comprised a walkover inspection of the development area undertaken at Low Water. A second stage of the assessment will be undertaken in 2019, including licensed underwater inspection and survey of the sub-tidal areas (see Appendix 14.3 for full report text). An underwater archaeology impact assessment which was carried out by ADCO Ltd in 2008 for a previous development has also been reviewed and is included as Appendix 4.4.

14.3 Description of Receiving Environment

14.3.1 Prehistoric

While the first definitive evidence for settlement at Wexford comes from the Viking or Norse period it is likely that prehistoric peoples would have been attracted to the shores of Wexford Harbour for its plentiful food supplies, its importance as a routeway and as a strategic access point (Colfer 2008, 20). Although reclamation along the foreshore and urban expansion have changed the character of the archaeological landscape within the town, prehistoric sites are known from its hinterland e.g. the Neolithic occupation site at Kerlogue and Bronze Age burnt mounds at Hayestown and Johnstown indicating that prehistoric people were settled in the vicinity.

14.3.2 Early Medieval

The earliest references to Viking activity in Wexford Harbour dates to the early part of the ninth century when the island monastery of Begerin, located to the north of Wexford town, was attacked. From the late ninth century, there are references in the Annals to the 'foreigners' of Loch Garman and it is likely that a longphort or temporary base had been established there by this time (Hore 1900-11 Vol. V. 12, Annals of the Four Masters, Annals of Ulster). The placename Wexford is derived from the Old Norse *'Ueigsfiord' 'the inlet of the waterlogged island'* or *'Waesfiord'* a *'broad shallow bay'*. A substantial settlement grew up at Wexford, comprising a town bounded by defences (RMP WX037-032002) with extra-mural suburbs to the south and south-west. It is speculated that the Hiberno-Norse town was surrounded by an earthen embankment faced with a stone wall or revetment surmounted by a wooden palisade, the whole surrounded by a significant fosse or ditch (Alastair Coey Architects 2008, 3). Archaeological excavations on Mary Street revealed evidence of a substantial ditch some 20m in width which has been interpreted as part of the Hiberno-Norse defences. The internal layout of the town has changed little since this period with Main Street acting as the principal thoroughfare and minor lanes running west to the town wall and east towards the sea. During the Hiberno-Norse period the seafront was significantly closer to Main Street than it is at present. The seafront was not defended and a series of laneways led to jetties or quays projecting out into the harbour (Colfer 1990-1, 18).

The proposed development is located to the south-east of the Hiberno-Norse town. One of the pre-Norman churches, the Church of the Holy Trinity (RMP WX037-032014) was located in this area. Its exact location is not known but was described in the seventeenth century as being 'near the castle'. The church was demolished during the Cromwellian period and its stone used to repair the adjacent castle (RMP WX037-032001-). Its location is remembered in Trinity Street and the location of a holy well (RMP WX037-038) of the same name indicated on the foreshore on the Ordnance Survey maps and now within reclaimed land to the immediate west of the proposed development.

The proposed development is located on reclaimed land to the east of the area known as *'Faythe'* or *'Feagh'*, derived from the term *'Faiche'* which corresponds to an open area or green used for fairs. A fair was held annually on the 24th August and the Ordnance Survey indicates a widening at the northwest end of The Feagh that would have functioned as the site of a market (see Plate 14.3 and Plate 14.4).

Plate 14.3 **The Faythe in the late nineteenth century (Lawrence Collection Photograph, copyright National Library of Ireland).**

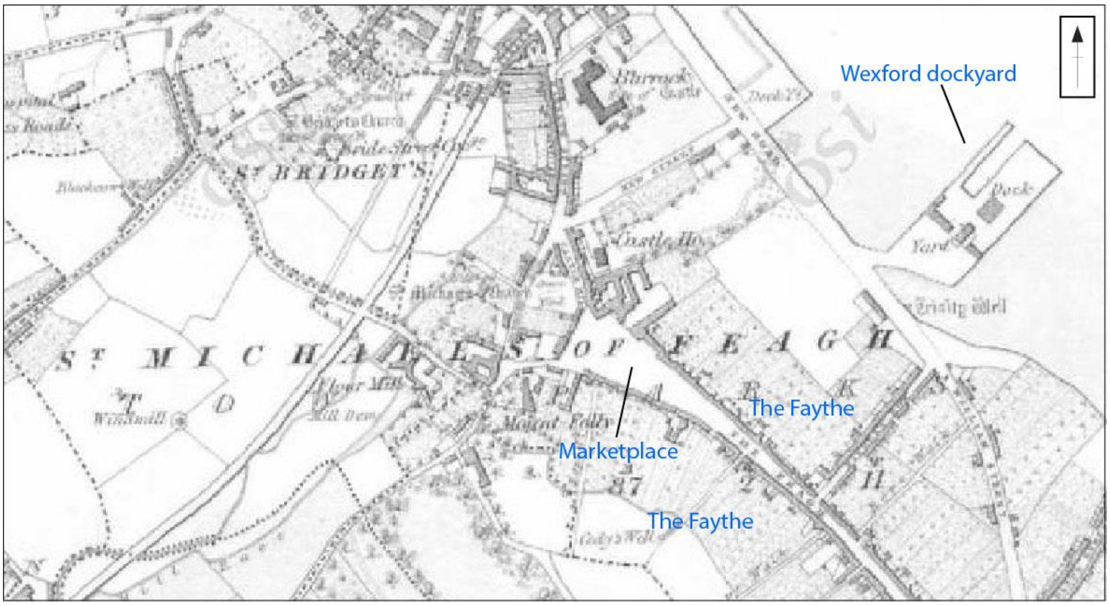

Plate 14.4 **Extract from First Edition Ordnance Survey 6" map of Wexford, showing site the Faythe (source www.osi.ie).**

Giraldus Cambrensis records the burning of the suburbs of Wexford following the arrival of the Anglo-Normans and it is possible that this includes the area of the Faythe. St. Michael's Church (RMP WX037-032017) was the parish church. The rectory of St. Michael's was in the ownership of the Hospitallers of Kilmainham at the time of the Dissolution. Burgesses are recorded in the suburb at that time and it is possible that it functioned as a separate borough. The church was demolished during the Cromwellian period and the stone was used to repair the castle (RMP WX037-032001). No above ground remains now exist of the site but its location is marked by a raised sub-rectangular graveyard defined by masonry walls (RMP WX037-032036).

14.3.3 Later Medieval

Following the Anglo-Norman landing at Bannow Island on the east side of Bannow Bay, the combined forces of Robert Fitz Stephen and Diarmait Mac Murchadha marched on Wexford town. At the outset of hostilities, the Hiberno-Norse inhabitants were confident of their ability to do battle with the Normans but on realising the strength of the opposing force they burnt the suburbs and withdrew within the town defences. The Normans proceeded to set fire to the fleet within the harbour and the towns people surrendered the following day (Colfer 2008, 39). The town was subsequently granted by Mac Murchadha to Fitz Stephen and Maurice Fitz Gerald (Bradley and King 1990, 148).

Giraldus Cambrensis' account of the Anglo-Norman attack on Wexford indicates that town defences existed by this time. He uses the word *'murus'* to describe the defences which may simply mean an earthen rampart. Archaeological excavations at Waterford and Dublin, which are similarly described, indicate that stone walls were already in existence and it is possible that this was also the case in Wexford. It is suggested that following the arrival of the Anglo-Normans at Wexford that the town defences were rebuilt though there is no definitive archaeological evidence to support this. The line of parochial boundaries, and the architectural design of surviving mural towers indicates that the Hiberno-Norse defences were extended to enclose the market place, ferry landing and possible monastic site creating the parish of Selskar (Colfer 2008, 64). Murage grants were collected at various points in the fourteenth century and the parliament enacted that monies should be spent on the maintenance of the wall in the mid-fifteenth century (Hore 1900-11, Vol. V., 60, 107, 122). During the Rebellion of 1641 Wexford was one of the chief ports of the Confederate forces and a contemporary account indicates that the citizens of the town attempted to strengthen the town and entrench the town wall and clear houses that had been built along its line (Hore 1900-11 Vol. V., 254). Cromwellian accounts of this period indicated that the town wall *'pleasantly seated and strong, having a rampart of earth within the wall nearly 15 feet thick'* (Thomas 1992, 210). While development has impacted on the town walls, gates and mural towers, substantial stretches are still standing to the present day. The closest gate to the proposed development was Castle Gate, due to its proximity to the site of Wexford Castle, it was also known as South Gate or Barrack Gate.

When Henry II visited Ireland in 1171-2 he took Wexford into his own hands. He stayed for a prolonged period in the town while awaiting favourable weather conditions to return to Wales (Colfer 2002, 158-9). His stay may have added impetus to the town's development. Following his departure, he granted the town to Strongbow and for a short period it became the principal town of the Lordship of Leinster. Records indicate that the town's economy was centred around overseas trade from the port comprising agricultural products including wheat, wine and cloth and fish, particularly herring. The port lost some of its significance following the foundation of the town of New Ross in the early thirteenth century but its fortunes revived somewhat in the seventeenth century when it overtook New Ross as the principal port in the county. The town's growth during the middle ages is reflected in a series of successive charters which expanded the privileges of the townspeople including Aymer de Valence in 1317, Henry IV in 1410, Henry VIII in 1538, and James I in 1609.

Accounts indicate that port moorings were some distance from the town centre as the Anglo-Norman attackers were able to set fire to the ships there before capturing the town. The core of the later medieval port is described by Hadden (1968, 11) as a pool c. 50m west or inland of the present Crescent Quay. Early seventeenth century documentary records include a list of the towns quays and wharfs including *'the quay of the Pale (Paul's Quay), Richard Hay's Quay, Nicholas Frenche's Quay, Turner's Quay, Morne's Quay, Bollane's Quay, Staple's Quay and Hassane's Quay'* (O'Leary 1994, 55-6).

The site of the Norman castle (RMP WX037-032001), is located c. 300m to the northwest of the proposed development on a site now occupied by the former military barracks. The site was located on a rock outcrop overlooking the town and port immediately outside the southern town defences. It is first recorded in 1231 and may have occupied the site of an earlier Norse or Norman defensive position. An inquisition of 1323-4 describes the castle as a *'stone castle in which there are four towers roofed with shingles…but it needs much repair. There is also one hall roofed with shingles and two other houses thatched'*. In the first half of the seventeenth century it was described in documentary sources as *'a small square regularly enough fortified and washed by the sea'* indicating that land reclamation had not yet progressed east of this point. Subsequent descriptions indicate it was out of repair. After the Restoration it was granted to a Mr. Borr and later sold to the government in the early eighteenth century. It was converted into a barracks in 1725. Mid-nineteenth century excavations revealed the substantial foundations of the castles tower and walls.

Due to pressure on space within the town defences, reclamation of land from the harbour was an ongoing process from at least the late thirteenth century. This was necessary to provide additional land for building and to formalise the waterfront and quay system (Colfer 2002, 168). Wexford's medieval shoreline coincided with the lower lying portions of Main Street. Pipelaying at the Bullring in the 1990s exposed sea sand with an embedded oak timber several metres below the present road surface. Above the sand was a layer of material containing medieval pottery, bones and shells. Work at South Main Street provided evidence for extensive land reclamation and consolidation. Post-and-wattle fences sometimes reinforced with timber planks were used to form revetments. Domestic rubbish was used to reclaim the area behind the revetment and paved surfaces were subsequently provided over. Archaeological testing (RMP WX037-032027; Licence no. 03E1729) on a site fronting onto Paul Quay uncovered sections of walls running northeast to southwest. One of the walls was encountered at a depth of 1.3m in association with organic material and Leinster ware pottery and is interpreted as a possible quay wall and reclamation material. Approximately one third of the walled town was constructed on reclaimed land.

According to the census of 1659 Wexford had a population of 902. In 1682 it was described by Colonel Solomon Richards as *'A walled town on all sides except to the sea-poole or Harbour, which washeth the north-east side thereof. It's of the form of an half oval divided the long way; it hath five gates for entrance…but now about two-thirds of it lies in ruins through the decay of the Herring fishing, which was so great that about the year 1654…..The greatest number of the inhabitants are Irish but the magistracy are all English or Protestants….It hath a well frequented market on Saturdays, and another on Wednesdays'* (Hore 1900-11 Vol. V., 363-4). The Down Survey map of the Barony of Forth, 1654-56 shows the *'citty'* at this time, the walls are clearly evident along with five jetties projecting into the harbour (see Plate 14.5).

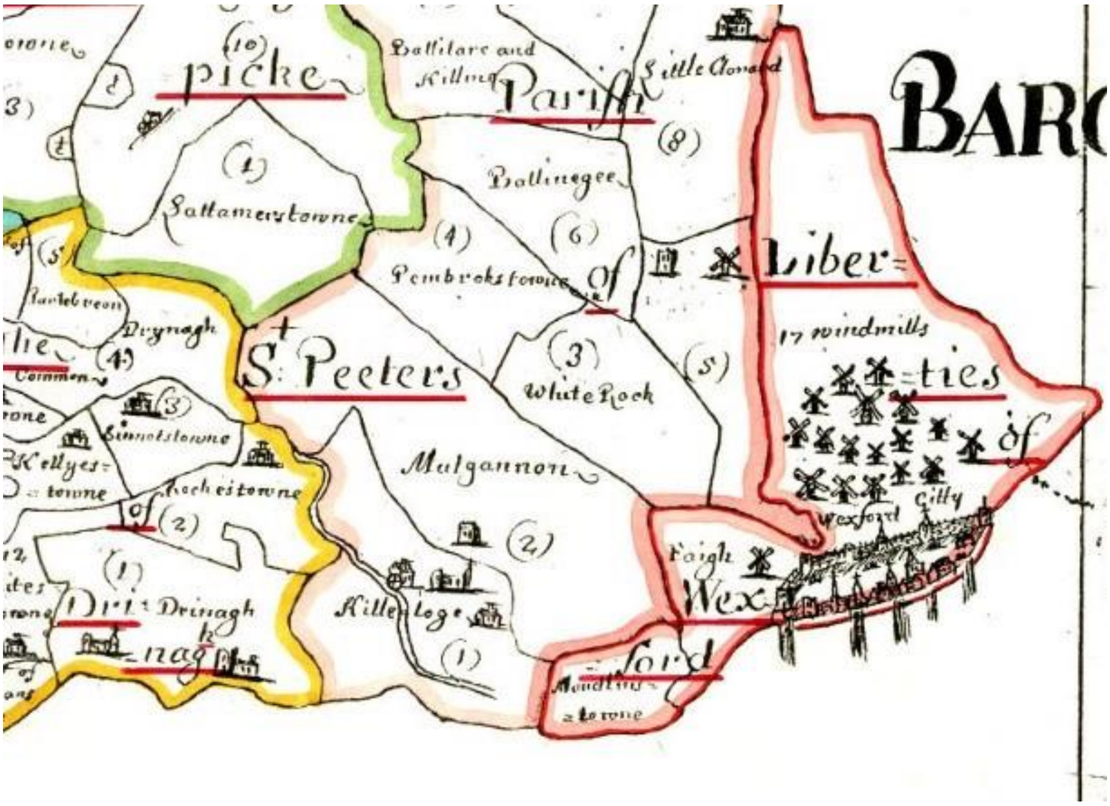

Plate 14.5: **Down Survey map of the 'Barony of Forth in ye County of Wexford, 1654-56' (source http://downsurvey.tcd.ie/down-survey-maps.php#bm=Forth&c=Wexford).**

14.3.4 Modern Period

Nineteenth century land reclamation projects further changed the face of the harbour (see Chapter 15 for further details). One of the key instigators was John Edward Redmond. Redmond reclaimed the northern portion of the Trinity Wharf site from the harbour in the early 1830s (see Plate 14.2). The newly reclaimed land was developed as the Wexford Dockyard which opened in 1832 (O'Leary 2014). The northern corner of the dockyard comprised a patent slip, indicated on Ordnance Survey maps of the site. While the site of the slip and dock has been infilled the structure may survive below the current ground surface.

The National Monuments Service Wreck Viewer indicates the location of a shipwreck cluster located to the immediate west (Ref. W11596, W11606, W11586) and individual shipwrecks to the north (Ref. W10637) and east (Ref. W10641) of the proposed development (see Plate 14.6). No further information on the name of these wrecks or their date of loss is available. A shipwreck identified in the mudflats to the north-west of the former dockyard in 2001 (see Plate 14.6). The site was assessed by the ADCO as part of a licenced underwater archaeological assessment undertaken for a previously proposed development at Trinity Wharf (Licence No. 08D005/08R001). This development was not undertaken. The wreck survived as a stem post rising over 2m above the mudflats. In addition to the stem the ribs and stern of the vessel were exposed above the mud. The timber-built vessel measured 19.69m in length and 4.62m in width. The position of the wreck was 20m west of the location of the shipwreck cluster (Ref. W11596, W11606, W11586) noted above. No indications of any wreckage were noted above the location of this cluster (ADCO 2008, 17-4 – 17-9). A loose ship's plank was also identified during the assessment. The plank retains holes for wooden pegs, c. 2cm-3cm in diameter and is 2m long, 14cm wide and c. 10cm thick. It was un-associated with any other features and lay loose on the seabed. Please note that the potential for shipwrecks, individual ship timbers and other archaeological features exists in pre-reclamation levels across the site.

Plate 14.6 **Locations of wrecks identified near the proposed development (source National Monuments Service Wreck Viewer and ADCO 2008).**

A mid-ninteenth century Ordnance Survey map of the site indicates a stone built breakwater located to the south of Trinity Wharf. The breakwater forms a small enclosed harbour known as Goodtide Harbour and formally as the Cot Safe. Cots are traditional timber-built, flat-bottomed boats which continue to be built in Co. Wexford particularly in Rosslare and Wexford Harbours. The Wexford Cots were traditionally used for herring fishing and the shallow draught allowed them to negotiate the shoals, sandbanks and mudflats of the estuarine waters. Basset's Guide of 1885 records that the town's fisheries provided employment to many townspeople with twenty-five craft 'smacks, luggers and cots' engaged in fishing off the harbour.

14.3.5 Site Survey

The site of the proposed development comprises an area of land reclaimed from the harbour between the early nineteenth and mid-twentieth centuries. The ground is relatively flat and raised above the level of the harbour. The Dublin-Rosslare rail line runs along the southern boundary of the site. Most of the buildings that stood on the site have been cleared. The remains of one concrete structure stands but is unroofed. There are significant piles of concrete rubble located throughout the site. The concrete floor slabs of several the former factory buildings survive particularly in the southern portion of the site.

A wall of squared rubble red sandstone runs in a north-east to south-west direction through the site and survives to a height of c. 2m (see Plate 14.7). This marks the boundary between the north-western portion of the site which was reclaimed in the early nineteenth century and the south-eastern portion of the site which was reclaimed in the later nineteenth and twentieth centuries.

Plate 14.7 Boundary wall marking the edge of former dockyard.

Elements of the infrastructure of the nineteenth century dockyard survives in the north-western portion of the site. A set of rubble red sandstone gate piers stands along the southern boundary of the former dockyard. In an area of collapsed material at the northern corner of the site, three large roughly dressed red sandstone blocks were noted (see Plate 14.8). These appeared to be aligned and may represent the western face of the former dock. It is possible that the dock walls were left in situ when it was infilled and survives bellow the ground surface.

Plate 14.8 Possible face of nineteenth century dock.

The north-western edge of the site is an early nineteenth century wall of red sandstone which has a slight batter at the base which extended below water level at the time of the survey (see Plate 14.9). The wall was heightened by shuttered concrete in the mid-twentieth century. The wall is highest, surviving to a height of over 3m, at south-western corner which corresponds with a building indicated on the 1st edition Ordnance Survey Map and contemporary illustration of the site.

The remains of a timber and cast-iron wharf run along the north-eastern edge of the site. This does not appear on the 1st edition Ordnance Survey map and is likely associated with the Star Iron Works or subsequent uses of the site. There is a large masonry beacon marking the eastern corner of the site. The beacon is indicated on the 25" Ordnance Survey map of the site and marked the eastern termination of a masonry breakwater, it is possible that the remains of the breakwater survive below the reclaimed ground surface. The stem post of the wreck investigated by ADCO was visible in shallow water to the north-west of the site (see Plate 14.10). No indications of any wreckage associated with the other possible wreck sites (Ref. W11596, W11606, W11586, W10637 and W10641) was noted during the site survey.

Plate 14.9 **Wall along north-western edge of site.**

Plate 14.10 **Stem post of wreck off south-western corner of site.**

The stone breakwater to the south of the site provides a small sheltered harbour known as Goodtide Harbour (see Plate 14.11).

Plate 14.11 Goodtide Harbour with traditional timber cots pulled ashore.

14.4 Description of Potential Impacts

This section assesses the predicted impacts associated with the proposed development in the absence of mitigation measures.

The proposed development is located at the south-east end of Wexford town and at the southern end of the town's quays. The scheme will encompass a total of 5.47 ha; 3.6 ha of this will comprise existing land reclaimed from the harbour during the nineteenth and twentieth centuries, while the additional area required outside of the existing reclaimed land will accommodate the marina and boardwalk developments within the foreshore area and the roadworks required along Trinity Street to provide a junction and access road to the Trinity Wharf site.

Because the site is on reclaimed land, it is considered that all buildings will require piled foundations. There is the potential for archaeological impacts, on both pre-reclamation archaeological features and elements of the former dockyard, associated with any sub-surface excavation works or piling required

The existing sea wall along the north-east edge of the site, which comprises a reinforced concrete structure, will be replaced as part of the proposed development. It is proposed to construct a steel sheet piled structure around the perimeter of the site and no excavation of these structures below ground will be required. The structure will be embedded into the stiff clay layers on the site identified at -10.5m D. There is the potential for archaeological impacts associated with any piling required.

A marina development is proposed off the northern edge of the site. It will comprise 64 berths and will comprise industry standard modular pontoons and finger units. A floating breakwater comprising pre-fabricated units will be tethered to the seabed to protect the marina. The proposed marina is located in an area of underwater archaeological potential to the south of the medieval quays, associated with the nineteenth century dockyard and the sites of three recorded shipwrecks. There is the potential for underwater archaeological impacts associated with the development of the marina.

A boardwalk connection will be provided between the northern corner of the site and Paul Quay. The boardwalk will carry pedestrians and cyclists and will be supported on a steel pile structure comprising single piles. The proposed boardwalk is located in an area of underwater archaeological potential to the south of the medieval quays, associated with the nineteenth century dockyard and the sites of three recorded shipwrecks. There is the potential for underwater archaeological impacts associated with the development of the boardwalk. The proposed landing point at Paul Quay is identified as one of the town's historic quays and there is the potential for archaeological impacts associated with its construction, below ground.

An access road leading from the site to Trinity Street runs immediately to the south of the site of a holy well (RMP WX037-038). While the vicinity of the well has previously been developed and there are no longer any archaeological features evident at ground level, it is possible that features associated with the well survive below ground.

The town walls of Wexford are designated as a National Monument. There are no direct impacts on the town walls associated with the proposed development. The visual impact of the proposed development has been considered in the Landscape and Visual Impact Assessment (see Chapter 11). The closest stretch of the town wall to the proposed development is located on Barrack Street c. 350m north-west of the site and this area does not have views to the site.

14.5 Mitigation and Monitoring Measures

The avoidance of direct or indirect impacts on archaeological heritage is the preferred mitigation measure. Where this is not possible the following archaeological mitigation measures are proposed:

14.5.1 Pre-Construction Measures

Archaeological Testing or Monitoring

Dependent on the nature of foundations proposed for individual structures within the proposed development archaeological testing or archaeological monitoring may be required where sub-surface development works are to be undertaken. This is particularly important in the northern corner of the site where it is possible that the remains of the nineteenth century dock infrastructure still exist below the current ground surface and at the site of the holy well (RMP WX037-038) where it is possible that features survive below ground.

Underwater Archaeological Impact Assessment

An underwater archaeology walkover inspection was undertaken by ADCO on the 11th December 2018 at Low Water. The mitigation measures included in their report are reproduced here while their full report is included in Appendix 14.3.

Underwater Archaeology Impact Assessment

An Underwater Archaeology Impact Assessment (UAIA) of the area to be impacted by the proposed marina and boardwalk will be carried out prior to any construction works. Such work is licensed by the National Monuments Service. The work will be carried out as part of the required UAIA, which will inspect the known underwater archaeological elements adjacent to the development area.

In the event that the underwater assessment identifies features that will be impacted by the construction phase, further archaeological mitigation will be required and may include investigation and excavation.

Archaeological Topographic Survey

An Archaeological Topographic Survey of the reclaimed land area and associated intertidal elements is required to capture a detailed pre-disturbance record of the existing land surfaces. The work will prepare detailed topographic mapping that enables metrically accurate 1:20 plan, elevation and section drawings. It will be necessary to capture an above ground stone-by-stone record of the dockyard walls and fabric. The record will serve as the permanent record of this element that will be destroyed or otherwise permanently buried by the development.

14.5.2 Construction Phase Measures

A review of the site investigation logs to assess the nature of the buried strata will be undertaken.

Archaeological Monitoring of Ground and Seabed Disturbance

Archaeological Monitoring of Ground and Seabed Disturbance activities during the construction phase and associated elements, with the proviso to fully resolve any archaeological features identified. Such work is licensed by the National Monuments Service.

Archaeological Excavation and Preservation In Situ

Archaeological excavation is the preservation by record of archaeological remains and is recommended only where archaeological features cannot be preserved *in situ*.

Should the results of the mitigations outlined above indicate the requirement for archaeological excavation and/or preservation *in situ*; this will be undertaken as per best practice and in consultation with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht.

14.5.3 Project Management Measures

AN ARCHAEOLOGICAL CONSULTANT experienced in and specialising in maritime archaeology should be appointed to the project to advise the design team on archaeological matters, liaise with the state regulators, prepare archaeological licence applications and complete archaeological site work.

ARCHAEOLGICAL MONITORING is licensed by the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht. The application for such a licence requires a detailed method statement, outlining the procedures to be adopted to monitor, record and recover material of archaeological interest during such work. Licence applications take four (4) working weeks to be processed and must be granted before archaeological-related work can commence.

THE TIME SCALE for the project should be made available to the archaeologist, with information on where and when the various elements and ground disturbances will take place.

SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of works commencing. This will allow for prompt arrival on site to undertake additional surveys and to monitor ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team, including an archaeological dive team, be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.

SECURE WET AND DRY STORAGE for artefacts recovered during the course of the monitoring and related work should be provided on or near those sites where excavation is required.

ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.

MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.

SPOIL should not be dumped on any of the selected sites or their environs.

POST-CONSTRUCTION PROJECT REPORT AND ARCHIVE. It is a condition of archaeological licensing that a detailed project report is lodged with the DCHG within twelve months of the completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland.

The recommendations listed above are subject to the approval of the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.

14.6 Residual Impacts

Subject to the implementation of appropriate archaeological mitigation measures, no significant residual impacts on archaeological and cultural heritage are predicted.

14.7 Difficulties Encountered

No difficulties were encountered during the completion of this assessment.

14.8 References

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Appendix 14.1 Recorded Archaeological Monuments and Places

ROUGHAN & O'DONOVAN

Recorded Archaeological Monuments and Places

Recorded Archaeological Monuments and Places Within c. 500m of the Proposed Development (source www.archaeology.ie).

RMP No.	WX037-032001-
Site Type	Castle - Anglo-Norman masonry castle
Townland	Townparks (St. Michael's of Feagh Par.)
ITM	705098, 621473
Description	The castle at Wexford is located on a slight rise at the S end of the town, and it may have been built on the site of a Viking strongpoint (Hadden 1968, 13). It is traditionally thought to have been built by King John, but it was certainly in existence by 1221, although a door-keeper of the castle is mentioned in 1185. A list of its constables from 1311 to 1590 survives (Hore 1900-11, vol. 5, 65). The castle was bombarded by Cromwell's forces in October 1649 and quickly surrendered, which led to the capture of the town (ibid. 293-304). The castle is described (ibid. 63-70) as having been a rectangular keep with four towers attached. It was converted to a military barracks in the 1720s (Colfer 1990-1, 18-21), and these buildings still occupy the site, but no features of a medieval castle are evident. The above description is derived from the published 'Archaeological Inventory of County Wexford' (Dublin: Stationery Office, 1996). In certain instances the entries have been revised and updated in the light of recent research. Compiled by: Michael Moore. Date of upload/revision: 19 December, 2012. References: Colfer, B. 1990-91 Medieval Wexford. Journal of the Wexford Historical Society (formerly known as Journal of the Old Wexford Society) 13, 5-29. Hadden, G. 1968 The origin and development of Wexford town. Parts 1 and Journal of the Wexford Historical Society, vol. 1, 5-19.

RMP No.	WX037-032002-
Site Type	Town defences
Townland	Wexford
ITM	704917, 621501
Description	The Anglo-Norman walls of Wexford town followed the likely line of much of the earthen ramparts of the Vikings, but the Viking defences have not yet been recognised in any excavation. The defences began at the harbour on the N side of the site of the castle (WX037-032001-), crossed Barrack St., King St. and Bride St. at the junction with Clifford St. From this point it progressed NNW to the top of Mary St., continued N to the W side of High St., Mallon St. and Abbey St., crossed Georges St. to the West Gate and turned NE back towards the harbour. Considerable portions survive. The town wall at the SW corner of the town off Bride St. rises from flat ground around the valley of the Bishops Water River (ext. H c. 4m) but deposits against the interior reduce the height (int. H to c. 2m). The curved corner (total L c. 42m) is interrupted by inserted windows and partly rebuilt. However, it has evidence of 5 gun loops and a benched wall walk. A length of town wall (total L c. 100m; Wth c. 1m; ext. H c. 4m) runs N from St Patrick's church (WX037-032010-) to Mary St. An earthen rampart (Wth 3m) within the wall at St Patrick's graveyard (WX037-032032-) dates from the Cromwellian siege in 1649. A section of town wall between Mary St. and Rowe St. was inaccessible. An accessible section of town wall survives between Rowe St. and John's Gate Street (total L 47m; H c. 2 3m), including an open backed rectangular tower, entered at the first storey. There is a section of wall running between John's Gate St. and George's St. (total L 25m; H 4

	6m) with a circular protruding tower entered from the wall walk. The foundation trench for part of this wall was found in excavation (E0797), but there was no evidence of an outer fosse (Ryan and Cahill 1980 1). The line of the wall is continued N and S of the original section by later walling. The longest surviving section of town wall is at the NW corner of the town running from George's St. to West Gate tower (WX037-032008-) and on to Westgate St. (total L c. 190m; wall H c 3-4m). There is some evidence of an external fosse (Wth c. 10m) towards the N end and there is evidence of some gun-loops. There is also a projecting circular tower, entered from the wall walk towards the George St. end. The Westgate entrance is the only surviving gateway into the town. Essentially it is a four-storey tower house, with a vaulted passage (NE-SW) at the ground floor. A mural stairs rises to the first and second floors. There is a fireplace, garderobe and two plain windows at each upper floor. There is also access from the second floor to the wall-walk of the town wall to the N. There is a newel stairs to the third floor and the destroyed parapet, which has lookout platforms on the W and S angles. The Westgate has been restored by Wexford County Council for use as visitor centre. Compiled by: Michael Moore. Date of upload; 19 December, 2012. References: Ryan, M. and Cahill, M. 1980-81 An investigation of the town wall at Abbey Street, Wexford. Journal of the Wexford Historical Society, vol. 8, 56-64. Notes Originally records WX037-0322002- to WX037-032008-, clockwise from south.

RMP No.	WX037-032012-
Site Type	Church
Townland	Wexford
ITM	705070, 621540
Description	The parish church of St Doologe's, which is a corruption of St Olave's, is at the extreme S end of the town. It is the smallest parish in the town, and perhaps in the country, occupying a little more than 1 ha. According to a Visitation by Thomas Ram, the Protestant bishop of Ferns, in 1615 David Browne was the curate of St. Towlocks, and the church and chancel were in repair (Hore 1900-11, vol. 6, 267). The church is mentioned in a survey of 1662 (ibid. vol. 5, 76, 338) but its location has never been recorded on a map. However, it is thought to have been located near the junction of Lower King St. and Barrack St. (Hadden 1968, 13). The above description is derived from the published 'Archaeological Inventory of County Wexford' (Dublin: Stationery Office, 1996). In certain instances, the entries have been revised and updated in the light of recent research. Compiled by: Michael Moore. Date of upload/revision: 19 December, 2012. Amended: 2 Sep. 2013. References: Hadden, G. 1968 The origin and development of Wexford town. Parts 1 and 2. Journal of the Wexford Historical Society, vol. 1, 5-19. Notes: Parish church of St. Duloges, which is a corruption of St. Olaves. St. Dulogues is the smallest parish church in the town. The church is reputedly located at the junction of Lower King Street and Barrack Street (Hore 1906, JOWS 1986, 13).

RMP No.	WX037-032017-
Site Type	Church
Townland	Townparks (St. Michael's of Feagh Par.)

ITM	705070, 621295
Description	The site of the parish church of St Michael of Feagh is within a raised sub-rectangular graveyard (dims c. 50m WNW-ESE; c. 30m NNE-SSW) defined by masonry walls. It is located towards the N end of a low NW-SE ridge. This parish is thought to be an Ostman or Viking suburb of Wexford (Colfer 1991-2, 22), and Hore (1900-11, vol. 4, 262) suggests that this is the church of St. Alloc, described in 1172 as being near Wexford when it was granted to the Knights Templar. The rectory of St. Michael's was owned by the Hospitallers of Kilmainham at the Dissolution in 1541 (White 1943, 103). According to a Visitation by Thomas Ram, the Protestant bishop of Ferns, in 1615 Thomas Gallamore was the curate and the church and chancel were in repair (Hore 1900-11, vol. 6, 268). The church is described as dedicated to St. Michael the Archangel c. 1680 when its material was used to repair the castle (WX037-032001-) (Hore 1862, 66). There are no visible remains of the church at ground level. Archaeological testing (94E0198) and (94E0202) on the E wall of the graveyard produced evidence of post-medieval burials (Scally 1995), but testing (04E1257) at Faythe Lane c. 60m to the S failed to produce any related material (Stafford 2008). The above description is derived from the published 'Archaeological Inventory of County Wexford' (Dublin: Stationery Office, 1996). In certain instances, the entries have been revised and updated in the light of recent research. Compiled by: Michael Moore. Date of upload/revision: 20 December, 2012. Amended: 2 Sep. 2013. References: Colfer, B. 1990-91 Medieval Wexford. Journal of the Wexford Historical Society (formerly known as Journal of the Old Wexford Society) 13, 5-29. Hore, H. F. 1862 An account of the barony of Forth, in the county of Wexford, written at the close of the seventeenth century. Journal of the Royal Society of Antiquaries of Ireland, vol. 7, 53-84. Scally, G. 1995 St. Michael's graveyard, Kevin Barry St., Wexford. Burial Site. In I. Bennett (ed.), Excavations 1995: summary accounts of archaeological excavations in Ireland, 84, No. 226. Bray. Wordwell. Stafford, E. 2008 Faythe Lane., Wexford. No archaeological significance. In I. Bennett (ed.), Excavations 2005: summary accounts of archaeological excavations in Ireland, 411, No. 1679. Dublin, Wordwell. White, N.B. 1943 Extents of Irish monastic possessions, 1540-1541. Dublin. Irish Manuscripts Commission.

RMP No.	WX037-032020-
Site Type	House(s) - medieval
Townland	Wexford
ITM	704961, 621596
Description	Excavations during 1988 (E000438) on a small site at the junction of Bride St. and South Main St. revealed the foundations of fifteen post and wattle houses in two plots dating from the 11th to the early 14th centuries. This is the most extensive evidence of the pre-Anglo-Norman settlement of Wexford town. (Bourke 1988; 1988-9). The above description is derived from the published 'Archaeological Inventory of County Wexford' (Dublin: Stationery Office, 1996). In certain instances, the entries have been revised and updated in the light of recent research. Compiled by: Michael Moore. Date of upload/revision: 20 December 2012. References: Bourke, E. 1988-9 Two early eleventh century Viking houses from Bride Street, Wexford, and the layout of the properties on the site. Journal of the Wexford

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RMP No.	WX037-032024-
Site Type	Midden
Townland	Wexford
ITM	705003, 621559
Description	Archaeological testing (96E0141) at the rear of No. 121 South Main St., on the W side of the street and just S of Stonebridge Lane, uncovered a layer of midden material (L 5m plus; max. T 0.6m) that included bands of organic material but which produced no ceramic or other artefacts. It was immediately beneath a layer that produced 17th century pottery but overlay a sterile grey/black sandy layer that in turn overlay a row of three posts. A SW-NE stone-lined culvert that holds the Bishops Water Pill was adjacent to the SE. Midden (WX037-032025-) is c. 10m to the SW. (Moran 1996, 3; Moran 1997). Compiled by: Michael Moore. Date of upload: 20 December 2012. References: 1. Moran, J. 1996 Archaeological site assessment at 112 South Main Street, Wexford. Licence: 96E0141. Unpublished report, Archaeografix. 2. Moran, J. 1997 South Main Street, Wexford. Medieval/post-medieval. In I. Bennett (Ed.) Excavations 1996: summary accounts of archaeological excavations in Ireland, 115, No. 406. Bray, Wordwell

RMP No.	WX037-032025-
Site Type	Midden
Townland	Wexford
ITM	704998, 621549
Description	Archaeological testing (96E0141) at the rear of No. 112 South Main St., on the W side of the street and just S of Stonebridge Lane, uncovered the top of a layer of midden material which produced no ceramic or other artefacts. It was immediately beneath a layer that produced 17th century pottery but overlay a sterile grey/black sandy layer that in turn overlay a number of stakes which support a plank (Wth 0.2m; T 3cm), probably one of a line of planks. A SW-NE stone-lined culvert that holds the Bishops Water Pill was adjacent to the SE. Midden (WX037-032024-) is c. 10m to the NE. (Moran 1996, 3; Moran 1997). Compiled by: Michael Moore. Date of upload: 20 December 2012. References: 1. Moran, J. 1996 Archaeological site assessment at 112 South Main Street, Wexford. Licence: 96E0141. Unpublished report, Archaeografix. 2. Moran, J. 1997 South Main Street, Wexford. Medieval/post-medieval. In I. Bennett (Ed.) Excavations 1996: summary accounts of archaeological excavations in Ireland, 115, No. 406. Bray, Wordwell

RMP No.	WX037-032027-
Site Type	Quay
Townland	Wexford
ITM	705061, 621663
Description	Archaeological testing (03E1729) on a site fronting onto Paul Quay and bordered

	by Oyster Lane on the NW and which is c. 50m S of the Crescent uncovered sections of a number of walls running NE-SW. One wall (Wth 1.6m), encountered at a depth of 1.3m had organic layers containing Leinster ware to its NW and is interpreted as a possible quay-wall with a lagoon on the NW and perhaps infill material to the SE. (McLoughlin 2004; 2006). Compiled by: Michael Moore. Date of upload: 20 December 2012. References: 1. McLoughlin, C. 2004 Archaeological monitoring and testing, Paul Quay/Oyster Lane, Wexford. Unpublished report, Stafford McLoughlin Archaeology. 2. McLoughlin, C. 2006 Paul Quay/Oyster Lane, Wexford. Urban medieval. In I. Bennett (ed.), Excavations 2003: summary accounts of archaeological excavations in Ireland, 539-40, No. 2053. Bray, Wordwell

RMP No.	WX037-032036-
Site Type	Graveyard
Townland	Townparks (St. Michael's of Feagh Par.)
ITM	705070, 621295
Description	The site of the parish church of St Michael of Feagh (WX037-032017-) is within a raised sub-rectangular graveyard (dims c. 50m WNW-ESE; c. 30m NNE-SSW) defined by masonry walls. It is located towards the N end of a low NW-SE ridge. There are no visible remains of the church at ground level. Archaeological testing (94E0198) and (94E0202) on the E wall of the graveyard produced evidence of post-medieval burials (Scally 1995), but testing (04E1257) at Faythe Lane c. 60m to the S failed to produce any related material (Stafford 2008). Compiled by: Michael Moore. Date of upload: 19 December 2012. References: Scally, G. 1995 St. Michael's graveyard, Kevin Barry St., Wexford. Burial Site. In I. Bennett (ed.), Excavations 1995: summary accounts of archaeological excavations in Ireland, 84, No. 226. Bray. Wordwell. Stafford, E. 2008 Faythe Lane., Wexford. No archaeological significance. In I. Bennett (ed.), Excavations 2005: summary accounts of archaeological excavations in Ireland, 411, No. 1679. Dublin, Wordwell.

RMP No.	WX037-032039-
Site Type	Structure (sea wall, possible)
Townland	Wexford
ITM	704984, 621545
Description	Archaeological testing (02E0205) on the W side of Stonebridge Lane uncovered stratigraphy that was more than 2m deep throughout. Most of the material at the upper levels was post-medieval redeposit, probably in an effort to raise ground levels. The lower deposits were estuarine in character, and a short section of the top of a wall (Wth 0.35m; L 2.2m) that was bonded with lime mortar was recorded in the silts. The silts relate to the estuary of the Bishop's Pill, a culverted section of which had been identified on another site c. 30m to the NE associated with midden material (WX037-032024-). (Stafford 2002; McLoughlin 2004). Compiled by: Michael Moore. Date of upload: 20 December 2012. References: 1. Stafford, E. 2002 Archaeological assessment report. Stonebridge Lane, South Main St., Wexford. Licence No. 02E0205. Unpublished report, Stafford McLoughlin Archaeology. 2. Stafford, E. 2004 Stonebridge Lane, Main St. South, Wexford: urban. In I.

	Bennett (ed.), Excavations 2002: summary accounts of archaeological excavations in Ireland, 524, No. 1937. Bray. Wordwell.

RMP No.	WX037-038----
Site Type	Ritual site - holy well
Townland	Townparks (St. Michael's of Feagh Par.)
ITM	705388, 621290
Description	Marked on the 1839 and 1941 eds of the OS 6-inch map and described in gothic lettering as Trinity Well on both, and additionally as 'Site of' on the later map. It is located on a N-facing slope adjacent to Wexford Harbour and was associated with the unlocated Trinity church (WX037-032014-), which is probably in the vicinity. The well site is in a small paved area on the NE side of Trinity St. surrounded by warehouses, but it is not visible at ground level. There is no evidence of, or record of veneration. Compiled by: Michael Moore. Date of upload: 19 December 2012 Notes: Hore JRSAI Vol. 7, p.66.

RMP No.	WX037-040----
Site Type	Ritual site - holy well
Townland	Maudlintown (Forth By.)
ITM	705733, 620780
Description	Marked on the 1839 and 1941 eds of the OS 6-inch map and described in gothic script as St. Mary Magdalene's Well on both, with the additional information 'Site of' on the later map. According to John O'Donovan writing c. 1840 the pattern was held at the well on July 22nd until c. 1790 (O'Flanagan 1933, vol. 1, 376). It is situated on a slight NE-facing slope and is located in the garden of a house, but it is not visible at ground level. Maudlintown church (WX037-041001-) is c. 150m to the SW. St. Mary Magdalene, the penitent, is recorded in the Gospels. Her repentance at the feet of Christ led to her becoming an ardent disciple. She was with Mary at the Crucifixion, and was the first to encounter the risen Christ. (Butler, 1883, 102). Compiled by: Michael Moore. Date of upload: 14 December 2012. Amended: 14 January 2014. References: Butler, Rev. A. 1883 Lives of the Saints. J. S. Virtue London and Dublin, Reprint (1990) London. Studio Editions (Abridged). O'Donovan, J. 1840. Letters containing information relative to the antiquities of the county of Wexford Vol. 1, p. 376. 'In the northeast part of the townland of Maudlinstown is the holy well called after Mary Magdelene, at which a patter was held on the 22nd of July annually till about 45 years ago, when it was abolished for 'weighty reasons'. Hore, P. H. (1925) The barony of Forth, Part III in The Past, Vol. 3, p. 10-40.

RMP No.	WX037-042001-
Site Type	Church
Townland	Maudlintown (Forth By.)
ITM	705614, 620676
Description	The parish church of Maudlintown is situated on a low-lying landscape within a rectangular graveyard (dims. c. 50-55m E-W; c. 35m N-S) defined by masonry

	walls. It was attached to the Leper Hospital (WX037-041----) and was granted to the Knights Hospitaller of St John at Kilmainham, Co. Dublin in the 15th century. Portion of the W gable (L 7m; max. H 2.5m) with a break at the centre survives with part of the adjacent S wall. The lower end of a medieval graveslab (Wth 0.41-0.51m; T 0.13m; H 0.67m) with a raised fleur-de-lis terminal is used as a grave-marker at the N edge of the church. The site of St Mary Magdalene's Well (WX037-040----), at which patterns were celebrated on the 22nd of July until c. 1790 (O'Flanagan 1933, vol. 1, 376) is c. 150m to the NE. The above description is derived from the published 'Archaeological Inventory of County Wexford' (Dublin: Stationery Office, 1996). In certain instances, the entries have been revised and updated in the light of recent research. Compiled by: Michael Moore. Date of upload/revision: 14 December 2012.

RMP No.	WX037-042002-
Site Type	Graveyard
Townland	Maudlintown (Forth By.)
ITM	705615, 620660
Description	The parish church of Maudlintown (WX037-041001-) is situated on a low-lying landscape within a rectangular graveyard (dims. c. 50-55m E-W; c. 35m N-S) defined by masonry walls. The graveslab (WX037-042003-) is in the vicinity of the N side of the church, and the site of St Mary Magdalene's Well (WX037-040----) is c. 150m to the NE. Compiled by: Michael Moore. Date of upload: 14 December 2012.

RMP No.	WX037-042003-
Site Type	Graveslab
Townland	Maudlintown (Forth By.)
ITM	705614, 620676
Description	The lower end of a medieval graveslab (Wth 0.41-0.51m; T 0.13m; H 0.67m) with a raised fleur- de-lis terminal is used as grave-marker in the graveyard (WX037-042002-), in the vicinity of the N side of the church (WX037-032001-). Compiled by: Michael Moore. Date of upload: 14 December 2012.

Appendix 14.2 Previously Published Archaeological Excavations

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Previously Published Archaeological Excavations

Previously published archaeological excavations in the area from 1970 to 2017 (www.excavations.ie) are summarised below.

Excavation Ref. 1988:67

Bride St./South Main St., Townparks, Wexford

Sites and Monuments Record No.: N/A

Licence number: —

Author: Edward Bourke, Wexford Corporation, Municipal Buildings, Wexford.

Site type: Medieval urban settlement

ITM: E 704828m, N 621351m

The excavation at Bride St. was carried out between April 1988 and January 1989 and was funded by Wexford Corporation and the Office of Public Works. Post-excavation work, funded by the National Heritage Council and the friends of Viking Wexford, commenced on 30 January and will be finished during 1989.

The site is located on the west side of South Main St. at the corner of Bride St. in the parish of St Mary's. Excavations by Dr P.F. Wallace at Oyster Lane, and foundation digging at other sites on the eastern side of South Main St., indicate that the site would originally have faced onto the medieval waterfront of Wexford.

The 19th-century buildings which existed on the site were built on shallow stone wall footings and did very little damage to medieval stratigraphy. Excavation uncovered the foundations of fifteen post and wattle houses dating from the early 11th century to the late 13th/early 14th century. The site was waterlogged and organic preservation was excellent. The houses appear to be a local variant of the most common Dublin type house plan (Wallace, Type 1). Other structures including pits, footpaths and animal pens were also uncovered.

The site was divided into two properties in the early 12th century and this division remained static until the present day. During the 11th century the houses were laid out with no regard to the alignment of any previous houses.

Evidence for iron working, carpentry, shoemaking, comb making, bone working, spinning and weaving and the making of querns was uncovered. Finds of pottery included 13th-century sherds from South Leinster, Bristol and Bordeaux; 12th-century sherds from South West England; and unidentified stamped lead glazed pottery from 11th-century contexts.

Excavation Ref. 1988:68 - 89

North Main St., Townparks, Wexford

Sites and Monuments Record No.: N/A

Licence number: —

Author: Helen Roche, Dept. of Archaeology, University College, Dublin

Site type: Urban site

ITM: E 704428m, N 621751m

The site investigated consisted of the property at 89 North Main Street, Wexford and the owner funded the work. The street frontage had been occupied by a 19th-century two-storied shop. On demolition, this building was found to have been built directly upon a layer of builders' rubble and was without foundations or cellars. The site, which runs east-west fronts onto the west side of the street. The site measures 9m across the street front and 44m from front to rear.

Three test pits were dug during one day with the aid of a machine, all measuring 3m by 1m and oriented east-west. Each pit was excavated to a depth of c..8m or to approximately twice the depth that the foundations are expected to reach. The purpose of these pits was to determine the archaeological potential, if any, of the site and whether the development was likely to interfere with archaeological deposits.

The stratigraphy uncovered in all of these pits was remarkably similar. The lowest layer was sterile black estuarine mud of the type normally deposited naturally in broad shallow estuaries. Above this in all cases are layers of redeposited estuarine mud and builders' rubble. These layers are consistent with land reclamation and represent material brought onto the site to raise the level of the ground and to provide a firm surface for building.

Only one artefact was found during the excavation of these pits: the base of a black-glazed flat-based pottery jar found in Pit C, Layer 3. This find indicates that the reclamation may have taken place as late as the 18th or 19th century.

Neither the layers nor the pottery jar are of archaeological significance except that they indicate a late date the reclamation of this area of the town. The uniformity of the layers from the street to the rear of the plot indicate that the whole area may have been reclaimed at the same time.

Excavation Ref. 1988:69

Townparks, Wexford

Sites and Monuments Record No.: N/A

Licence number: —

Author: Edward Bourke, Wexford Corporation, Municipal Buildings, Wexford.

Site type: Urban Site

ITM: E 704528m, N 621951m

Test excavations took place on six sites within the three designated areas for urban renewal in Wexford town.

Cornmarket

Only one test pit was excavated on this site as only one small yard was available for excavation, the rest of the site being covered by derelict buildings in a dangerous condition. This site produced dumped 19th-century material to a depth of 1 .5m

Redmond Place (Meyler's Garage)

Ten test pits were excavated with the aid of a machine on this site. The stratigraphy in all of these pits was similar. In each case the upper 0.3m-0.5m consisted of 19th 20th-century builders' rubble. Below this, on the western side of the site, a deep deposit of black estuarine silt was encountered. On the eastern side, nearer the river, a deposit consisting of 18th-19th-century dump material 1.5m deep overlay the estuarine silt.

Wilson's Yard/Imperial Bar

Three test pits were excavated and here again 19th-20th-century builders' rubble directly overlay sterile estuarine mud on the western or landward side of the site. On the eastern side, closer to the river, a deposit of 19th-century dump material 1 3m in depth lay between the rubble and the estuarine silt.

These sites lie on land reclaimed from the River Slaney in the 18th and 19th centuries and stratigraphy encountered is consistent with the historical evidence for the reclamation.

West Gate/John Street (West Gate yard)

Seven test trenches were excavated on this site. In all of them the stratigraphy was similar. Beneath the 20th-century floors and road surfaces, deposits of early 20th-century dump material, consisting mainly of waste from industrial iron working, was encountered. In some of the cuttings disturbed boulder clay and 19th-20th-century material was encountered beneath this deposit. These layers directly overlay bedrock and from the surface profile of the bedrock it is likely that this area was used as a quarry in the 19th century.

The site is bounded on the west by the town wall and on the south by the precinct of St Selskar's Abbey. It is clear that whatever medieval deposits existed inside the yard were subsequently removed by the 19th-century activity on site. Prior to the excavation, it was noted that the town wall stood directly on a deposit of boulder clay, 25m thick, standing proud of the ground level in the yard.

Temperence Row

Three pits were excavated and in all of them a deposit of 19th and 20th-century brick rubble and organic material 0.3m—0.5m thick was encountered, lying directly on marl or estuarine mud. On the western or landward side the marl lay directly on bedrock. On the eastern side the estuarine mud was not bottomed.

John's Street

Four pits were excavated, in these the upper layer of humus contained early 20th-century pottery and bone, which overlay orange boulder clay, decayed shale and ultimately bedrock.

Excavation Ref. 1990:121

Westgate/Slaney Street/Temperance Row/Redmond Place, Townparks, Wexford, Wexford

Sites and Monuments Record No.: N/A

Licence number: —

Author: Edward C. Bourke, 62 Rockville Drive, Blackrock, Co. Dublin.

Site type: Urban

ITM: E 704828m, N 621951m

Westgate A limited excavation was carried out where the Wexford Main Drainage crossed the line of the town wall in the spawell Road opposite Westgate. The base of the town wall as uncovered sitting directly on rock outcrop. A small deposit of 13th-century material and a larger deposit of 14/15th-century material was found outside the town wall. The rock outcrop directly underlay the road surface inside the wall.

Slaney Street/Redmond Place

Rock outcrop reached the surface at the west end of Slaney street and monitoring of the digging of the sewer trench revealed the rock to be steeply sloping towards the line of natural shore. No datable deposits were uncovered. However, a thin organic deposit overlay the boulder clay, and above this lay a deposit of post-medieval landfill and box drains which increased in thickness as it came closer to the line of the natural shore. The natural shoreline occurred at the junction of Slaney Street and Selskar Street. All material uncovered east of this in Redmond Place consisted of 18th- and 19th-century land reclamation.

Temperance Row

The natural rock lay within c. 300mm of the surface in Temperance Row, thus no stratigraphy was uncovered.

Excavation Ref. 2001:1318

The Faythe, Townparks, Wexford, Wexford

Sites and Monuments Record No.: RMP 37:32

Licence number: 01E0103

Author: Mary G. O'Donnell, Archaeological Services Unit, Department of Archaeology, University College, Cork.

Site type: No archaeological significance

ITM: E 705286m, N 621122m

The site of a single house development at the Faythe, Townparks, Wexford, lay outside the walled town of Wexford, but within an area likely to have contained some suburban medieval settlement. The area known as 'the Faythe' is part of the zone of archaeological potential. Records dating from the 16th century indicate that at least 24 burgages existed in the street called Fayght Street (Colfer 1990–1, 22).

An archaeological assessment, including testing, was required by the planning authorities prior to the start of any work on the site. The test excavation was undertaken in February

2001. As there was no apparent archaeological content, no further archaeological requirement was recommended.

Reference

Colfer, B. 1990–1 Medieval Wexford. Journal of the Wexford Historical Society 13, 5–29.

Excavation Ref. 2003:2051

Newtown Road, Townparks, Wexford, Wexford

Sites and Monuments Record No.: N/A Licence number: 03E0268

Author: Anne Marie Lennon, for Mary Henry Archaeological Services Ltd, 17 Staunton Row, Clonmel, Co. Tipperary.

Site type: No archaeological significance

ITM: E 703487m, N 622158m

Monitoring was undertaken of all ground disturbance associated with a housing development. Nothing of archaeological interest was uncovered.

Excavation Ref. 2003:2061

Townparks, Waterloo Road, Wexford, Wexford

Sites and Monuments Record No.: N/A

Licence number: 02E1806

Author: Emmet Stafford, Stafford McLoughlin Archaeology, Unit 4, Enniscorthy Enterprise Centre, Milehouse Road, Enniscorthy, Co. Wexford.

Site type: Ditch

Monitoring of geotechnical test-pit excavation was undertaken at the site of a proposed development at Waterloo Road, Wexford, in December 2002 (Excavations 2002, No. 1941). The site is within Wexford town's zone of archaeological potential immediately to the south and west of a proposed development site that was tested and subsequently monitored under licence (Excavations 2002, 1940, 02E1684).

Little of archaeological significance was uncovered in the majority of the test-pits excavated. The fill of one large subsoil-cut feature was, however, uncovered towards the northern limit of the site. It is possible that the brown humic material uncovered represents the fill of a linear feature uncovered during the testing of the adjacent site (C11, 02E1684). The feature, which appears to run in a south-east to north-west direction, may represent an enclosing ditch, possibly associated with the site of a Franciscan priory (SMR 37:32(19)) located immediately north-east of the proposed development site. The priory was established in 1230 and was described at the suppression as consisting of a house, chapter house, belfry, dormitory, hall and kitchen with other buildings.

Further monitoring undertaken at the site in 2003 revealed no further features of archaeological significance. The utilisation of a pad and ground-beam substructure beneath the apartment block constructed on the site ensured the preservation in situ of the ditch feature uncovered towards the northern boundary of the site.

Excavation Ref. 2013:506

Townparks, Joseph Street, Wexford, Wexford

County: Wexford Site name: Townparks, Joseph Street, Wexford

Sites and Monuments Record No.: WX037-050

Licence number: 13E0462

Author: Rob O'Hara

Site type: No archaeological significance

ITM: E 704710m, N 621309m

Testing took place of a proposed school at Joseph Street and Green Street, Wexford at the site of WX037-050 (windmill). Four test trenches totalling 155m were excavated across the site. A significant quantity of rubble and soil has been used to raise ground level within the site, up to 1.1m deep to the west and south, and greater than 2m to the east. Further testing is planned prior to construction. No features, structures or objects of archaeological significance were recorded.

8 Beat Centre, Stephenstown, Balbriggan, Co. Dublin.

Excavation Ref. 2014:459

Townparks, Joseph St Wexford, Wexford

Sites and Monuments Record No.: WX037-050----

Licence number: 13E0462

Author: Rob O'Hara

Site type: No archaeology found

ITM: E 704710m, N 621309m

A second phase of test trenching was undertaken at Wexford CBS in advance of an extension to the existing school. The first phase of testing (undertaken in December 2013 and described under a separate entry) was confined to areas outside of the sports pitches. This phase of testing involved the excavation of a further 150m of test trenches across the playing pitch, including the location of WX037-050—- (windmill). No finds or features of archaeological potential were recorded.

Archer Heritage Planning, 8 Beat Centre, Stephenstown, Balbriggan, Co. Dublin

Excavation Ref. 2015:340

St John's Graveyard, Townparks, Wexford, Wexford

Sites and Monuments Record No.: WX037-032015

Licence number: E004583

Author: Catherine McLoughlin

Site type: Medieval graveyard

ITM: E 704574m, N 621945m

Monitoring under ministerial consent was undertaken during conservation works at St John's Graveyard in Wexford. The works involved the importation of topsoil to counteract erosion problems in the graveyard. No artefacts were removed from the graveyard prior to the spreading of the new soil, which was then seeded with grass. A medieval window fragment was recovered from the surface of the graveyard and placed in a safe position. The church and graveyard of St John's date to the early 13th century and was a Knights Hospitaller foundation. There is a sarcophagus in the graveyard and the church does not survive.

Stafford McLoughlin Archaeology, Moonrise Farmhouse, Coolballow, Drinagh, Wexford.

Excavation Ref. 2015:467

Coolcotts Lane, Newtown/Townparks, Wexford, Wexford

Sites and Monuments Record No.: N/A

Licence number: 15E0504

Author: Niall Colfer

Site type: Rural

ITM: E 703052m, N 621339m

An assessment was undertaken at Coolcotts Lane, Newtown/Townparks, Wexford on behalf of Minetta Ltd. who have applied for planning permission from Wexford Co. Council to build a substantial residential development on the site. The proposed development site is a greenfield area consisting of 5.13ha.

Test trenching was undertaken on 28 and 29 October 2015. This involved the excavation of a single centreline trench and staggered offset trenches excavated using a tracked machine with a 2m wide ditching bucket. It revealed 0.3-0.5m of soil overlying orange/grey stony natural boulder clay. Occasional stone-filled land drains were uncovered. No features of archaeological significance were recorded. No further archaeological mitigation is recommended.

5 Ashdale Park, Terenure, Dublin 6w

Excavation Ref. 2016:063

'Old Gardens', Clifford Terrace, Townparks, Wexford, Wexford

Sites and Monuments Record No.: WX037-032

Licence number: 16E0051

Author: Catherine McLoughlin

Site type: Urban medieval

ITM: E 704856m, N 621589m

Testing and assessment was undertaken at a site bounded by St Mary's graveyard and a section of the town wall. A series of test trenches was excavated which showed a high build-up of post-medieval deposits, down to a depth of 1.8m. Excavation below this level did not occur as it was beyond the reach of the mini-digger.

Stafford McLoughlin Archaeology, Moonrise Farmhouse, Coolballow, Drinagh, Wexford.

Appendix 14.3 Maritime Archaeological Assessment 2018

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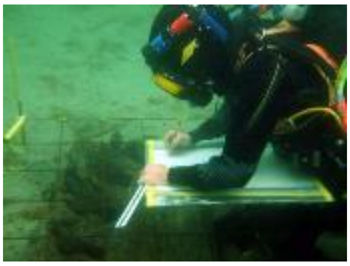
Maritime Archaeological Assessment
Trinity Wharf, Wexford

Leading Maritime Archaeology

Maritime Archaeological Assessment
Trinity Wharf, Wexford

15/01/2019

Project Director **Niall Brady**

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EXECUTIVE SUMMARY

Wexford County Council proposes to develop Trinity Wharf, Wexford, to create a mixed-use area on reclaimed land that formerly served as a dockyard and ironworks site. A marina and boardwalk will extend the development footprint into the active seabed to the north of the site. Underwater Archaeological Impact Assessment (UAIA) was carried out of this area in 2008 by ADCO for an earlier development proposal, and fresh assessment of the terrestrial element has been conducted by CRDS for the present proposal. The National Monuments Service has requested a revised UAIA, allowing for the passage of time since 2008. The present report is a first stage in the UAIA and is based on a walkover inspection of the development area. A second stage will be conducted in 2019, based on licensed underwater inspection and survey of the sub-tidal area.

The walkover inspection was conducted at Low Water on 11/12/2018. Elements of the former dockyard and the ironworks site are visible within the reclaimed land area. A stone-built navigation beacon stands at the south end of the reclaimed land, and the stem post of a known shipwreck extends above Low Water in the marine sector to the north.

The ground and seabed impacts will comprise:

- Site preparation, earthworks, drainage and utilities.
- Sea wall construction.
- Boardwalk construction.
- Marina.

The location of an apparently unassociated ship’s timber identified in 2008 lies within the proposed marina development.

This report finds no archaeological reason why the proposed works should not proceed.

Further archaeological mitigation is recommended:

- Underwater assessment of the proposed marina and boardwalk. Such work is licensed by the National Monuments Service.
- Archaeological topographic survey of the reclaimed land area and associated intertidal elements, to capture a detailed pre-disturbance record of the existing land surfaces.
- Review of Site Investigations logs to assess the nature of the buried strata.
- Archaeological monitoring of ground and seabed disturbance activities during the construction phase and associated elements, with the proviso to resolve fully any archaeological features identified. Such work is licensed by the National Monuments Service.

Recommendations are subject to the approval of the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.

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1.0 INTRODUCTION

Wexford County Council proposes to develop Trinity Wharf, Wexford, to create a mixed-use area on reclaimed land that formerly served as a dockyard and ironworks site (Figure 1). A marina and pedestrian link bridge/boardwalk will extend the development footprint into the active seabed to the north of the site. Underwater Archaeological Impact Assessment (UAIA) was carried out of this area in 2008 by the Archaeological Diving Company (ADCO) for an earlier development proposal, and fresh assessment of the terrestrial element has been conducted by CRDS for the present proposal that forms part of the Trinity Wharf Development Environmental Impact Assessment Report (EIAR).[1] The National Monuments Service (NMS) has requested a revised UAIA, allowing for the passage of time since 2008 that is to dovetail into the EIAR.[2] ADCO has been appointed by Roughan O'Donovan, consulting engineers on behalf of Wexford County Council to do so. The present report is a first stage in the UAIA and is based on a walkover inspection of the development area. A second stage will be conducted in 2019, based on licensed underwater inspection and survey of the sub-tidal area.

The walkover inspection was conducted by the author at Low Water on 11/12/2018 in the company of Wexford County Council engineer Fintan Ryan. Full access to the reclaimed area was possible. Elements of the former dockyard and the ironworks site are visible within the reclaimed land area. A stone-built navigation beacon stands at the south end of the reclaimed land, and the stem post of a known shipwreck extends above Low Water in the marine sector to the north.

2.0 THE RECEIVING ENVIRONMENT

The baseline data is set out in the previous archaeological assessment and chapters 14 and 15 of the current EIAR.[3] Trinity Wharf lies south of the historic town. There is one recorded terrestrial archaeological site within the development area, and that is the site of a Holy Well or sacred well (RMP reference WX037-038), which is located within the proposed entrance area to the new development (Table 1, Figure 2). The

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[1] Niall Brady, 'Trinity Wharf development, underwater assessment, at Townparks, Wexford. 08D005, 08R011', unpublished report of the Archaeological Diving Company Ltd, 2008; Aislinn Collins, 'Archaeological and cultural heritage', chapter 14 of Trinity Wharf Development EIAR, 2018; 'Architectural heritage', chapter 15 of Trinity Wharf Development EIAR, 2018.

[2] Correspondence from Department of Culture, Heritage and the Gaeltacht, reference G Pre00257/2018, dated 20/11/2018.

[3] See footnote 1.

well is marked on the 1839 and 1941 editions of the OS 6-inch map and described in gothic lettering as Trinity Well on both, and additionally as 'Site of' on the later map. It was most probably associated with the site of Trinity church (WX037-032014), whose location is not known but may be in the same general area. The well site is not visible at ground level.[4]

The active sea area retains a sequence of archaeological features. There are seven features associated with shipwreck close to the wharf: five lie to the north; one lies to the east; and a final element is located within the reclaimed area (Table 1).

Reference	ITM E	ITM N	Description	Proximity
WX037-038	705388	621290	Holy Well, site of	Within entrance area
W11596	705405	621441	Wreck. A sequence of three possible wrecksites recorded the UKHO database.	Adjacent to marina
W10637	705567	621405	Wreck. Frames of a wreck lying NE/SW standing proud of seabed; small part of forward section clearly visible, taken from 1955 aerial photograph (AP), entered onto UKHO database 1975.	Adjacent to east side of Wharf
W10641	705684	621262	Wreck. Identified on 1955 AP and entered onto UKHO database in 1975: frames of a large wreck lying NE/SW proud of the seabed, with bow hard against northern beacons marking entrance to boat park and training wall.	South of Wharf
08D005	705371 and 705384	621430 and 621445	Wreck. Coordinates taken at stem post and stern post. Originally identified in 2001, it survives as a stem post that rises 2.39m above the mudflat. Beneath the mudflat the ground is very flat and hard, suggesting that the vessel was dragged up onto the hard. The ribs and stern of the vessel are exposed. The timber is eroded but more perfectly preserved at depth where they are buried in mud. The vessel measures 19.69m long stem to stern, and is 4.62m in maximum width. This equates to a vessel that was 66½ feet long and over 15 feet wide. The vessel appears to survive with its keel in place and the ribs are in various states of eroded disrepair. Thirty-two ribs were detected on the port side. Fewer ribs are evident on the starboard side. On average the ribs are 11cm, 13cm and 14cm wide and squared in shape. The ribs are closely spaced together and appear to lie *c*. 25cm apart on average. In greatest dimensions the vessel is 4.62m wide. The stem post is formed from three pieces of timber. The outer timber also has a steel eye-bolt attached, onto which is tied a polypropylene rope and a short anchor	Adjacent to boardwalk

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[4] http://webgis.archaeology.ie/historicenvironment/

Reference	ITM E	ITM N	Description	Proximity
			has no real antiquity. There is otherwise an absence of metal on this wreck. The vessel was a sailing vessel.	
08D005	705422	621479	Timber. A loose ship's plank was identified. The plank retains holes for wooden pegs, *c*. 2cm–3cm in diameter, and is 2m long, 14cm wide and *c*. 10cm thick. It was unassociated and lay loose and on the seabed.	Within marina footprint

Table 1: Registered archaeological features at and in proximity to Trinity Wharf, Wexford.

The wharf itself is a block of reclaimed land that is integrally related to the later development of Wexford. Although none of its features are registered archaeological sites or sites of architectural heritage interest, they are *de facto* cultural heritage sites related to Industrial Archaeology and Contemporary Archaeology (Table 2). Reclamation works carried out in the 1830s are associated with John Edward Redmond, who reclaimed the northern portion of the Trinity Wharf site from the harbour and it was developed as the Wexford Dockyard, opening in 1832. The north corner of the dockyard comprised a patent slip, indicated on Ordnance Survey maps of the site (Figure 2a, Figure 3). The Wexford–Rosslare railway line opened in 1882 and part of its route ran alongside the western edge of Trinity Wharf, resulting in the embankment today that forms the shoreline north and south of the wharf (Figure 2b). Further reclamation at the end of the nineteenth century to the south of the Dockyard extended the wharf and created an area for the development of Wexford Engineering Company, which in turn became Star Iron Works. The extended facility allowed for the discharge of coke and scrap iron and a railway siding for loading and unloading of company waggons. It operated in this capacity until 1964. The northern part of the site was subsequently used as the Clover Meats Packing Yard, before being abandoned in the late 1980s.

Adjacent to the wharf and extending from its southeast corner are the remains of navigation aids. These comprise remnants of a breakwater that still functions to provide an enclosed inlet for light craft inside the breakwater, and presumably the same feature assists the natural scouring action within the navigation channel to help maintain access to the town's quayside. The wharf is built out to the breakwater. The very southeast corner of the wharf retains a stone-built navigation buoy, which is recorded on the historic OS maps as a 'pillar' (Figure 2B).

Reference	ITM E	ITM N	Description	Proximity
Dockyard	705456	621391	As recorded on the OS maps, the dockyard extended across much of the north end of Trinity Wharf and included a patent slip as well as a lesser slipway	Within development area

Reference	ITM E	ITM N	Description	Proximity
			to the south (Figure 3). An historic drawing depicts the yard in use in the mid-1900s (see EIAR Plate 15.2).	
Ironworks	705510	621332	The core area of the former ironworks lies within the northern half of Trinity Wharf and works extended to the southern section as reclamation continued in the late 1800s.	Within development area
Breakwater	705619	621329	The eastern limit of Trinity Wharf echoes that of the former breakwater, which may survive beneath the later reclamation works. A portion of the breakwater is recorded on the historic OS 25-inch map (Figure 2B).	Within development area
Beacon	705658	621317	A stone-built beacon that is circular in plan and conical in shape remains upstanding and occupies the very southeast corner to the wharf today.	Within development area

Table 2: Unregistered archaeological features at and in proximity to Trinity Wharf, Wexford.

3.0 SITE INSPECTION

The walkover inspection was conducted at Low Water on 11/12/2018. The author was accompanied by Fintan Ryan, Wexford County Council engineer. Full access to the wharf was possible, and no constraints were encountered. Inspection was based on non-intrusive walkover only, no dive work / sub-tidal was included.

The site is derelict, with all its former standing buildings demolished and the ground surface overgrown (Plate 1). Boundary walls survive, and various elements of former buildings are embedded in the walls, as described in chapters 14 and 15 of the EIAR. Remains of the former dockyard are evident. The most obvious element is the north-facing boundary wall that defines the northern limit of the wharf (Plate 2). The wall is referred to in EIAR chapter 15 as BH11 (Built Heritage feature 11). The wall is built of roughly-shaped squared red sandstone blocks and it retains a base batter. It has a series of red brick-lined drainage ports, some of which retain pipes. The wall was heightened on its landward side by shuttered concrete in the mid-twentieth century. The seaward corner of the wall is more derelict but it continues around as indicated on the nineteenth-century map, and elements of the wall return are evident along the east-facing perimeter (Plates 3–4). This permits the observation that the structure of the dock remains relatively intact, albeit buried beneath later concrete surfaces. A length of similar wall survives within the interior of the wharf, and this is identified as the former south wall of the dockyard. It is referred to in the EIAR as BH10.

Although derelict and overgrown, it is clear that the surface area of the wharf retains floors of the various buildings that were constructed on it, as evident in the spreads of floor tiles that occur (Plates 5–6). The site also retains evidence of the ironworks activities, in the form of extensive spreads of metal and vitrified ground (Plates 7–8). The archaeological mapping of same would inform the historical development of the site.

The remains of a wooden jetty survive on the east side of the site (Plates 9–10). It is not clearly identified on historic mapping and is probably related to the ironworks.

The navigation beacon stands at the southeast corner of the site (Plate 11). It predates the reclamation of Trinity Wharf and is associated with pre-existing efforts to assist navigation into and out of the harbour.

There was no sub-tidal inspection as part of the present report, and so no opportunity to inspect the seabed for the remains of shipwreck, both in relation to those sites recorded in the Historic Shipwreck Inventory, and in relation to those elements recorded in 2008. Nevertheless, the prow of the vessel described in 2008 remains visible at Low Water (Plate 12).

4.0 IMPACT ASSESSMENT

A summary plan of the development area is presented in Figure 4. The ground and seabed impacts from the works are set out in Chapter 4 of the EIAR, and will comprise:

- Site preparation, earthworks, drainage and utilities.
- Sea wall construction.
- Boardwalk construction.
- Marina.

Table 3 summarises the impact assessment.

Impact Stage	Known Site	Impacts	Mitigation
Site preparation, earthworks, drainage and utilities	WX037-038 Dockyard Ironworking site	Raising ground level Piling for foundations Localised excavations	Avoid known locations of archaeological sensitivity SI logs review Investigation Monitoring
Sea wall construction	Dockyard Ironworking site/timber jetty W10637	Removal of dockyard boundary wall. Removal of Ironworking site boundary and timber jetty. Impact on W10637 unknown.	Archaeological recording of boundary walls and timber jetty. Re-use of dockyard stonework and related elements where possible. Underwater inspection to confirm location of W10637 in relation to proposed works.
Boardwalk construction	W11596 08D005	Pile driven foundations	Avoid known locations of archaeological sensitivity Investigation/resolution if avoidance is not possible.
Marina	W11596 08D005	Pile driven foundations	Pre-development archaeological dive inspection of design footprint. Avoid known locations of archaeological sensitivity Investigation/resolution if avoidance is not possible.

Table 3: Impact assessment and proposed archaeological mitigations at Trinity Wharf, Wexford.

4.1 Site preparation, earthworks, drainage and utilities

The existing levels across the site vary but are on average around 2.0m OD. The proposal is for the development to be constructed above existing site levels in order to raise the entire site to a level of 3.5m OD, to safeguard against storm surge and wave action. Rather than large-scale excavation of existing ground level, it is intended to import good quality granular material. The proposal is to leave the contaminated made-ground in place and build up the level of the site to the desired finish floor level. The foundations for the buildings are intended to be piled and will be driven through the made-ground material.

Some soil stripping or excavation can be expected, particularly relating to the construction of the drainage proposals and the construction of the foul water pumping station. It is anticipated that pumping of the foul water will be required from the development site to the existing foul/combined sewer network due to the site's distance from public wastewater infrastructure and topographical constraints. The anticipated depth of this pumping station will approximately 4.5m below finished ground level and will therefore require approximately 2m depth of excavation into the existing made ground.

The construction of the buildings across the site will commence upon completion of the earthworks. The level of the whole development will be raised to the required finished floor level across the site. Following compaction of the imported fill material, a piling rig will be set-up at the locations of the required piles and steel piles will be driven from the finish floor level. The use of driven piles will mean that no arisings will be generated from the piling operations.

Upon completion of the pile driving operations, local excavations will be carried out around the driven piles to the extents and level required for constructing the reinforced concrete pile caps. The pile caps, columns, beams and slabs for the buildings' structures will be carried out using traditional reinforced concrete construction techniques.

Such works will reduce the impacts on existing ground levels and buried strata. It is however likely that there will be some direct impact on the former working levels of the dockyard and iron-working site. Archaeological input to the design process will mitigate this risk by advising avoidance of such areas. Consideration will include the location of the Holy Well site, WX037-038. Where avoidance is not possible, archaeological investigation and monitoring will be required.

4.2 Sea wall

A 2.4m-high revetment/sea wall with a 1m parapet wall along the sea adjacent perimeter of the site is to be constructed to protect the development against storm surge and wave action.

The existing sea wall bounding the site comprises a combination of shallow rock armour along the southeast edge; reinforced concrete wall along the northeast edge; and old stone masonry wall along part of the northeast edge and all of the northwest edge of the site.

The structural wall associated with the former dockyard on the northeast and northwest edges show signs of deterioration throughout and has been assessed to be inadequate to be maintained or rehabilitated for the proposed development.

In addition, due to the flooding requirements, the level of the development is required to be raised by approximately 1.5 to 2.0m above its current level. Utilising and modifying the existing sea wall for the purposes of this development is therefore considered to be unfeasible. As such, a new sea wall must be constructed around the perimeter of the site.

The proposed sea wall consists of a combination of a vertical sheet pile wall along the northeast and northwest edges of the site and a rock armour revetment along the southeast (EIAR Figures 4.17–4.18). The sheet piled wall comprises steel sheet piles to be installed around the coastal perimeter of the site to create a coastal defence level of approximately 3.5m OD in order to retain the levels of the development site. The sheet piles will be embedded into the stiff gravelly clay layer at approximately –10.5m OD. The sea wall design will consist of ground anchors or tie bars connected to a row of sheet piles driven into the made ground and located approximately 12m behind the retaining wall. A reinforced concrete capping beam will be constructed along the top of the wall within which the anchor head will be located, and a 1.4m high hand rail will be installed along the top of the capping beams.

Along the south-east edge of the site, rock armour will be placed on the seabed immediately in front of the sheet pile wall to form a 1:1.5 sloped revetment. The purpose of this is to reduce the possibility of wave reflection to the moored vessels in the harbour to the south.

The proposed works represent a direct and permanent negative impact on the sea-facing boundary walls of the former dockyard and the timber jetty to the south, and will remove them. Full archaeological recording of the walls and the jetty is required in advance of construction, and archaeological monitoring of the construction phase works is required, to record the detail of wall construction and the jetty as they are being exposed and removed. Consideration should be given to re-use of the stonework and any quayside furniture from the dockyard walls within a heritage context within the wider development or developments elsewhere along the waterfront.

The proposed works will also extend seawards the footprint for the development boundary. The location of recorded wrecksite W10637 lies adjacent to Trinity Wharf on this eastern side. The UAIA will seek to confirm the location and extent of W10637. The detailed design will seek to avoid impacting with the site. If avoidance is not possible, full archaeological recording, investigation and resolution of the impacted portion of the wrecksite will be required.

4.3 Boardwalk

The total length of the boardwalk is 180m between end supports and will have an internal width of 6m between handrails to accommodate both pedestrians and cyclists. The northern end of the boardwalk will tie-in to the existing promenade of Paul Quay and the southern end will tie-in to the public space immediately adjacent to the proposed hotel at Trinity Wharf (Figure 5).

The foundations for the boardwalk structure are proposed to be driven steel tubular sections which will be installed to immediately beneath the soffit level of the boardwalk deck where an integral connection will be made. These supports will be placed at 15.0m centres, and inserted with a marine piling rig into the seabed to rock level at approximately 8–10 below ground level. The north and south landings for the boardwalk will consist of reinforced concrete abutments where bearings will be provided for the deck.

The boardwalk is proposed to be connected into Paul Quay Promenade to the existing footpath and a reinforced concrete channel is proposed to form the approach ramp to the superstructure. The construction of this ramp will mean that the existing car park will be excavated to the required formation level at which point piled foundations for the approach ramp will be constructed. No construction in the sea is proposed for the construction of the boardwalk abutment or approach ramp.

The known and charted locations of shipwreck debris, as indicated in Table 1, are to be avoided. In addition, the UAIA to take place will inspect the seabed along the proposed route of the board, to assess whether additional features are present exposed on the seabed, and these findings will inform the detailed design stage in advance of construction commencing. Impact avoidance is the preferred mitigation. Where avoidance is not possible, additional archaeological mitigation will be necessary that might include underwater investigation.

4.4 Marina

The design of the marina includes creating a sheltered marina area with 61 berths by constructing a series of high-end pre-fabricated 5m-wide floating breakwaters with skirts that will be tethered to the seabed. This design means that no dredging is required to achieve the desired minimum operating depth of –2.5m CD.

It is proposed that the floating pontoons of the marina will be constructed using industry standard modular pontoon and finer units. Pontoon berths and walkways will be restrained using tubular piles driven into the seabed. An alternative method to this the use of helical anchors being drilled into the seabed which will connect and secure the pontoon berths and walkways. A single gangway that will be pivoted on the reclaimed deck and rested on the main walkway will provide access to the proposed marina area.

The location of the proposed marina has been selected to minimise navigational restrictions within the existing approach channel to Wexford Harbour, and minimise sedimentation and impacts on the shellfishery industry.

Pile sockets will be pile-driven for the breakwater units and the pontoon walkways. Vertical steel piles will then be grouted into the pile sockets. Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units and pontoon walkways and finger berths.

The known and charted locations of shipwreck debris, as indicated in Table 1, should be avoided. However, the location of a loose ship's plank was identified in 2008 at approximately 305495E 121428N, which is now within the development footprint for the marina. The plank retains holes for wooden pegs, c. 2cm-3cm in diameter, and is 2m long, 14cm wide and c. 10cm thick. It was unassociated and loose and on the seabed; it may have washed in with the tide or become dislodged from the wrecksite to the southwest. The UAIA that is to take place in advance of the marina, will inspect the location of the loose timber and confirm its presence/absence where possible. The inspection will also consider the seabed along the proposed route of the marina and the boardwalk, to assess whether additional features are present exposed on the seabed. These findings will inform the detailed design stage in advance of construction commencing. Impact avoidance is the preferred mitigation. Where avoidance is not possible, additional archaeological mitigation will be necessary that might include underwater investigation.

5.0 MITIGATION

This report finds no archaeological reason why the proposed development should not proceed.

5.1 Pre-construction Measures

UNDERWATER ASSESSMENT of the proposed marina and boardwalk. Such work is licensed by the National Monuments Service. This work will be carried out as part of the required UAIA, which will also inspect the known underwater archaeological elements adjacent to the development area.

In the event that the underwater assessment identifies features that will be impacted by the construction phase, further archaeological mitigation will be required and may include investigation and excavation.

ARCHAEOLOGICAL TOPOGRAPHIC SURVEY of the reclaimed land area and associated intertidal elements is required to capture a detailed pre-disturbance record of the existing land surfaces. This work will prepare detailed topographic mapping that enables metrically accurate 1:20 plan, elevation and section drawing. It will be necessary to capture a stone-by-stone record of the dockyard walls and fabric. The record will serve as the permanent record of this element that will be destroyed or otherwise permanently buried by the development.

5.2 Construction Phase Measures

REVIEW OF SITE INVESTIGATIONS LOGS to assess the nature of the buried strata.

ARCHAEOLOGICAL MONITORING OF GROUND AND SEABED DISTURBANCE ACTIVITIES during the construction phase and associated elements, with the proviso to resolve fully any archaeological features identified. Such work is licensed by the National Monuments Service.

5.3 Project Management Measures

An ARCHAEOLOGICAL CONSULTANT experienced in and specialising in maritime archaeology should be appointed to the project to advise the design team on archaeological matters, liaise with the state regulators, prepare archaeological licence applications and complete archaeological site work.

ARCHAEOLGICAL MONITORING is licensed by the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht. The application for such a licence requires a detailed method statement, outlining the procedures to be adopted to monitor, record and recover material of archaeological interest during such work. Licence applications take four (4) working weeks to be processed and must be granted before archaeological-related work can commence.

THE TIME SCALE for the project should be made available to the archaeologist, with information on where and when the various elements and ground disturbances will take place.

SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of works commencing. This will allow for prompt arrival on site to undertake additional surveys and to monitor ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team, including an archaeological dive team, be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.

SECURE WET AND DRY STORAGE for artefacts recovered during the course of the monitoring and related work should be provided on or near those sites where excavation is required.

ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.

MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.

SPOIL should not be dumped on any of the selected sites or their environs.

POST-CONSTRUCTION PROJECT REPORT AND ARCHIVE. It is a condition of archaeological licensing that a detailed project report is lodged with the DCHG within twelve (12) months of the completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland.

PLEASE NOTE: All of the above observations and conclusions are based on the archaeological information and information supplied for the Trinity Wharf development project. Should any alteration occur, further assessment may be required.

PLEASE NOTE: the above recommendations are subject to the approval of the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.

Plate 1: View looking north from south side of Trinity Wharf, showing the abandoned and overgrown nature of the site.

Plate 2: North-facing boundary wall of Trinity Wharf, that served originally to define the edge of the nineteenth-century dockyard. The concrete additions are later.

Plate 3: View showing the northeast corner of the Trintiy Wharf boundary. The stonework below later concrete relates to the line to the older dockyard wall.

Plate 4: View looking west at river-frontage of Trinity Wharf. The stonework relates to former elements of the dockyard while the later concrete additions either side may mark where infill of the patent and related slipways has taken place.

Plate 5: View showing tiled surface that represents a former working area within one of the buildings at the north end of Trinity Wharf.

Plate 6: View looking east across the north end of the site showing various works surfaces that served as part of the buildings on Trinity Wharf.

Figure 7: View of molten material that has flowed between concrete copings on the east edge of Trinity Wharf, indicating the intensity of the ironworks activity.

Figure 8: Spread of molten metal debris at the south end of Trinity Wharf, another tell-tale sign of the metalworking activity and an indication of its presence at the most southern extremes of the site.

Plate 9: View looking south at the remains of a timber jetty that is integrated into the concrete copings of Trinity Wharf associated with the ironworking.

Plate 10: View looking east at a set of nine timber posts that formed a short extruded feature associated with the timber jetty.

Plate 11: View looking southeast from Trinity Wharf at the stone-built navigation beacon that predates the wharf and served as part of the aids to safe passage into and out of Wexford Harbour. The breakwater is also visible.

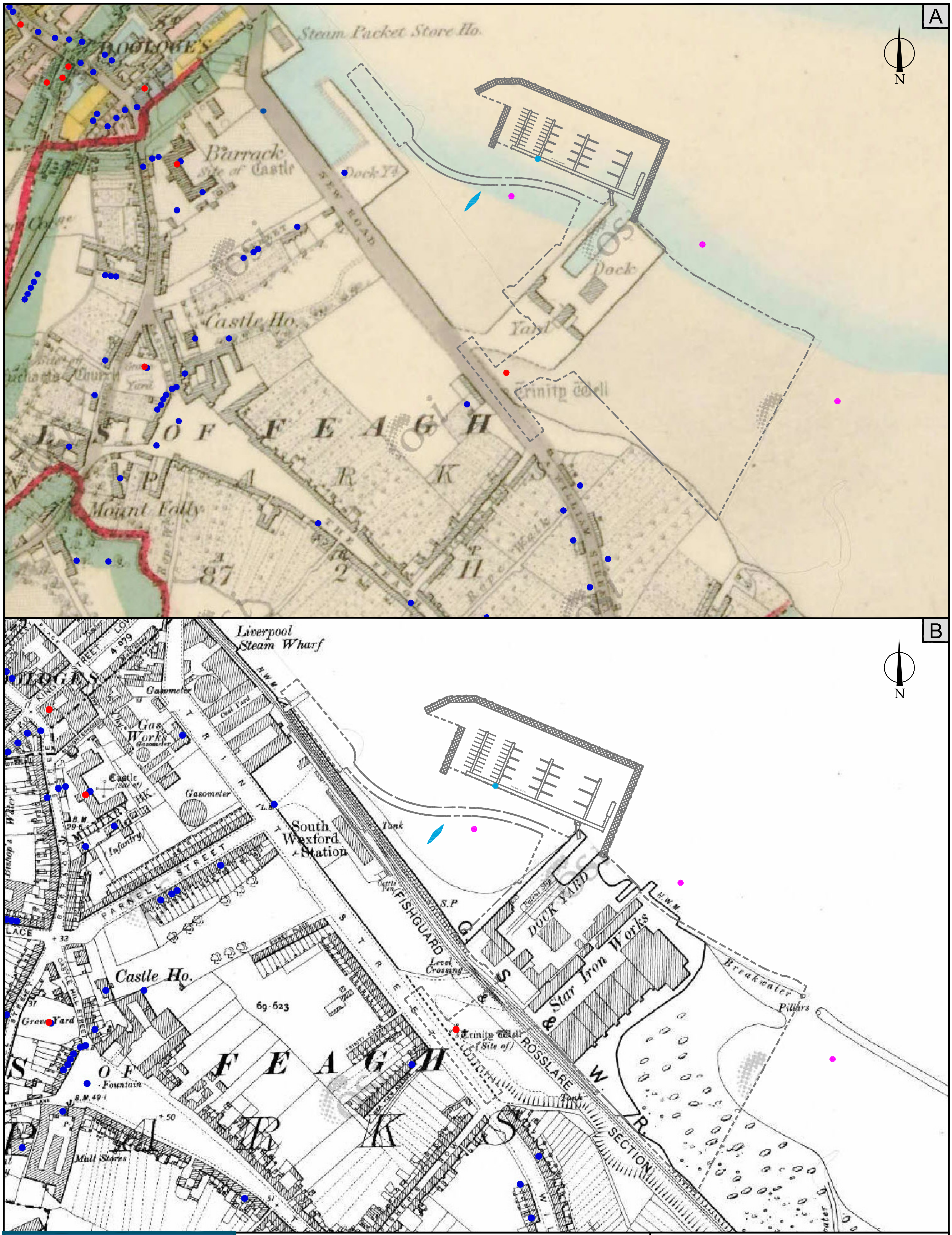
Plate 12: View looking north from the railway embankment at the prow or stem post of the timber vessel identified in 2001 and provisionally recorded in 2008.

ADCO

Notes
Source:
Main- OSi Discovery Series Mapping.
Inset- Google Satellite Image.

A4

Job/Exc No. ------	**Compiled by** R.Bangerter	**CAD reference** Trinity_Wharf	**Client** ROD/ Wexford County Council	**Title** Figure 1- Extract from OS Map showing location of proposed development at Trinity wharf, Wexford Harbour. Thumbnail: Satellite image with development superimposed.
Date 11.12.18	**Scale** 1:50,000/ 1:10,000	**Drawing No.** Figure 1	**Project** AIA, Trinity Wharf Development	



Notes

Source: OSi Historic Map Archive.

- - - Extent of Proposed Development

● Sites listed in the RMP ● Sites listed in the NIAH

● Sites listed in the Shipwreck Inventory

● Wreck sites identified as part of 2008 ADCO Assessment [licence Number: 08D005]

A4

Title

Figure 2-

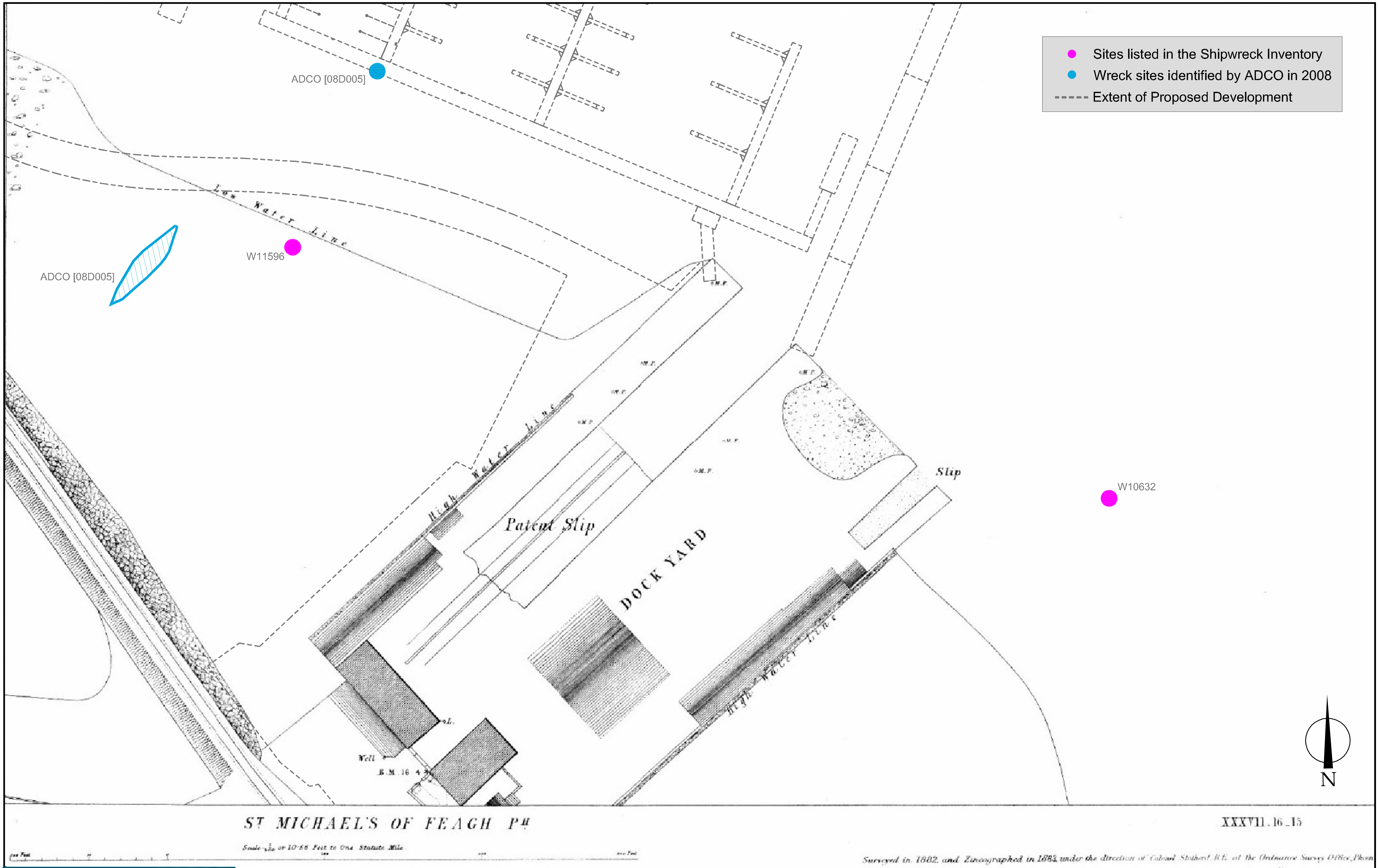
A). Extract from OS First Edition (1839) Map with extent of proposed development superimposed.

B). Extract from OS 25-inch Edition (c.1890) Map with extent of proposed development superimposed.

Client

ROD/ Wexford County Council

Project	**Job/Exc No.**	**Compiled by**	**CAD reference**	**Date**	**Scale**	**Drawing No.**
AIA, Trinity Wharf Development	------	R.Bangerter	Trinity_Wharf	12.12.18	1:4000	Figure 2



Notes
Source: UCD Map Archives,
Sheet XXXVII.16_10

A4

Job/Exc No.

Date
12.12.18

Compiled by
R.Bangerter

Scale
1:1000

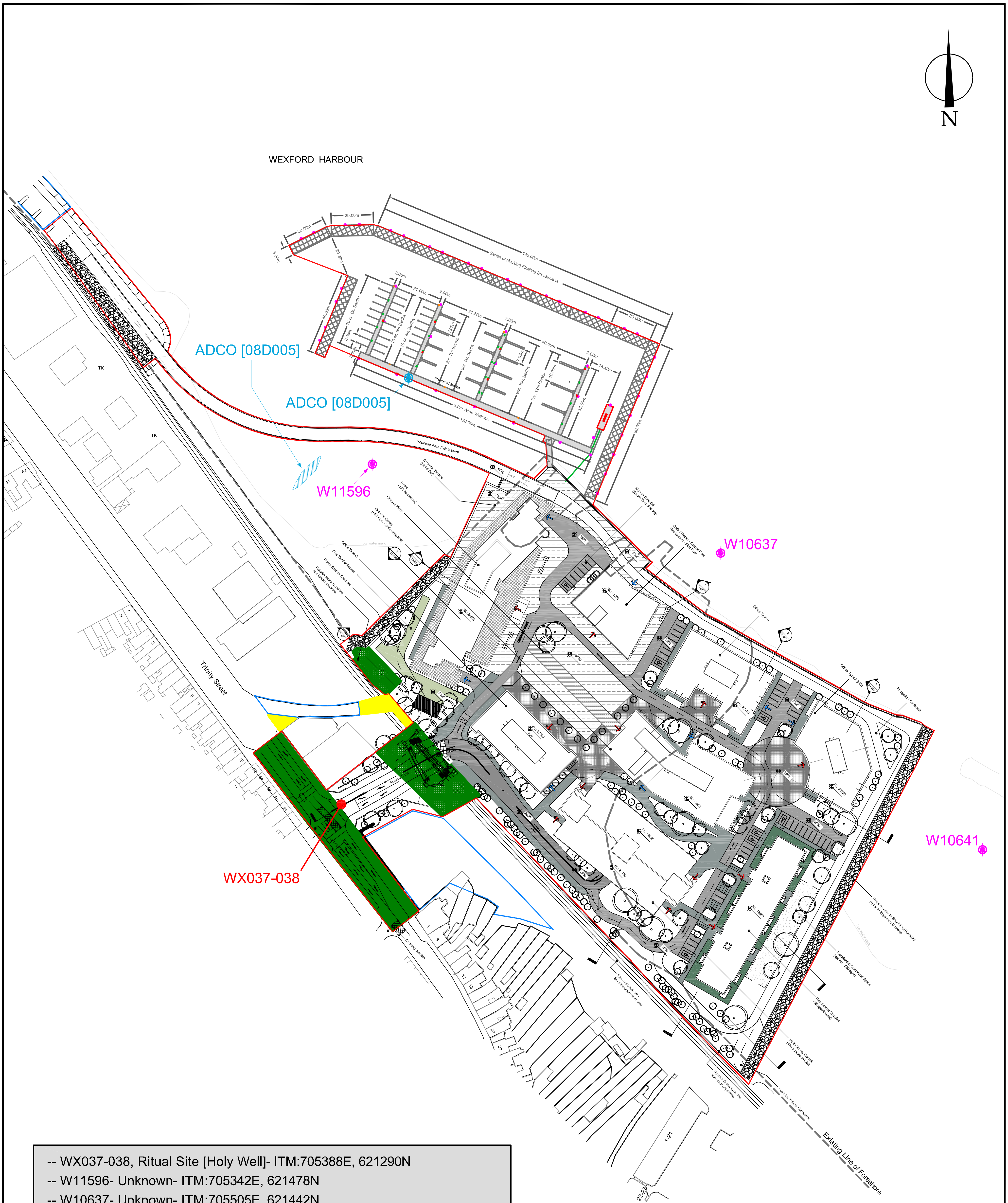
CAD reference
Trinity_Wharf

Drawing No.
Figure 3

Client
ROD/ Wexford County Council

Project
AIA, Trinity Wharf Development

Title
Figure 3- Extract from OS Map (1882) of Wexford Harbour showing extent of nineteenth-century Dock Yard and associated Patent Slip.



-- WX037-038, Ritual Site [Holy Well]- ITM:705388E, 621290N
-- W11596- Unknown- ITM:705342E, 621478N
-- W10637- Unknown- ITM:705505E, 621442N
-- W10641- Unknown- ITM:705622E, 621299N
-- 08D005- Timber Wreck- ITM:705371E, 621430N - ITM: 705384E, 621445N
-- 08D005- Ship's Timber- ITM:705422E, 621419N

Client
ROD/ Wexford County council

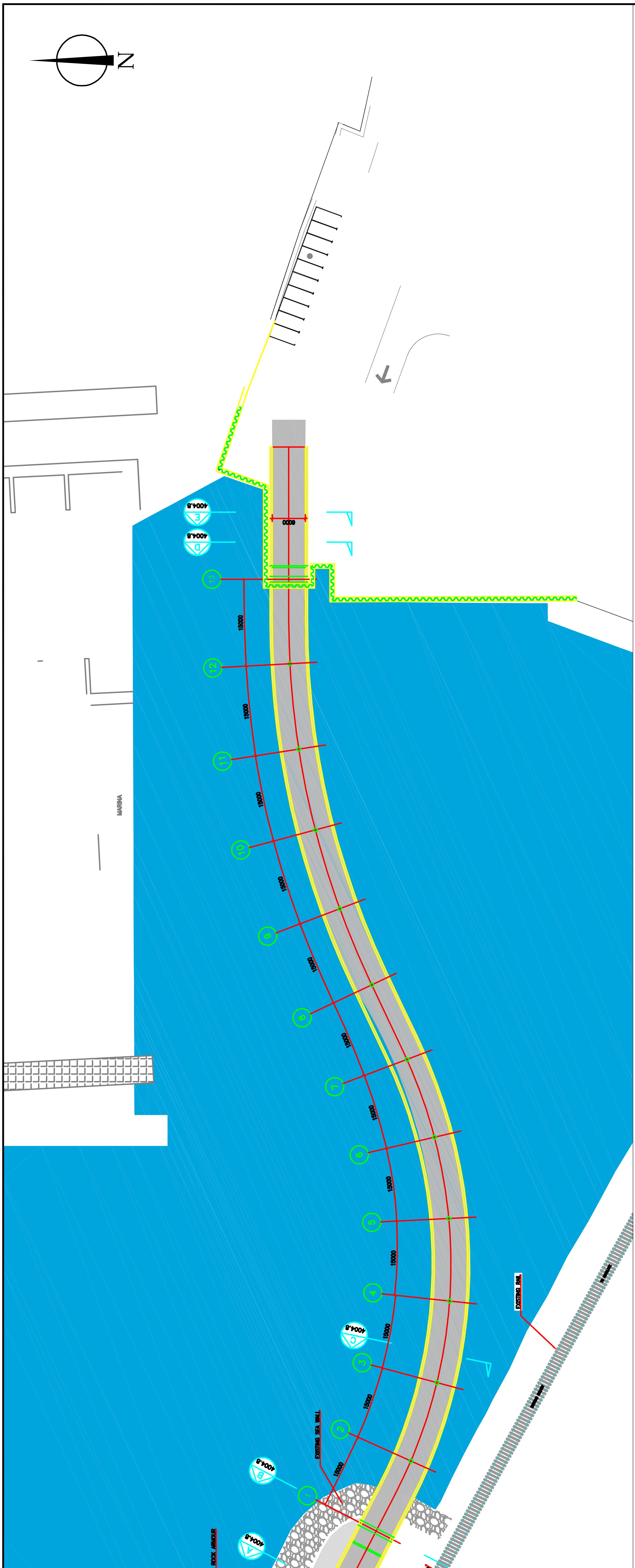
Notes
Source: Roughan & O'Donovan (ROD) Consulting Engineers
[RMP & Shipwreck Inventory sites superimposed by ADCO].

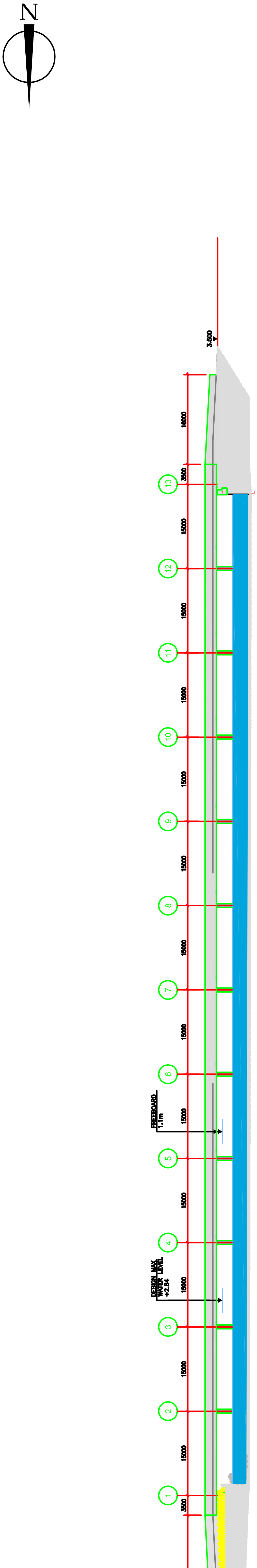
● Sites listed in the RMP ◉ Sites listed in the Shipwreck Inventory
● Wreck sites identified as part of 2008 ADCO Assessment [08D005]
— Development Boundary

A4

Title
Figure 4- Extract from Project Drawing Showing extent of proposed development at Trinity Wharf, Wexford Harbour.

Project	Job/Exc No.	Compiled by	CAD reference	Date	Scale	Drawing No.
AIA, Trinity Wharf Development	------	R.Bangerter	Trinity_Wharf	12.12.18	1:2500	Figure 4

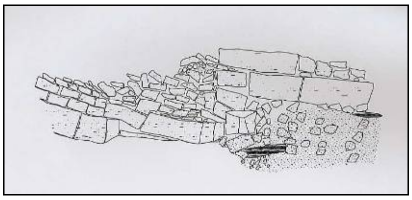


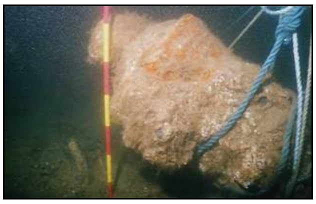


ELEVATION
A1 SCALE 1:350
A3 SCALE 1:700

Appendix 14.4 Trinity Wharf Development Underwater Assessment 2008

ROD
ROUGHAN & O'DONOVAN





TRINITY WHARF DEVELOPMENT
UNDERWATER ASSESSMENT, AT TOWNPARKS, WEXFORD

08D005, 08R011

THE ARCHAEOLOGICAL DIVING COMPANY LTD.

TRINITY WHARF DEVELOPMENT
UNDERWATER ASSESSMENT, AT TOWNPARKS, WEXFORD

08D005, 08R011

10 March 2008

Project Director **Dr. Niall Brady**

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THE ARCHAEOLOGICAL DIVING COMPANY LTD.

CONTENTS

EXECUTIVE SUMMARY

Archaeological intertidal and underwater assessment was conducted over a c. 310m NW/SE by 180m NE/SW area off Trinity Wharf, Wexford town, as part of pre-development requirements for a proposed hotel and marina development, Wexford Borough Council Reg. Ref. 6042 and W/2007/065.

Existing desktop survey undertaken for the present scheme identified a previous survey conducted in 2001 that indicated a wrecksite on the intertidal foreshore. Additional data supplied by the Department of the Environment, Heritage and Local Government (DoEHLG) indicated that a series of three wrecks were located in the same area. The present work sought to further assess the nature of the information, and to pinpoint the location and extent of any exposed wreckage for design purposes.

The intertidal and underwater assessment was conducted on 4 March 2008 under licence for non-disturbance survey from the DoEHLG, 08D005, 08R011. The assessment worked systematically across the intertidal and sub-surface mudflats. Data was logged and position-fixed using a hand-held GPS unit.

No archaeologically significant material was observed on the seabed of the proposed marina.

The site of the proposed hotel complex retains the north-facing wall of a nineteenth-century dock yard. This defines the southern side of the development. The seabed area retains a considerable amount of modern debris, in terms of discarded junk and some anchors, perhaps stored securely over winter under the protective walls of the former meat factory at the south end of the site. The wrecksite identified in 2001 is still clearly visible. It 19.69m long, stem to stern, and is 4.62m in maximum width. The vessel appears to survive with its keel in place but with diminished ribs due to erosion. No side planking was evident but it remains possible that the lowest planks survive in the portion that remains buried by the mobile mudflat. While the vessel is not obviously ancient in origin, the absence of metal in its fabric, apart from a recent steel eye-bolt applied to its stempost, and a series of two earlier iron bolts also attached to its stempost, perhaps as a repair, suggests that the vessel retains interest as a craft of local and historic origin. Its stempost is located at 305444E 121379N; its stern at 305457E 121394N. This position places the wrecksite 20m west of the location for the three wrecks noted in the DoEHLG files.

The development proposes to extend along most of the dockyard wall. It also proposes the construction of a car park area over the location of the wrecksite. Direct impacts therefore appear to be inevitable.

A programme of further archaeological mitigation is recommended, both to record in detail the dock yard wall fabric, and to resolve the details of the wrecksite/s in this area in advance of development works proceeding. In order for the further information to be gained from the exposed wrecksite, it is recommended that the enveloping sands be removed to more fully survey the site; to ascertain the survival of outer planking and related internal details; to seek a suitable sample for dating; and to verify whether the site represents a single wreck in isolation or is part of the complex of three sites identified previously in the DoEHLG files. If the wreck is more than 100 years old it would be treated as an archaeological site, and its resolution would require the full mitigation strategy expected of such. In this instance, such work may require the excavation in total of the wreck and any associated features, to the requirements of the DoEHLG and the National Museum of Ireland.

Similarly, test trench investigation of the mudflats at the site location of the DoEHLG records may clarify whether the archaeological impact area extends beyond the exposed wrecksite.

Recommendations are subject to the approval of the Department of the Environment, Heritage and Local Government.

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1.0 INTRODUCTION

The Archaeological Diving Company Ltd (ADCO) was appointed by Tom Philips and Associates, Town planning Consultants, to conduct an intertidal and underwater survey of the seabed off Trinity Wharf, Wexford town, as part of the pre-development assessments associated with a hotel and marina development project, Wexford Borough Council Reg. Ref. 6042 and W/2007/065. The work was conducted under licence from the Department of the Environment, Heritage and Local Government (DoEHLG) as a non-disturbance dive inspection and metal detection survey, on 4 March 2008, licences 08D005 and 08R011. The site is located immediately north of the former Clover Meats Packing Yard, and off the present quayside (see Figure 1).

2.0 PROPOSED DEVELOPMENT

The permitted development reclaims the portion of the seabed adjacent to the former meat packing yard for use as a hotel complex, while the current proposal covers a second area to its north as an associated pontoon marina (Figure 1).

3.0 RECEIVING ENVIRONMENT

The archaeological potential of this scheme has been addressed by Maurice Hurley for this scheme, which is appended to this report as the report must issue separately to the DoEHLG to fulfil licensing requirements.[1] The Ordnance Survey First Edition map indicates that the site used most recently as the Clover Meats Packing Yard served as a Dock Yard in the nineteenth century (Figure 2). Figure 2 also shows the extent of the tidal mudflats in the nineteenth century, and the degree to which the dock yards exploited access to the narrow navigation channel by building right up to it.

It is therefore perhaps of no surprise that this location was known to shipping. A survey conducted in 2001 identified the stem of a timber vessel standing proud of the mudflat, with remnants of its profile and ribs surviving.[2] That observation has occasioned the present report, in an attempt to locate the vessel more accurately and assess its character.

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[1] Maurice Hurley, 'Archaeological and Cultural Heritage'-Chapter 17 (i).
[2] Detailed in Hurley and based on Licence 01D0137, reported by Máire Ní Loingsigh.

The DoEHLG made available some new data in its Historic Shipwreck Inventory that was not available at the time of Hurley's assessment, which indicates the presence of several shipwreck sites and one shipwreck cluster in the immediate environs (Figure 1, Wrecks 1-3, 4 and 6), Table 1:

	Original (UKHO)		OSi Conversion			
Wreck	Latitude	Longitude	Latitude	Longitude	Easting	Northing
1-3	52 20 04N	06 27 12W	52 20 04.000 N	06 27 12.000 W	305478.999	121390.106
4	52 20 02.75N	06 27 03.5W	52 20 02.750 N	06 27 03.500 W	305640.763	121354.914
6	52 19.967N	06 26.958W	52 19 58.020 N	06 26 57.480 W	305757.878	121211.161

Table 1: Coordinates of Wreck Data in DoEHLG Historic Shipwreck Inventory, in the immediate environment of the Trinity Wharf development. Based on data acquired from United Kingdom Home Office (UKHO) files.

The entries are detailed as follows:

- Wrecks 1-3: three wrecks noted in UKHO database.
- Wreck 4: frames of wreck lying NE/SW standing proud of seabed; small part of forward section clearly visible, taken from 1955 aerial photograph (AP), entered onto UKHO database 1975.
- Wreck 6: located today in what may be the brownfield reclamation, but identified on 1955 AP, and entered onto UKHO database in 1975: frames of a large wreck lying NE/SW proud of the seabed, with bows hard against northern beacons marking entrance to boat park and training wall.

This data is based on observations made from aerial photographs studied and annotated in 1975 by the UKHO.[3]

The site, Wrecks 1-3, is the only location noted within the survey area; the other two sites being located outside the proposed development area. The details provided for site Wrecks 1-3 are minimal but suggest that three wrecks were noted abandoned in this location.

In addition to the assessment of the known wrecksite, the present survey aimed to correlate that information with the UKHO data. It further sought to conduct a general intertidal and underwater assessment and metal-detector survey of the larger development footprint, to further assess the archaeological potential over the proposed development.

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[3] Information courtesy of the DoEHLG Historic Shipwreck Inventory.

4.0 ARCHAEOLOGICAL ASSESSMENT

Methodology

Site assessment of the proposed hotel and marina footprint was conducted during Low Water, which permitted more than 70% of the site area to be walked over in the 'dry'. The remaining assessment was conducted as a diving operation, which took place during the same incoming tide.

The intertidal survey was conducted by walking the shoreline systematically, recording details along the existing quaysides, and continuing out onto the sand and mudflats. The wrecksite itself was subject to its own more detailed survey, using a tape measure to elicit the specific measurements.

The dive work was conducted by tending the diver from the shore, with pendulum searches proceeding from three primary locations, ensuring full coverage of the diver environment:

- Shoreline location on the existing quayside, to cover the extension of the marina below the present-day rock armour.
- Beach location beside surface water outfall, to cover marine/hotel footprint.
- Dockyard/Meat factory location at most seaward extent, to cover the seaward/navigation channel area and landwards section of the hotel footprint that remains under the permanent waterline.

Site conditions were very good. Clear skies, a slowly filling tide, and 3-4m underwater visibility proved to make the job expeditious and complete.

Seabed Topography

The bulk of the seabed is covered with an interitdal mudflat that is highly mobile and dynamic. A wet, slimey sand covers the natural substrate of hard gritty sand, which is apparent along the shoreline and at the navigation channel (Plates 1-2). The topography is otherwise relatively featureless until the deeper water is reached below Low Water, where a steep fall is noticeable and the bed drops away by 3-4m.

Observations

Dock Yard

The old north-facing quay wall of the former dock yard and later meat factory is well preserved at the south end of the site. It is made of a schist/metamorphic rock that is roughly shaped. It includes a base batter, and retains a series of red brick-lined drainage ports, some of which retain pipes (Plate 3). The seaward corner of this wall is much more derelict but it continues around as indicated on the nineteenth century map, and therefore it may be concluded that the structure of the dock remains relatively intact. The landward side of this element has been infilled but it is clear from the surviving stonework that the basal structure of the dockyard remains intact.

Railway Embankment

The southwest side of the foreshore is defined by the current embankment for the railway, which postdates the First Edition map but is itself an example of the good stone masonry of that era (Plate 4). To the north of the embankment, modern reclamation has added a car park and quayside that masks the second dock yard which is recorded in this location on the nineteenth century maps (Plate 5).

Seabed

Metal detection registered countless hits but in all cases these were due to recent dumping of debris and related junk material, while in some instances along the base of the Dock Yard wall the hits relate to modern iron anchors which seem to be placed here for safe-keeping, perhaps over winter. In the area of the proposed marina, beside the recently reclaimed land, angular boulders relating to the rock armouring event litter the seabed, while at the very north end of the site a slight rise of the seabed level was associated with an array of rope and iron encrustations, which was associated with shellfish remains, and seem to suggest the remnants of mussel farming. Deep mud covers most of the seabed area below the Low Water mark, with occasional boulders or cobbles sticking out. A loose ship's plank was identified at approximately 305495E 121428N. The plank retains holes for wooden pegs, c. 2cm-3cm in diameter, and is 2m long, 14cm wide and c. 10cm thick. It was unassociated and loose and on the seabed; it may have washed in with the tide or become dislodged from the wrecksite. It was replaced at its findspot.

Wrecksite (Figure 3, Plates 6-10)

The wreck identified in 2001 was revisited. It survives as a stem post that rises 2.39m above the mudflat, which in turn is up to 40cm deep at this point. The wreck is located 24.4m from the High Water Mark on shore. Beneath the mudflat the ground is very flat and hard, suggesting that the vessel is not buried in ancient estuarine mud but was dragged up onto the hard and left to allow the tidal mudflats develop around it. In addition to the stem, the ribs and stern of the vessel are exposed at the top of the mudflat. The timber is in an eroded state and it is clear that exposed timbers are thicker and more perfectly preserved at depth where the muds have helped to preserve them from constant exposure during Low Water. The vessel is effectively timber-built. It measures 19.69m long, stem to stern, and is 4.62m in maximum width. This equates to a vessel that was 66 and a half feet long by more than 15 feet wide (allowing for the fact that the ribs are not surviving fully and therefore cannot reflect the original width of the vessel). The vessel appears to survive with its keel in place and the ribs are in various states of eroded disrepair. There is no indication of side-planking but since the very base of the vessel is buried in mud it is possible that remnants survive *in situ* there. A total of thirty-two ribs were detected on the port side, commencing 3.3m from the stern, and ending 4.98m from the bow. Fewer ribs are evident on the starboard side, commencing 10.50m from the stern and ending 7.63m from the bow. On average the ribs are 11cm, 13cm and 14cm wide and squared in shape, but thicknesses as much as 17cm and as little as 8cm were also observed. The full widths of the ribs are masked by the muds which cover the central area of the wreck. The ribs are closely spaced together and appear to be separated by c. 25cm on average. In greatest dimensions the vessel is 4.62m wide. The stem post is formed from three pieces of timber, 2.39m long (exposed) and 24cm wide; the middle timber is the thickest at 28cm, while the inner timber is 20cm thick and the outer timber is 12cm thick. The outer timber has had two iron bolts driven through to tie it to the middle timber. It may represent a repair to the bow section. The outer timber also has a steel eye-bolt attached, onto which is tied a polypropylene rope and a short anchor has no real antiquity. The steel eye, rope and anchor are presumably recent attachments, perhaps added to secure the vessel to the site when it was abandoned.

Apart from the steel eye-bolt and the two iron bolts, there is an absence of metal on this wreck. Metal-detection located several anomalies towards the stern port side, but in all instances these turned out to be recent wash-ins of junk and debris. Had the vessel accommodated an engine, it would be expected that a large metallic signature would be identified in the midships stern section, but this is not the case. It may be concluded therefore that this served without an engine and was therefore a sailing vessel. The absence of metal suggests that the vessel retains interest as a craft of local and historic origin.

The stempost is located at 305444E 121379N; the stern at 305457E 121394N. The position places the wrecksite 20m west of the location for the three wrecks noted in the DoEHLG files. There are no indications of any wreckage material protruding above the location of Wrecks 1-3, as defined by the UKHO records.

5.0 DISCUSSION

The details arising from the present survey highlight the seabed off Trinity Wharf as preserving aspects of Wexford's maritime past, both in terms of the dock yard walls structure, and the abandoned timber vessel. The proposed development will impact both these locations and consequently it is may be anticipated that further archaeological mitigation will be required as part of the development requirements.

6.0 PROPOSED IMPACTS

The development proposes to extend along the dockyard wall, where a car park facility to serve the hotel and associated features will be built against the shoreward half of the wall (Figure 4). In accordance with Condition 30 of the permission granted under 6042, an archaeological survey will be conducted of the dockyard wall in advance of the development, to more fully record the nature, extent and fabric of this piece of Wexford's maritime and industrial history.

The development also proposes to extend the carpark over the location of the identified wrecksite, and that of the UKHO Wrecks 1-3 charted location. While it is possible that the latter refers in fact to the former, and that the c. 20m variation in distance is a feature of mapping discrepancy from aerial photographs, the suggestion remains to be proven. Given the timber nature of the known wrecksite, it appears to represent a remnant of local ship-building craft and therefore will be further explored/recorded prior to development works proceeding.

The proposal to construct a pontoon marina does not appear to represent any direct impact with fearures of known archaeological significance.

7.0 RECOMMENDATIONS

Pre-construction Measures

The dock yard wall will be archaeologically surveyed in detail, to record the fabric and extent to the wall, to provided scaled 1:20 drawings, in plan, elevation and sectional drawings that will more fully establish a clear record of what is a feature of the town's industrial maritime heritage.

Archaeological investigation of the UKHO Wrecks 1-3 site will be conducted to clarify the presence/absence of wreckage in this location.

Archaeological investigation and survey will be conducted on the known wrecksite, to more fully record the detail of this timber vessel, to ascertain a sample for dating, and to inform more clearly the maritime history that it belongs to.

If the wreck is more than 100 years old it would be treated as an archaeological site, and its resolution would require the full mitigation strategy expected of such. In this instance, such work may require the excavation in total of the wreck and any associated features, to the requirements of the DoEHLG and the National Museum of Ireland.

All the above work is subject to licensing by the DoEHLG.

Construction Phase Measures

ARCHAEOLOGICAL MONITORING. Archaeological monitoring licensed to the Department of the Environment, Heritage and Local Government will be conducted for ground and seabed disturbance works associated with this scheme. A suitably qualified archaeologist will undertake the archaeological monitoring under licence from the Department of the Environment, Heritage and Local Government. The archaeological monitoring will be undertaken with the proviso for full excavation of any archaeologically significant material uncovered as part of the operation.

RETAINING AN ARCHAEOLOGIST/S. An archaeologist will be retained for the duration of the relevant works.

THE TIME SCALE for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances and dredging will take place.

SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of the construction works commencing. This will allow for prompt arrival on site to monitor the ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. The core of a suitable archaeological team will be on call to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.

FENCING/BUOYING of any such areas would be necessary once discovered and during excavation.

ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.

MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.

SPOIL should not be dumped on any of the selected sites or their environs.

PLEASE NOTE: All of the above recommendations are based on the information supplied for the Trinity Wharf development project. Should any alteration occur, further assessment maybe required.

PLEASE NOTE: Recommendations are subject to the approval of The Department of the Environment, Heritage and Local Government.

8.0 ACKNOWLEDGEMENTS

Thanks are extended to Julie Costello for Tom Cronin and Associates. The additional UKHO data was supplied by the Underwater Archaeology Unit, DoEHLG. The dive team constituted Dr. Niall Brady, Brian MacAllister (Dive Supervisor), and Dr. Edward Pollard.

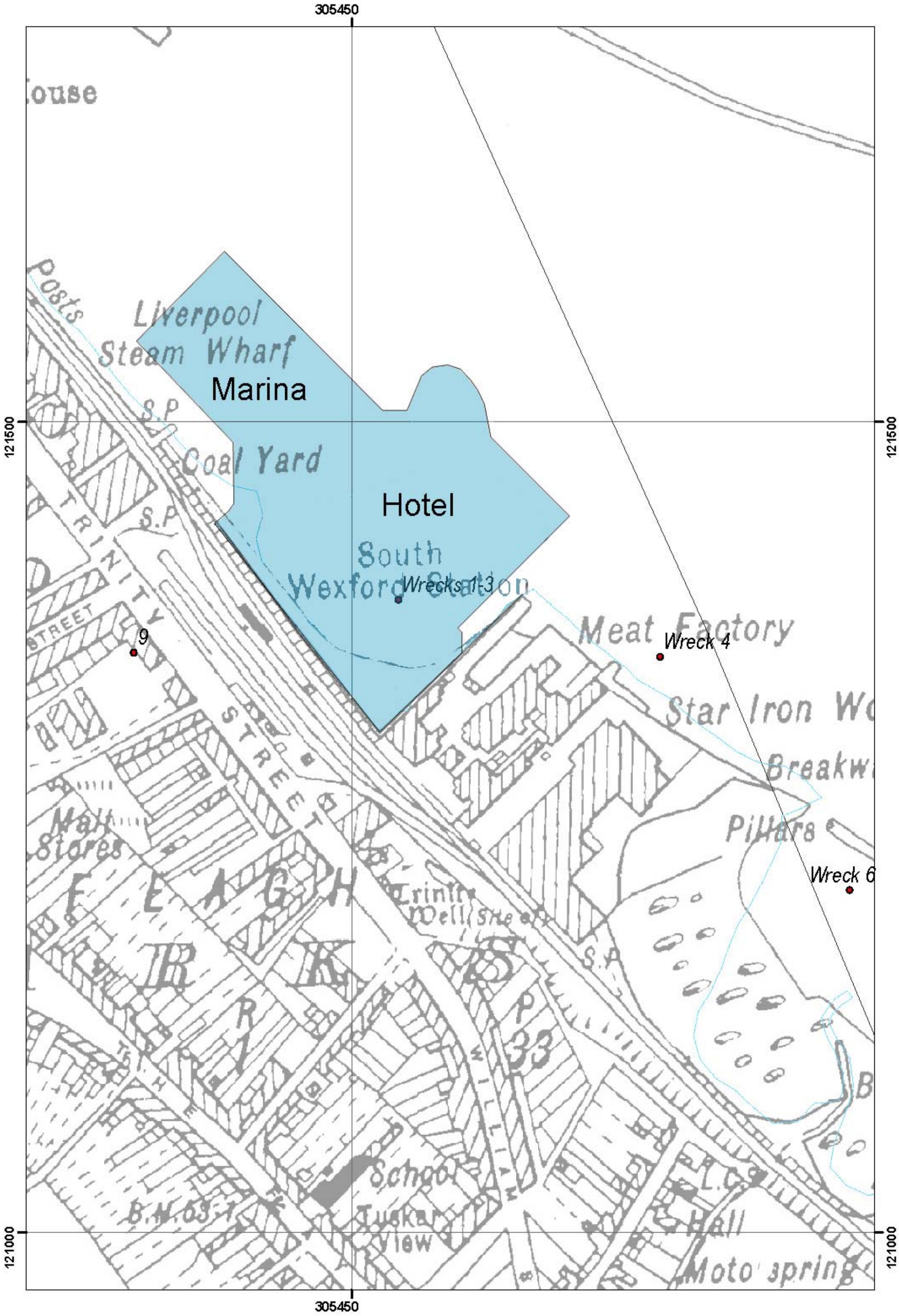

Figure 1: Location of development highlighted in blue, and showing the known seaward archaeological indicators, based on OS six-inch series. Source: Discovery Programme.

Figure 2: Detail from Ordnance Survey First Edition mapping (1842), showing the present development area (highlighted in red) as a green field site. Source: Sheila Lane and Associates

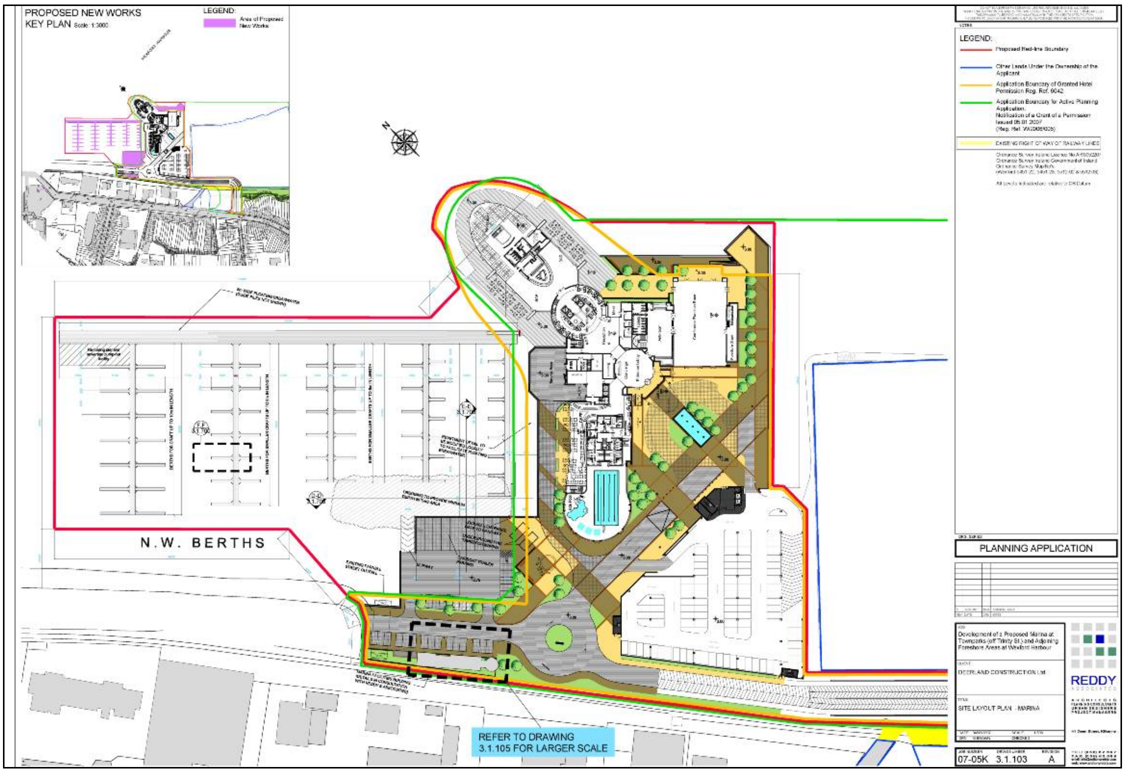

Figure 3: Project design plan summarizing the primary features proposed for the Trinity Wharf development.

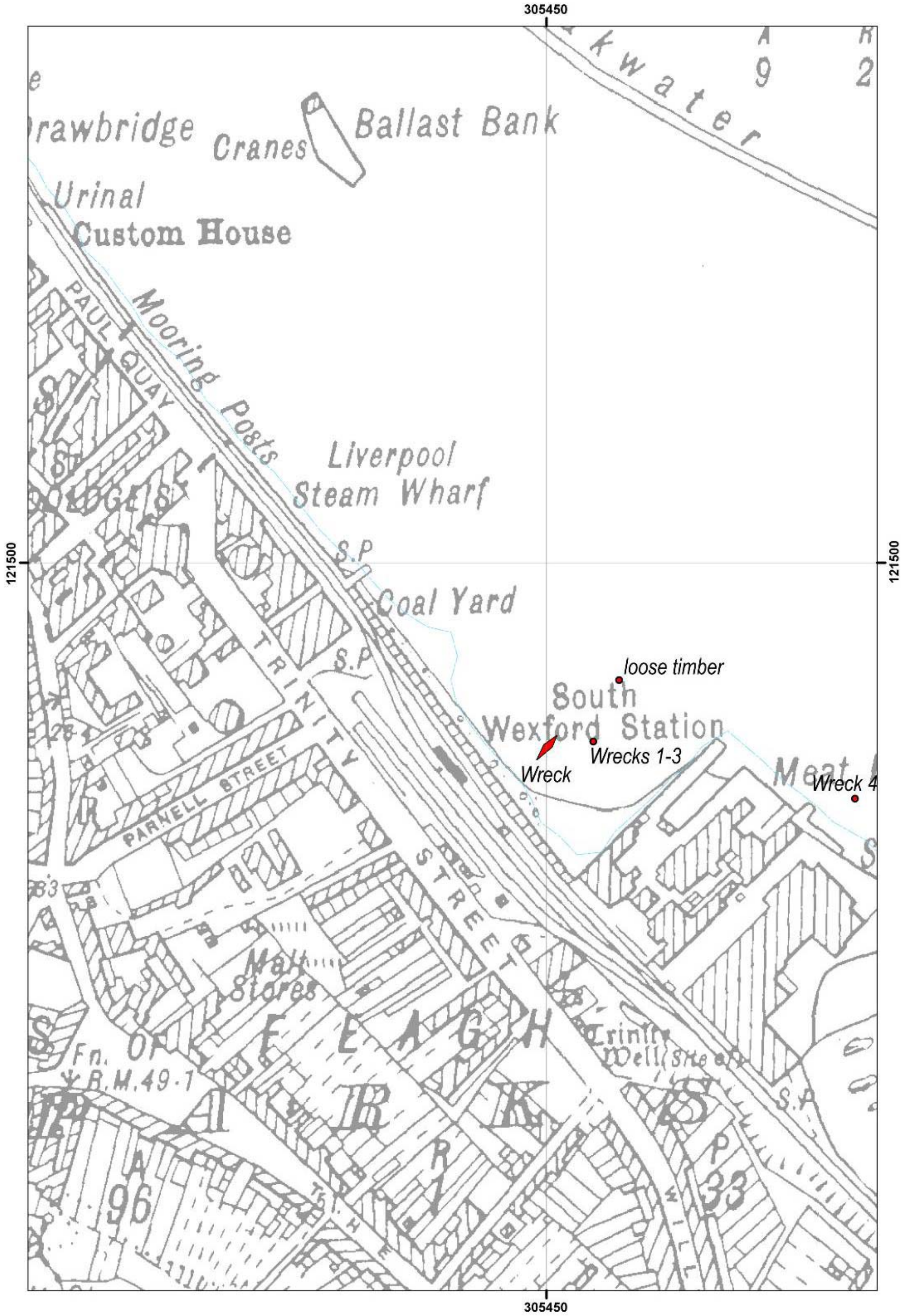

Figure 4: Location of archaeological wreckage components based on OS six-inch series. Source: Discovery Programme.

Plate 1: Intertidal mudflat sand that covers most of the development footprint

Plate 2: The natural harder stony/gritty substrate showing through beneath the more fluid intertidal mudflat.

Plate 3: North-facing battered stone wall of former dock yard, at south end of proposed development site, with one example of the red-bricked drainage outflows indicated.

Plate 4: Foot of the railway embankment that defines the SW side of the development, where it is built onto by the newly reclaimed car park and quayside that runs north from here. The timber post in the foreground is an isolated instance and perhaps an old mooring post.

Plate 5: View looking North at the recently reclaimed foreshore that has masked the second dock yard indicated on the OS First Edition map (see Figure 2).

Plate 6: View from South of stempost at wrecksite identified in 2001

Plate 7: View from SE looking at extent of wreck as tape measure is being pulled over its length

Plate 8: View from West of port side ribs protruding

Plate 9: View from West of starbaord side ribs protruding

Plate 10: View of anchor, temporarily removed fromits resting place to show its form

A D C O

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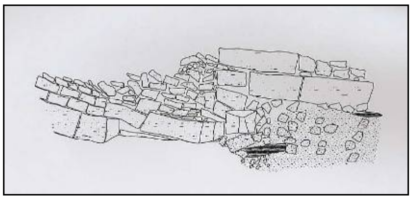
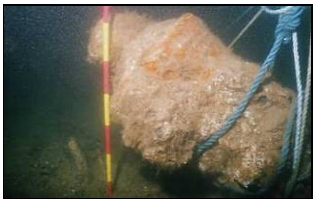


Iron cannon on site of 17th-century timber wreck discovered during dredging programme, Waterford Harbour



Chapter 15:
Architectural Heritage

ROUGHAN & O'DONOVAN

Chapter 15 Architectural Heritage

15.1 Introduction

This chapter was prepared by Aislinn Collins of CRDS Archaeological Consultants, to assess the impact of the proposed Development on Architectural Heritage. The architectural heritage assessment identified a total of 11 features of architectural heritage interest in the vicinity of the proposed development. Of these, only two will be directly impacted and two will be impacted indirectly by the proposed development.

15.2 Methodology

The architectural heritage assessment examines buildings and other structures within and in the vicinity of the proposed development, assesses their architectural significance and the likely effects of construction on their architectural character. The site of the proposed development has been cleared and the remains of only one standing building survives in situ. The site includes a number of structures including a former boundary wall and a wharf wall of early nineteenth century date.

15.2.1 Cartographic Sources

The identification of sites of architectural heritage merit was based on the analysis of cartographic sources. The range of primary cartographic sources consulted consisted of the Ordnance Survey 6" and 25" maps, and large-scale town plans (T.C.D. Map Library, www.osi.ie, Colfer 2008).

15.2.2 Local Authority Development Plans

The Wexford County Development Plan 2013 - 2019 and the Wexford Town and Environs Development Plan 2009 – 2015 (as extended) were consulted. The plans include policy objectives for the protection of the town and county's architectural heritage through their inclusion in the Record of Protected Structures (RPS) or in Architectural Conservation Areas (ACA). The RPS is a list of every structure which is of special architectural, archaeological, artistic, cultural, scientific, social or technical interest within the council's functional area. No structures included in the RPS or in an ACA have been recorded in the study area.

15.2.3 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) is a systematic programme of identification, classification and evaluation of the architectural heritage of the State. The Minister for the Culture, Heritage and the Gaeltacht is currently using the Inventory as the basis for making recommendations for the inclusion of structures in the Record of Protected Structures (RPS) (see Plate 15.1 and Section 15.3.3 below, see also Figure 15.1 in Volume 3 of this EIAR).

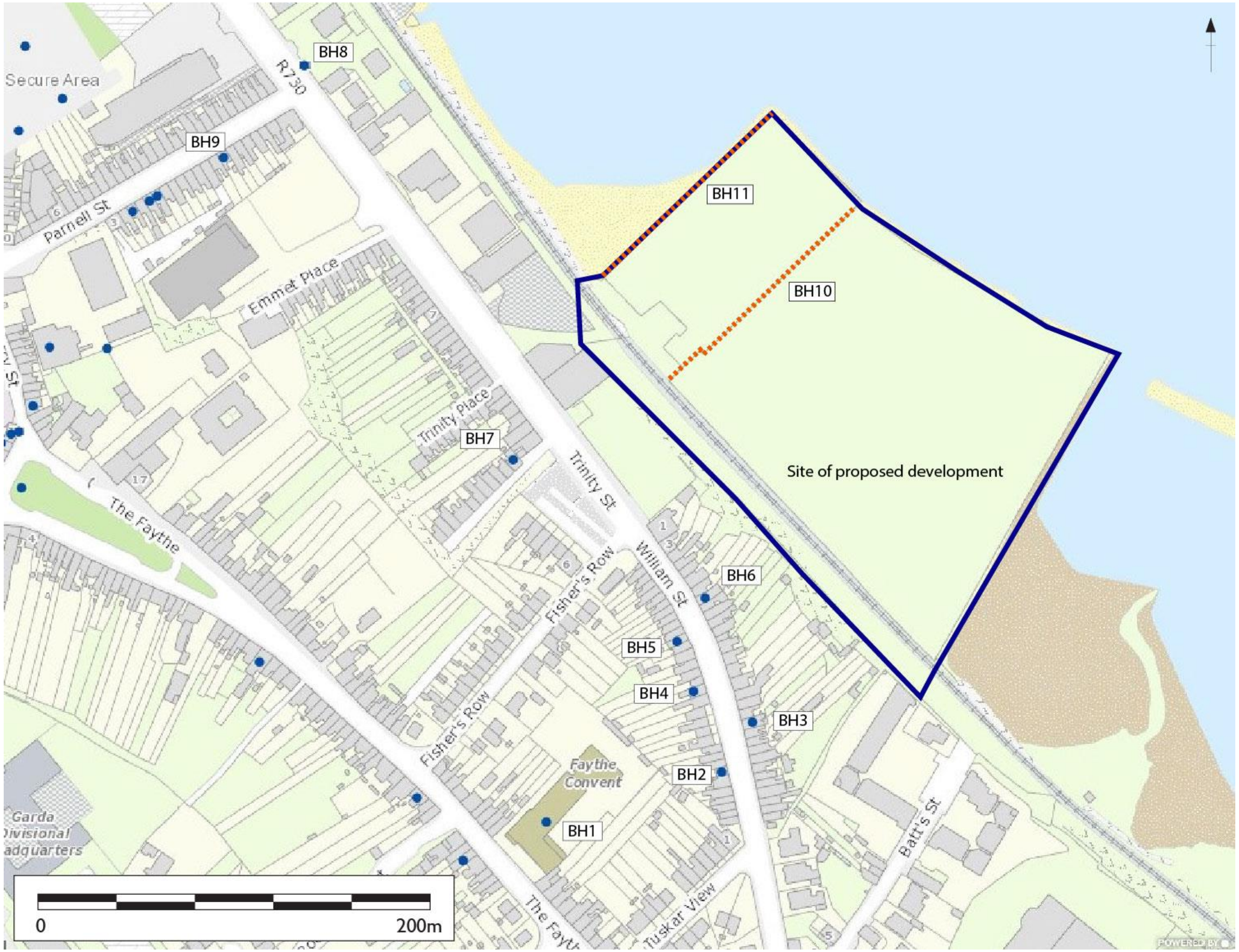


Plate 15.1 Structures of architectural heritage interest within c. 200m of the proposed development (see also Figure 15.1 of Volume 3)

15.2.4 Documentary Research

Sources consulted included A History of the Town and County of Wexford (Hore 1900-11), the Journal of the Old Wexford Society, and Wexford: A Town and Its Landscape (Colfer 2008) (see Section 15.9 References for full list).

15.2.5 Site Assessment

A site assessment was undertaken on the 10th October 2018. The site was inspected to identify features of architectural heritage interest and a photographic survey was undertaken. The sites of features included in the NIAH within the vicinity of the proposed development were visited and photographed in order to update the descriptions. The visual impact of the proposed development on features of architectural interest was considered as part of the site assessment.

15.3 Description of Receiving Environment

15.3.1 Historical Background

International trade was a significant element of the town's economy in the eighteenth and nineteenth centuries. An 'Act for the Improvement of the Town and Harbour of Wexford, and for Building a Bridge or Bridges over the River Slaney at or near said Town' was forwarded in the mid-eighteenth century. The Act identified that the *'trade of said town would be much benefited by the making, erecting and extending new or more quay or quays along the said town, from St. Paul Quay to the Ferry Boat Quay'* (O'Leary 2014, 35). Harbour records also indicate that 583 ships berthed in the port of Wexford in 1830 (O'Leary 2014, 24).

Nineteenth century land reclamation projects greatly changed the face of the harbour, of which one of the key instigators was John Edward Redmond. Redmond reclaimed the site of the proposed development from the harbour in the early 1830s. The newly reclaimed land was developed as the Wexford Dockyard and opened in 1832 (O'Leary 2014). The dockyard thrived throughout the nineteenth century and became the town's most significant employer. A contemporary illustration (See Plate 15.2) shows ships being repaired on the patent slip which occupied the northwest corner of the site, fishing boats pulled up elsewhere for repair, and logs used for the manufacture of planks for repair work scattered throughout the southern portion of the site. The structures indicated correspond with those on contemporary Ordnance Survey maps of the site (see Plate 15.3). These were removed by later development at the site.

Plate 15.2 Wexford Dockyard from a mid-nineteenth century view (source Colfer 2008, 159).

The Ordnance Survey town plan of 1840 indicates the suburb of the Faythe immediately after its redevelopment. New streets had been laid including Trinity Street, William Street and New (Parnell) Street and the two dockyards, including the site of the proposed development, are evident (see Plate 15.3). As indicated by the presence of nearby rope walks, the dockyards supported ancillary services including the manufacture of sails and rope.

Plate 15.3 **Extract from Ordnance Survey large-scale town plan, 1840, showing the Faythe and the Wexford Dockyard (source Colfer 2008, 105).**

The first vessel built there was the Vulcan for local shipowner Nathaniel Hughes. The Town of Wexford, the only steamship built at the dockyard was launched in 1836. The dockyard was a significant employer in the nineteenth century with 90 men recorded in 1875 and 60 shipwrights employed in 1906.

The Wexford-Rosslare rail line, which runs along the western boundary of the proposed development was opened for service in 1882. Wexford South Station, provided for the convenience of the inhabitants of the southern portion of the town, was opened on Trinity Street in 1885. The station which was located to the northwest of the site was closed in the late twentieth century (see Plate 15.4).

Further land was reclaimed to the east of the dockyard in the later nineteenth century to facilitate the construction of the factory buildings for the Wexford Engineering Company. Following the dredging and reclamation of the site a large factory was constructed along with a shipping wharf for the discharging of coke and scrap iron and a railway siding for loading and unloading of company wagons (Colfer 2008, 164; Hearn 2002-3, 13-4). The company was later known as the Star Iron Works. In the mid-twentieth century the factory was sold to Smith Holdings (Hearn 2002-3, 5).

The opening of land through reclamation and the presence of the dockyards, the railway station and the later iron works provided impetus for the intensification of residential development in the southern part of Wexford. Trinity Street, William Street and their adjoining laneways are characterised by modest two-storey houses dating of late nineteenth and early twentieth century date interspersed with more recent industrial and business premises (see Plate 15.4).

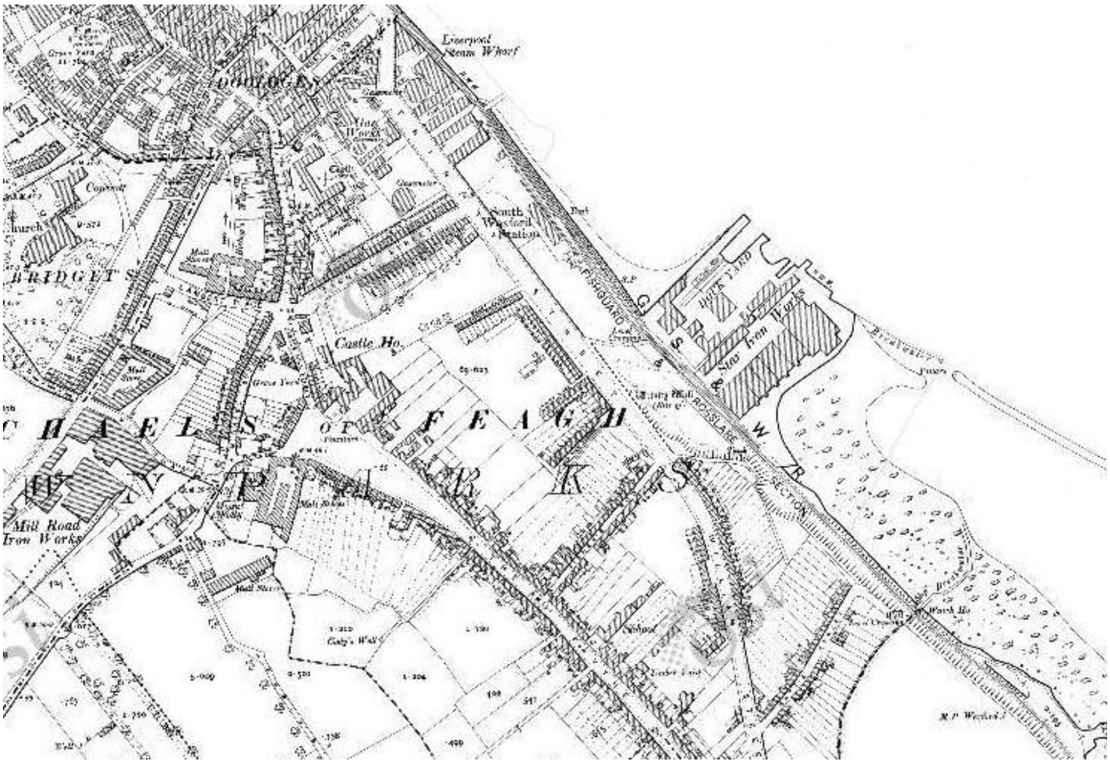


Plate 15.4 **Extract from Ordnance Survey 25" map, showing further reclamation and the site of the Star Iron Works (source www.osi.ie).**

15.3.2 Site Assessment

The site of the proposed development comprises an area of land reclaimed from the harbour between the early nineteenth and mid-twentieth centuries. The ground is relatively flat and raised above the level of the harbour. The Dublin-Rosslare rail line runs along the south-western boundary of the site and most of the buildings that stood on the site have been cleared. The remains of one concrete structure of mid-twentieth century dates stand but is unroofed (see Plate 15.5).

Plate 15.5 Standing building in south-west corner of site

A wall of squared rubble red sandstone runs in a north-east to south-west direction through the site and survives to a height of c. 2m (see BH10). This marks the boundary between the former Wexford Dockyard and the land which was reclaimed in the later nineteenth century.

Elements of the infrastructure of the nineteenth century dockyard survive in the north-western portion of the site. A square-profile gate pier of squared rubble red sandstone stands along the southern boundary of the former dockyard (see Plate 15.6).

Plate 15.6 **Gate pier to south of site**

The north-western edge of the site is an early nineteenth century wharf wall of red sandstone which has a slight batter at the base (see BH11). The wall was heightened by shuttered concrete in the mid-twentieth century. The wall is highest, surviving to a height of over 3m, at south-western corner which corresponds with a building indicated on the 1st edition Ordnance Survey Map (see Plate 15.3) and a contemporary illustration of the site (see Plate 15.2).

The remains of a timber and cast-iron wharf run along the north-eastern edge of the site. This does not appear on the 1st edition Ordnance Survey map and is likely associated with the Star Iron Works or subsequent uses of the site. There is a large masonry beacon marking the eastern corner of the site (see Plate 15.7). It is constructed of coursed red sandstone with a rendered cap. The beacon is indicated on the 25" Ordnance Survey map of the site and marked a masonry breakwater (see Plate 15.4).

The ground level rises up significantly to the south of site towards Trinity Street and William Street. The majority of the structures of architectural heritage interest identified in the study are screened from the proposed development by intervening topography and vegetation (see Plate 15.8).

Plate 15.7 **Beacon marking eastern corner of site**

Plate 15.8 **View south from site towards houses on south side of William Street**

15.3.3 Statutory Designations

Record of Protected Structures

The Record of Protected Structures in the Wexford Town & Environs Development Plan 2009 – 2015 (as extended) contains over 300 structures. These are located over 300m from the proposed development and no significant impacts are predicted.

Conservation Areas

Three Architectural Conservation Areas are identified in the Wexford Town & Environs Development Plan 2009 – 2015 (as extended). These are located over 300m from the proposed development and no significant impacts are predicated.

National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) was carried out in two phases between 2005-6 and 2007-8 for Co. Wexford. Structures included in the NIAH within c. 200m of the proposed development are listed below. The records have been updated to take into accounts changes to the structures since the completion of the inventory.

15.4 Inventory of Architectural Heritage

BH1

Feature Reference	BH1
NIAH Reference	15505095
Address	Saint John of God National School, The Faythe
Date of Construction	1940 - 1950
Protected Structure	No
Special Interest	ARCHITECTURAL SOCIAL
Rating	Regional
Description	Detached three-bay two-storey flat-roofed national school, built 1943-5, on an L-shaped plan with single- or two-bay two-storey flat-roofed projecting end bay. Bitumen felt-covered flat roof with concealed rainwater goods in overhanging eaves retaining cast-iron downpipes; flat roof not visible behind parapet (end bay). Rendered walls on rendered chamfered plinth. Grouped square-headed window openings with concrete sills, and concealed dressings framing timber casement windows. Bisected square-headed door opening (end bay) with cut-granite step threshold, and concealed dressings framing timber panelled double doors having overlight. Set back from line of street. A national school erected to designs by Thomas Joseph Cullen (1879-1947) of Suffolk Street, Dublin (Irish Builder 6th May 1944, 190), representing an important component of the mid twentieth-century built heritage of Wexford with the architectural value of the composition confirmed by such attributes as the angular plan form; the very slight diminishing in scale of the grouped openings on each floor producing a feint graduated visual impression; and the oversailing flat roof.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings.
Mitigation required	No mitigation required.

BH2

Feature Reference	BH2
NIAH Reference	15505096
Address	24 William Street
Date of Construction	1890 - 1910
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced single-bay two-storey house, c.1900. Pitched artificial slate roof with terracotta ridge tiles, shared rendered chimney stacks, rendered coping to party walls, and iron rainwater goods on rendered eaves having iron ties. Rendered walls. Square-headed window openings with masonry sills, and replacement uPVC casement windows. Square-headed door opening with replacement uPVC door. A picturesque small-scale house retaining the original form and massing together with most of the original fabric, thus contributing positively to the somewhat urban vernacular streetscape character in William Street.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings.
Mitigation required	No mitigation required.

BH3

Feature Reference	BH3
NIAH Reference	15505097
Address	41 William Street
Date of Construction	1890 - 1910
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced two-bay two-storey house, c.1900, probably with dormer attic. One of a group of six. Pitched artificial slate roof with terracotta ridge tiles, shared rendered chimney stacks having profiled capping, rendered coping to party wall, and cast-iron rainwater goods on rendered eaves having iron ties. Ruled-and-line rendered walls with rendered channelled quoins to end. Square-headed window openings with masonry sills and replacement uPVC casement windows. Elliptical-headed door opening with step supporting padstones, rendered surround, and replacement uPVC door. A pleasant small-scale house built as one of a group of six identical units (remainder in group not included in NIAH survey) contributing to the modest streetscape quality in William Street.
Impacts on built heritage	No direct impact
Effect on setting of feature	Slight, on rear site of house
Mitigation required	No mitigation required.

BH4

Feature Reference	BH4
NIAH Reference	15505098
Address	42 William Street
Date of Construction	1890 - 1910
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced two-bay two-storey house with dormer attic, c.1900. One of a pair. Pitched artificial slate roof with clay ridge tiles, rendered chimney stack, rooflight, and iron rainwater goods on rendered eaves having iron ties. Ruled-and-line rendered walls with rendered channelled quoins to west end. Square-headed window openings with masonry sills, moulded rendered surround to ground floor, and one-over-one pane timber sliding sash windows. Elliptical-headed door opening with padstones supporting moulded rendered surround, and replacement timber panelled door, having overlight. Interior with timber panelled reveals or shutters to window openings. A pleasant house of modest size built as one of a pair (second in pair not included in NIAH survey) contributing significantly to the streetscape quality of William Street with attributes establishing an amiable design programme including the staggered composition pattern, the rendered accents producing an appealing Classical theme at street level.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings.
Mitigation required	No mitigation required.

BH5

Feature Reference	BH5
NIAH Reference	15505099
Address	54 William Street
Date of Construction	1890 - 1910
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced single-bay two-storey house, built 1907. One of a group of twelve. Pitched artificial slate roof with clay ridge tiles, rendered and red brick (shared) chimney stacks having stepped capping supporting yellow terracotta pots, rendered coping to party walls, and replacement uPVC rainwater goods, on rendered eaves having iron ties. Ruled-and-lined rendered, walls. Square-headed window openings with masonry sills, and replacement timber casement windows. Square-headed door opening with rendered surround over cut-granite padstones, and tiled step leading to replacement glazed timber door, having overlight. An amiable small-scale house built as one of a group of twelve identical units (remainder in terrace not included in NIAH survey) contributing to the modest streetscape quality in William Street with the slightly stepped roofline corresponding with the slight gradient or incline in the street.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings.
Mitigation required	No mitigation required.

BH6

Feature Reference	BH6
NIAH Reference	15505100
Address	15 William Street
Date of Construction	1895 - 1900
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced two-bay two-storey house with dormer attic, built 1899. One of a pair, forming part of a group of six houses. Pitched artificial slate roof with clay ridge tiles, rendered chimney stack having red brick stepped capping supporting yellow terracotta pots, rooflight and cast-iron rainwater goods on rendered eaves having iron ties. Ruled-and-lined rendered walls. Square-headed window openings with masonry sills, and one-over-one pane timber sliding sash windows. Round-headed door opening in shared round-headed recess with cut-granite step, moulded rendered surrounds with inner surround on padstones, and replacement timber panelled door, having overlight. An elegantly appointed modest-scale house built as one of a pair (second in pair not included in NIAH survey) forming part of a larger ensemble of six houses (remainder not included in NIAH survey) identified in the street scene on account of individual attributes including the slender vertical emphasis of the massing featuring a somewhat disproportionate bias of solid to void, the understated decorative programme limited to the distinctive shared doorcase, and so on. Having been well maintained, the house remains as the last in the group to present an early aspect with the original fabric surviving largely intact, thereby upholding some of the character or integrity of the collective assemblage in William Street.
Impacts on built heritage	No direct impact
Effect on setting of feature	Slight, impact on rear site of house
Mitigation required	No mitigation required.

BH7

Feature Reference	BH7
NIAH Reference	15505101
Address	1 Sea View Avenue, off Trinity Street
Date of Construction	1885 - 1895
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	End-of-terrace two-bay two-storey house, built 1890, on site of earlier range, pre-1840, with single-bay two-storey side (north-east) elevation continuing into single-bay two-storey return to north-west. Extensively renovated. One of a group of twelve. Pitched and hipped artificial slate roof (pitched to return), clay ridge tiles, rendered (shared) chimney stack, rooflight, and replacement uPVC rainwater goods, on rendered eaves having iron ties. Ruled-and-lined rendered walls. Triangular-headed window openings with masonry sills, and replacement two-over-two timber sash windows. Square-headed door opening to side (north-east) elevation with step, and replacement glazed timber panelled door, having overlight. Occupying the position of an earlier range indicated on archival editions of the Ordnance Survey, a small-scale house built as one of a group of twelve identical units (remainder in group not included in NIAH survey) possibly having connections with the maritime legacy of Wexford Town exhibits an amiable composition as identified by attributes including the compact plan form, the distinctive profile of the openings, and so on. Although the subject of a comprehensive renovation programme, the elementary form and massing prevail together with replacement fitting replicating the original predecessors, thereby maintaining some of the character of the collective ensemble off Trinity Street.
Impacts on built heritage	No direct impact
Effect on setting of feature	Slight impact on setting (see Photomontage 14 in Figure 11.31 of Volume 3 of this EIAR).
Mitigation required	No mitigation required.

BH8

Feature Reference	BH8
NIAH Reference	15505102
Address	Trinity Street
Date of Construction	1901 - 1903
Protected Structure	No
Special Interest	Architectural, Historical, Social
Rating	Regional
Description	Pier-mounted cast-iron post box, c. 1903, with 'ER [Edwardus Rex] VII' royal cipher. Set in pier. A post box supplied by W.T. Allen and Company (fl. 1881-1955) of London representing an interesting example of mass-produced cast-iron work making a pleasing, if largely inconspicuous visual statement in an urban street scene with embellishments identifying the artistic potential of the composition including the King Edward VII (1841-1910; r. 1901-10) royal cipher of additional significance as an imprinted reminder of the period when Ireland formed part of the British Empire.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings.
Mitigation required	No mitigation required.

BH9

Feature Reference	BH9
NIAH Reference	15505104
Address	29 Parnell Street
Date of Construction	1865 - 1870
Protected Structure	No
Special Interest	Architectural
Rating	Regional
Description	Terraced two-bay three-storey house, built 1867, possibly incorporating fabric of earlier house, pre-1840, on site with single-bay three-storey lean-to lower return to south. One of a pair. Pitched roof continuing into lean-to to return with clay ridge tiles, rendered chimney stack over red brick construction having profiled capping, rendered coping, and iron rainwater goods on stepped eaves having iron ties retaining cast-iron ogee hopper and downpipe. Re-rendered walls with slate hanging to rear (south) elevation. Square-headed window openings (originally in segmental-headed recess to ground floor) with masonry sills, and replacement one-over-one pane sash windows. Round-headed door opening and timber panelled door. A pleasantly composed house of modest size built as one of a pair (second in pair not included in survey) identified in the street scene by traits including the vertical thrust of the massing, the diminishing in scale of the openings on each floor producing a tiered visual effect, and so on. Although the subject of a renovation programme carried out following damage caused to a number of sites in Parnell Street by road works in the mid to late twentieth century, the house continues to project an early aspect with the elementary composition surviving in place together with much of the historic or original fabric including increasingly-rare slate hanging once representing a characteristic common in the built heritage of Wexford Town.
Impacts on built heritage	No direct impact
Effect on setting of feature	None, screened by intervening buildings
Mitigation required	No mitigation required.

BH10

Feature Reference	BH10
NIAH Reference	N/A
Address	Trinity Wharf
Date of Construction	1820-1840
Protected Structure	No
Special Interest	Architectural
Rating	Local
Description	A wall of squared rubble red sandstone runs in a north-east to south-west direction through the site and survives to a height of c. 2m. This marks the boundary between the former Wexford Dockyard and the land which was reclaimed in the later nineteenth century.
Impacts on built heritage	Direct impact
Effect on setting of feature	Direct, significant
Mitigation required	The wall will be subject to architectural recording prior to construction.

BH11

Feature Reference	BH11
NIAH Reference	N/A
Address	Trinity Wharf
Date of Construction	1820-1840
Protected Structure	No
Special Interest	Architectural
Rating	Local
Description	The north-western edge of the site is an early nineteenth century wharf wall of squared red sandstone which has a slight batter at the base. The wall was heightened by shuttered concrete in the mid-twentieth century. The wall is highest, surviving to a height of over 3m, at south-western corner which corresponds with a building indicated on the 1st edition Ordnance Survey Map and contemporary illustration of the site.
Impacts on built heritage	Direct impact
Effect on setting of feature	Direct, significant
Mitigation required	The wharf wall will be subject to architectural recording prior to development.

15.5 Description of Potential Impacts

The proposed development is located at the south-east end of Wexford town centre at the southern end of the quays. The scheme will encompass 3.6 ha of land reclaimed from the harbour from the early nineteenth and twentieth century. The details of the proposed mixed-use development including construction methodologies are outlined in Chapter 4 Description of the Proposed Development and the associated Figures in Volume 3.

The two sites of built heritage within the site (BH10 and BH11) will be required to be removed to allow the construction of the proposed development as described in Chapter 4. The description of these features, the impact rating and the mitigation measures have been outlined in Section 15.4.

15.6 Mitigation and Monitoring Measures

Avoidance of architectural heritage is the preferred mitigation measure, however either direct or indirect impacts on architectural heritage is likely to occur as a result of the development where avoidance is not possible.

Mitigation by architectural record involves the production of a written account generally supplemented by measured drawing and a photographic survey. The level of recording will depend on the significance of the structure in question. Any architectural features within the site including the former boundary wall (BH 10) running northeast-southwest through the site and the stone wall (BH 11) along the western boundary of the site should be subject to architectural recording prior to their removal.

15.7 Residual Impacts

There will be a slight residual impact on the setting of three structures of architectural heritage interest (BH 3, BH 6, BH 7).

15.8 Difficulties Encountered

No difficulties were encountered during the completion of this assessment.

15.9 References

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Hearn, I. M. (2002-3) The Star Iron Works in Journal of the Wexford Historical Society, No. 19, pp. 5-35.

Hore, H. F. (1900-11) History of the town and county of Wexford, five volumes. London.

NIAH (2017) National Inventory of Architectural Heritage Handbook. Department of Culture, Heritage and the Gaeltacht, Dublin.

O'Leary, J. (2014) Maritime Wexford: The life of an Irish Port Town. The History Press, Ireland, Dublin.

Wexford County Council 2009. Wexford Town and Environs Development Plan 2009 – 2015 (as extended).

Wexford County Council 2013. Wexford County Development Plan 2013 – 2019.

Appendix 15.1 Ratings of Architectural Heritage Significance Used by the NIAH

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Ratings of Architectural Heritage Significance Used by the National Inventory of Architectural Heritage (NIAH)

The NIAH uses five rating values namely International, National, Regional, Local and Record Only. Structures which are considered of International, National, and Regional significance are recommended by the Minister to the relevant planning authority for inclusion in their Record of Protected Structures (NIAH Handbook 2017).

International

Structures or sites of sufficient architectural heritage importance to be considered in an international context. Examples include St Fin Barre's Cathedral, Cork. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries.

National

Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context. Examples include Ardnacrusha Power Station, Co. Clare; the Ford Factory, Cork; Carroll's Factory, Dundalk; Lismore Castle, Co. Waterford; Sligo Courthouse, Sligo; and Emo Court, Co. Laois.

Regional

Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Examples would include many Georgian terraces; Nenagh Courthouse, Co. Tipperary; or the Bailey Lighthouse, Howth. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shopfronts.

Local

These are structures or sites of some vintage that make a contribution to the architectural heritage but may not merit being placed in the RPS separately. Such structures may have lost much of their original fabric.

Record Only

These are structures or sites that are not deemed to have sufficient presence or inherent architectural or other importance at the time of recording to warrant a higher rating.

Chapter 16:
Material Assets & Land

ROD
ROUGHAN & O'DONOVAN

Chapter 16 Material Assets and Land

16.1 Introduction

This Material Assets and Land chapter has assessed the impact of the proposed development on material assets including built services, residential and commercial property, development land and maritime businesses within the Study Area. A development may affect material assets if it involves any of the following:

- Acquisition of land;
- Demolition of buildings;
- Revaluation of or change in the development potential of adjoining lands/ properties; or,
- Changes to existing services / infrastructure.

This assessment also identifies the positive impacts that such a development will have, such as the amenity that the development will provide.

16.2 Methodology

This chapter will describe the receiving environment and determine the significance of the impact of the proposed development on:

- Land use and ownership – an examination of impacts on housing, severance, loss or rights of way or amenities, conflicts, or other changes likely to ultimately alter the character and use of the surroundings;
- Local businesses – an assessment of employment and employment opportunities, property and lands for development. The type and extent of positive and/ or negative impacts of the proposed development to current economic activity will be assessed;
- Infrastructure; and,
- Existing services and utilities.

The following EPA guidelines have informed the assessment process:

- Guidelines on the Information to be contained in Environmental Impact Statements, EPA, 2002; and
- Advice notes on Current Practice (in the preparation of Environmental Impact Statements), EPA, 2003.

The following Draft Guidance documents have also been consulted:

- Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports, EPA, August 2017; and,
- Draft Advice Notes for Preparing Environmental Impact Statements, EPA, September 2015.

In order to complete this assessment, a baseline study of the existing material assets environment has been undertaken using desktop research. The following sources of information were consulted in the process of this assessment:

- Trinity Wharf Stage 2 Masterplan;
- Wexford Town and Environs Development Plan, 2009-2015; and,

- The Department of Agriculture, Food and the Marine resources.

In addition to the sources listed above, aerial photography, OSI maps, Google Maps and a site layout plan of the existing area and proposed development have been consulted.

The Material Assets and Land chapter should be read in conjunction with the following chapters:

- Chapter 4 – Description of the Proposed Development;
- Chapter 5 – Traffic Analysis;
- Chapter 6 – Population and Human Health; and;
- Chapter 12 – Noise and Vibration.

16.3 Description of Receiving Environment

16.3.1 Existing Site

The Trinity Wharf site is currently a brownfield site of approximately 3.6 ha, which was reclaimed from the sea between 1832 and the early 1900s. The site is located within Wexford Harbour on the eastern extents of Wexford Town and at the southern end of the Wexford Quays. The site is an urban area, located off Trinity Street in Wexford Town and is within the area zoned for Town Centre by the Wexford Town and Environs Development Plan 2009-2015 (as extended).

16.3.2 Land Use and Ownership

The Trinity Wharf site is currently owned by Wexford County Council. The Dublin/Rosslare Railway line runs adjacent to the site in a north-south direction on land which is under the ownership of Coras Iompair Eireann (CIE). Wexford County Council has been in consultation with CIE since the beginning of the proposed development to gain access into the site across the live Dublin/Rosslare Railway line. The current access road to the Trinity Wharf site is owned by Wexford County Council, while access into the site requires crossing the Dublin to Rosslare Railway line. Paul Quay to the north of the site along the Wexford Quayfront, which the boardwalk will tie into is also owned by Wexford County Council and is currently a public car park.

The lands surrounding the Trinity Wharf site are comprised mostly of commercial and residential, as discussed in Chapter 6. Directly opposite the proposed development is a residential area consisting of a row of terraced houses with side streets such as Sea View Avenue and Fishers Row which are also occupied by family homes. Details on the demographics of the area can be found in Chapter 6 of this EIAR. Adjacent land uses also include businesses on Trinity Street.

The development of the proposed Trinity Wharf Development will also require construction within the Foreshore area. A Foreshore lease will be required, and Wexford County Council have engaged in Pre-Application Consultations with the Department of Housing, Planning and Local Government and will be submitting foreshore lease applications for all works on the Foreshore including the sea wall, marina and boardwalk as necessary.

16.3.3 Commercial Land Use

A number of automotive businesses are located along Trinity Street, adjacent to the proposed development. These include Trinity Land Rover Wexford, Meyler's Tyres and Maxol Auto 24 Petrol Station. McMahons Building Supplies is also located adjacent to the site on Trinity Street, beside which the entrance to the site is proposed.

16.3.4 Aquaculture and Maritime Businesses

Wexford Harbour is designated as a protected Shellfish area by the EPA and is currently farmed by a number of licensed Mussel Fisheries. Aquaculture licences are currently held under the Department of Agriculture, Food and the Marine within Wexford Harbour while a number of Mussel Fisheries applications are currently with the Department for consideration. A number of fishing trawlers also moor in Wexford Harbour along the quays and travel out to sea past the Trinity Wharf site, through the main navigational channel of Wexford Harbour.

There is a strong presence of maritime recreation within Wexford Harbour. The Wexford Harbour Boat and Tennis Club is located in Carcur, 2km from the Trinity Wharf site, in the inner harbour past Wexford Bridge. Founded in 1873 initially as a rowing club, sailing was brought to the club in the 1920's. The Club has a fleet of dinghies and safety boats, while also having a pontoon and mooring for larger boats, and a crane and slipway for launching vessels. The Club runs Summer and Winter sailing programmes and is an ISA Accredited training centre. Within the harbour there are two existing visitor mooring locations which are managed by the Harbour Office and Wexford's Harbour Master. The northern area runs alongside the southern side of the northern training wall, while the second area is located adjacent to Paul Quay. A slipway is provided within the town with facilities for visitors provided by the Harbour Office at Crescent Quay. There is also a small area to the south of the Trinity Wharf site that is used for mooring small boats by local fishermen/residents.

16.3.5 Local Economy and Businesses

In terms of commercial activity, the study area is urban in nature and, as highlighted within the Land Use and Ownership section, is characterised by tourism, community, cultural and residential property. The Talbot Hotel, National Opera House, Wexford Arts Centre, West Gate Tower and Selskar Abbey cater for tourism and culture within the study area whilst Wexford Tourist Information Centre can be found to the north of the proposed development at the Crescent Quay. A range of businesses operate on Trinity Street which may be indirectly affected by the proposed development.

16.3.6 Services and Utilities

The lands proposed for development were once used for many industrial uses, but currently are part of a derelict brownfield site and have been disused since production ceased on site in 2001. As the buildings onsite have been demolished for the most part, there are no existing services that are currently used to provide services to any adjacent land uses.

16.3.7 Infrastructure

The Trinity Wharf site is located off the R730 on Trinity Street at the southern end of Wexford Quays. The only existing access to the site is a laneway between Trinity Land Rover and McMahons Hardware Supplies which is not sufficient to provide access into the site for the proposed development. The Dublin to Rosslare Railway line is located adjacent to the western length of the site. The existing road infrastructure along Trinity Street and the adjoining road network is outlined in Chapter 5 of this EIAR.

16.4 Description of Potential Impacts

16.4.1 Extent of the Development

While the majority of development will occur within the brownfield Trinity Wharf site and within the Foreshore of Wexford Harbour to accommodate the marina and boardwalk, works will also be required on Paul Quay and along Trinity Street as proposed in Chapter 4. Realignment of traffic lanes on Trinity Street is required to provide a junction into the site and a level crossing of the Dublin to Rosslare railway line will provide access into the site over the railway.

The development will also require connection to existing utilities along Trinity Street. This will include a connection from the proposed Irish Water owned underground pumping station located at the north-west corner of the proposed development, to the existing public combined sewer network on Trinity Street (outside of the redline boundary). A connection to the existing water supply within Wexford Town is also required. The watermain designed to service the Trinity Wharf site will be connected to the main public network at Trinity Street via the main access road to the site. The exact details of the connection and extent of the upgrade works required are yet to be finalised by Irish Water. The impacts of upgrade works and connection works along Trinity Street to facilitate connection to the water and waste water supplies will be temporary and are likely to be slight.

16.4.2 Impact on Land Use and Ownership

The proposed development will have positive impacts on land use due to the redevelopment of a brownfield site increasing attractiveness of the local area and the increased accessibility through a proposed link road and circulatory route which will provide access for hotel drop offs and disabled parking etc. (See Chapter 5). It is likely that the proposed development will attract businesses to invest in the wider area in the future, to complement the urban hub and provide services and facilities to benefit the new residents within Trinity Wharf and existing population within the vicinity of the site.

There will be no significant adverse impact on land ownership within the study area. The Trinity Wharf site is owned by Wexford County Council, and while the railway is owned by Coras Iompar Éireann the project team have been in consultation with CIE throughout the development of the project to agree consent on a preferred railway crossing.

The proposed development will require construction within the Foreshore and therefore a Foreshore Lease or leases will be sought from the Department of Housing, Planning and Local Government.

16.4.3 Commercial Land Use

The proposed development will temporarily impact on McMahon Building Supplies during construction stage as a result of the construction of the site access road. Parking which is used for McMahons premises will also be removed as part of the works on Trinity Street which will have a slight long-term impact. The development will not directly impact on any of the other commercial properties along Trinity Street. The new road layout as proposed in Chapter 5 will accommodate all traffic using the site, while serving the existing traffic and businesses.

16.4.4 Aquaculture and Maritime Businesses

The proposed development will involve the development of a 64 berth marina and a boardwalk connecting to Paul Quay within Wexford Harbour. The proposed boardwalk will be supported by driven steel piles as described in Chapter 4 of Volume 2 and in Figures 4.7 and 4.8 in Volume 3 of this EIAR. The marina will be located off the north-east corner of the development. It is proposed that the floating pontoons of the marina and the walkways will be restrained using either piles driven into the seabed or helical anchors drilled into the seabed as lower terminals for anchor chains that will connect and secure the breakwater units, pontoon walkways and finger berths. Depending on substrate conditions, restraint chains could also be anchored by appropriately sized anchor blocks buried into the seabed. The method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to ground investigations and will be confirmed during the detailed design phase. Pre-fabricated floating breakwaters with skirts that will be tethered to the seabed will also be provided on the outer side of the marina to shelter the marina and boardwalk from incoming waves.

The area of the seabed to be directly impacted by the proposed development will not directly impact on any existing areas designated under Aquaculture licences granted by the Department of Agriculture, Food and the Marine. There are three Aquaculture licences within 500m of the proposed development. The closest licenced site to the development is Aquaculture Licence No. T03/047A and is located 250m north of the site. Two other licences are located to the north east and south east of the proposed development namely T03/030D and T03/046C at approximately 500m from the proposed development. These licence locations can be seen in Plate 16.1.

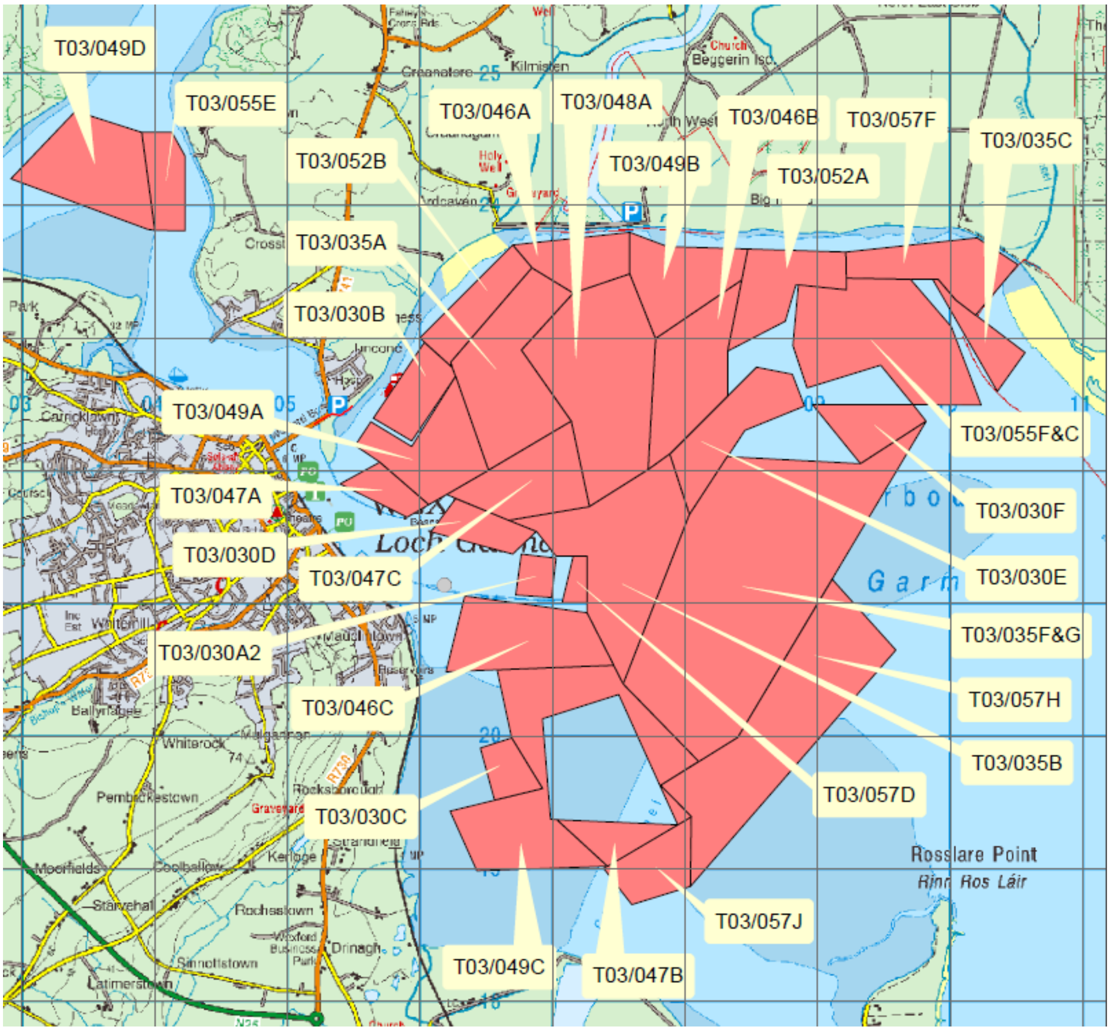

Plate 16.1 **Licenced Aquaculture sites within Wexford Harbour**

An additional licence application is currently with the Department of Agriculture, Food and the Marina, which has applied for the development of the lands adjacent to Trinity Wharf for the production of Mussels. The licence application T3/099 was submitted in September 2017. The area which this licence application has applied for not only includes the area in which the marina is proposed as part of this development, but also includes a large area within the navigational channel of Wexford Harbour which could have an impact on the operation and development of Wexford Harbour.

The proposed development would have a positive impact in making this area of the town significantly more attractive, with the potential to facilitate tourism, leisure, recreational activities and related commercial opportunities, allowing for the economic growth. It is proposed to capture the maritime history of the site in the development of the site by creating signage around the Trinity Wharf site, promote the historical background of the site including its former use as a dockyard.

While there is no direct impact on the area of any licenced aquaculture sites, the potential for indirect impacts has also been assessed. The Trinity Wharf Feasibility Study completed by RPS Group in November 2018 carried out hydrodynamic modelling to assess the impact of the construction of the proposed marina and boardwalk on the sediment morphology within the Harbour. The assessment primarily assessed the impact that the proposed landside development and the landside development in combination with the marina would have on the tidal regime and the prevailing wave climate. This provides assessment for different stages throughout the phasing of the development, including if the development has been constructed but the marina as yet, has not been. The Hydrodynamic Modelling found that the proposed development (with or without the marina) will not result in any significant changes to the existing inshore wave climate beyond the immediate vicinity of the proposed marina. Similarly, the modelling also found that neither the landside development in isolation, or in combination with the marina will result in any significant impact to the existing tidal regime.

The report concludes that it is well established that the sediment transport in any coastal area is governed principally by the combination of prevailing tidal currents and wave climate, i.e. littoral currents. Given that the report has ruled out significant effects as a result of the proposed development on the above processes, RPS Group have concluded that nearby environmentally sensitive areas will not be adversely impacted by any changes in the sediment transport as a result of either the landside development in isolation or in combination with the marina.

RPS Group also carried out sediment sampling and chemical analysis of sediment in the vicinity of the Trinity Wharf site for their Trinity Wharf Marina Feasibility Study (November 2018). This analysis has been taken into account in the relevant chapters of the EIAR and mitigation measures have been put in place to ensure that any construction or operation works will not have an impact on the water quality of Wexford Harbour.

The proposed development is not expected to have any impacts on local maritime and boat users. The footprint of the marina does not encroach on the navigational channel within Wexford Harbour. The Starboard and Port lateral buoys within the harbour denote the navigational channel as per the Maritime Buoyage System and are located north of the proposed marina. The marina will provide mooring for visitors and locals alike, and the provision of the marina is expected to boost tourism facilities within Wexford Town while complimenting the rich maritime history of the site. The hydrodynamic modelling carried out by RPS assessed the impact on wave action as a result of the proposed development. The revetment wall as proposed along the south east boundary was proposed to attenuate any inbound waves and to minimise any potential impact on Goodtide Harbour to the south of the development as seen in Plate 16.2. The Trinity Wharf Marina Feasibility Study found that the proposed development "*will not result in any significant changes to the existing inshore wave climate beyond the immediate vicinity of the preferred marina"*. Therefore, there will be no significant adverse impact on the adjacent boats and users of Goodtide Harbour.

Plate 16.2 Existing Goodtide Harbour south of Trinity Wharf

16.4.5 Impact on Services and Utilities

As there are no utilities located within the site, the proposed development will have no impact on existing utilities within the existing site. Proposed utilities as per Chapter 4 however will comprise Surface Water Drainage, Foul Water Drainage and Water Supply. The proposed development will need to provide for its own services and utilities to service the site for future tenants and businesses.

As described in Chapter 4, the surface water drainage for the development site will comprise a Sustainable Drainage System (SuDS) based approach. This will consist of blue/green roofs for all buildings, raingardens at the perimeter of buildings, bio-retention areas and swales/basins in soft landscaped areas and permeable paving on hardstanding areas. The drainage network will attenuate and cleanse the surface water runoff from the site prior to discharge to the sea through a diffuse system or point discharge as described in Chapter 4.

Foul waste from the site will be required to be pumped to the public wastewater infrastructure network. Foul effluent will discharge from the proposed buildings by gravity to a large-scale public (Irish Water owned) underground pumping station located at the north-west corner of the development site adjacent to the access road. Here wastewater will ultimately be pumped to the existing public combined sewer network. A connection to the existing combined sewer network on Trinity Street is required. This will have short term impacts on users of Trinity Street while a connection is being established but will not cause significant adverse effects.

In addition, a class II petrol interceptor will be located beneath the multi-storey carpark ground floor slab together with a pumped manhole in order to convey detergent runoff from the carpark cleaning operations to the foul drainage network. Details of the foul water drainage network are shown in Figure 4.3 in Volume 3 of this EIAR.

A new water supply will be required to service the site which will require a connection to the existing water network within Wexford Town. A pre-connection enquiry was submitted to Irish Water and discussions are ongoing with Wexford County Council. It is likely that upgrading of the surface water pipe on Trinity Street will be required, which would have short term impacts on Trinity Street users and local businesses but due to the short term nature of the works is not expected to cause significant adverse effects. A water abstraction point will also be required at the northern corner of the site to provide an inlet supply of water from Wexford Harbour for use by Fire Engines in the event of a fire on the site. This supply is a requirement of the Wexford Fire Officer and will provide a capacity of water which can be used in the event of an emergency.

Ducting for new services will be installed under the railway in possession including electrical, telecommunications, foul and surface water with associated access chambers.

16.4.6 Impact on Local Economy and Businesses

Local businesses may experience temporary nuisances during the construction phase of the proposed development from construction traffic and noise and any temporary traffic works. The construction of a new level crossing will involve site clearance and earthworks activities as highlighted in Chapter 4. As outlined above, connection to the water network may require an upgrade to the existing water main on Trinity Street as yet to be decided from discussions with Irish Water.

The contractors will work within stringent construction limits and guidelines in order to protect local amenities. The proposed development will ultimately enhance the attractiveness of the area for residents, businesses, tourists and development. Increased footfall within the area has the potential to benefit local businesses such as Aldi and Centra, with local employees being within walking distance. Additionally, tourist facilities such as the National Opera House and Wexford Arts Centre may also benefit from the increased footfall and the proposal of a new hotel. The increased employment opportunities for local people will also enhance local economic activity within the area and increase demand for housing.

16.4.7 Infrastructure

The development of the Trinity Wharf lands will result in a new influx of traffic visiting the Trinity Wharf site, as opposed to its current vacant brownfield status.

An access road into the development is proposed to provide a new level crossing over the Dublin to Rosslare Railway line, with a new junction providing access onto Trinity Street from the Trinity Wharf site. The development of the Trinity Wharf site will also require a level crossing to cross the Dublin to Rosslare Railway line. While Iarnród Éireann have agreed in principal to the design of the level crossing which will consist of signalised automatic controlled boom barriers. It is expected not to interrupt any scheduling or operation of trains along the line. A signal building to service the Railway crossing will also be located along the access road to facilitate the level crossing.

The proposed access junction will result in the loss of 71m of on-street parking along the eastern side of Trinity Street and 24m of on-street parking either side of Seaview Avenue on the western side. This equates to the loss of 16 parking spaces. This is discussed in Chapter 5 and has been assessed as a moderate impact on residents and businesses in the immediate facility. The impact on parking as a result of the boardwalk tie in on Paul Quay will also remove approximately 21 no. car parking spaces which is expected to have a slight impact on users of the long-term car park.

An assessment on car parking provisions has been undertaken in Chapter 5 and has calculated an estimated regular daily parking demand of 678 no. spaces. The development proposes to provide 509 onsite car parking spaces, with the surplus to be accommodated within nearby carparks that are currently not used to capacity.

The marina and cultural centre will generate a peak demand for parking when hosting large events, primarily during evening hours and at the weekends. The peak demand is estimated to be 200 spaces based on a venue capacity of 400 people with typically 2 people travelling per car. Events in the cultural and performance centre will rarely be held at times which coincide with office hours. Events held at these times will implement an accessibility management plan which will include matters such as ensuring nearby off-street parking facilities are open and possibly operating extra buses on the local bus route servicing long-term carparks on the outskirts of the Town.

16.5 Mitigation and Monitoring Measures

There are no specific mitigation measures in relation to Material Assets. The design of the development has accommodated the necessary improvements in infrastructure to service the site, without having impacts on infrastructure along Trinity Street. The provision of the proposed utilities and services will facilitate the required needs of the development without impacting on any existing utilities within the site.

16.6 Residual Impacts

There will be no negative residual impacts on material assets as a result of the proposed development. The proposed development will provide an additional amenity to the area with positive impacts for the local community in regard to increased tourism and improved economic activity.

Chapter 17:
Interrelationships, Major Accidents and Cumulative Effects

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ROUGHAN & O'DONOVAN

Chapter 17 Interrelationships, Major Accidents & Cumulative Effects

17.1 Introduction

In addition to the assessment of impacts on individual topics presented in the previous chapters of this Environmental Impact Assessment Report (EIAR), the interaction between these factors has also been considered. This chapter also assesses the expected effects arising from the vulnerability of the project to risks of major accidents and disasters that are relevant to the project. Finally, the cumulative effects of the proposed development with those of previous developments and developments for which planning authorisation has been received and development objectives in the development plans for the areas through which the development is proposed, have been assessed and are described in this chapter.

17.2 Methodology

17.2.1 Interrelationships

The determination of interrelationships was facilitated through an iterative design process that included consultation between designers, environmental specialists and technical specialists. In addition, the process was informed by consultation with statutory and non-statutory consultees and in particular with the Department of Culture, Heritage and the Gaeltacht (the National Monuments Service and National Parks and Wildlife Service) and Inland Fisheries Ireland. Where potential exists for interaction between two or more environmental topics, the relevant specialists have taken these into account when making their assessment and, where possible, complimentary mitigation measures have been proposed.

17.2.2 Major Accidents and Disasters

Article 3 of the Environmental Impact Assessment (EIA) Directive, as amended by Directive 2014/52/EU, requires that: *"The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned".* Furthermore, Annex IV, Section 8 of the Directive states that the EIAR shall contain:

> *"A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned."* The Directive also states that 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."* This section comprises an assessment of the vulnerability of the proposed development to risks of major accidents and/or disasters which are relevant to the proposed development.

The assessment of major accidents and disasters is a new requirement and national guidelines are not yet available. In the absence of such guidance, Highways England's (equivalent body to Transport Infrastructure Ireland (TII)) guidance has been consulted.

As identified in the EIAR chapters, the proposed development is designed, and will be built and operated, in accordance with best practice. It has been ensured that the

proposed development is capable of being constructed safely and without risk to health, can be maintained safely, and complies with all relevant health and safety legislation.
An understanding of the potential consequences of major accidents and disasters due to the proposed development was gained through a desktop study, the results of which are discussed in Section 17.4.

In assessing the expected effects arising from the vulnerability of the project to risks of major accidents and disasters that are relevant to the project, the assessment has assessed:

- The potential of the project to cause major accidents and disasters, including implications for human health, cultural heritage, and the environment; and
- The vulnerability of the project to potential accidents and disasters, including the risk to the project of both natural disasters (e.g. flooding) and man-made disasters (e.g. technological disasters).

The methodology adopted included three main stages, as follows:

- Stage 1: a long list of all possible major accident and disaster events was developed. This list drew upon a variety of sources, including the UK Government's Risk Register of Civil Emergencies. Major events with little relevance (for example volcanic eruptions) were not included. Stage 1 also included an initial review of potential receptors to identify any groups that were considered necessary to include in the assessment;
- Stage 2: a screening exercise was undertaken to review the long list of major events and to give consideration to their relevance to the proposed scheme, and therefore whether they should be included on the project specific short list of events requiring further consideration; and
- Stage 3: where further design mitigation is unable to remove the potential interaction between a major accident and disaster event and a particular topic, the relevant EIAR chapter identifies the potential consequence for receptors covered by the topic and gives a qualitative evaluation of the potential for the significance of the reported effect to be increased as a result of that event.

The qualitative evaluation of the potential for the significance is presented in Table 17.2 of this chapter. The residual assessment is based on the exceptionality of the major accident and disaster event to this scheme and whether there is a significant effect after the application of mitigation.

17.2.3 Cumulative Effects

In assessing cumulative effects, the following were the principal sources consulted:

- Wexford County Council Planning Department;
- Wexford County Development Plan, 2013-2019;
- Wexford Town and Environs Development Plan, 2009-2015 (as extended);
- Wexford Local Economic and Community Plan 2016-2021;
- An Bord Pleanála website; and
- EIA Portal.

A 1km buffer of the Slaney Estuary, as far upstream as Ferrycarrig Bridge (5km north of the development) and as far into the Slaney Estuary as Rosslare Point (4km south east) and the Raven Point (5.6km northeast), was identified to search for any projects identified within close proximity to the proposed development site. An online planning search was also carried out for projects within 15km of the site for projects which have potential for pathways for cumulative impacts to occur.

Development objectives in the relevant current development plans were also considered. This cumulative assessment has considered cumulative impacts that are:

a) Likely;
b) Significant; and
c) Relating to an event which has either occurred or is reasonably foreseeable together with the impacts from this development.

Proposed and existing developments and plans, identified as having potential for cumulative effects in combination with the proposed development, are assessed in Section 17.5.

17.3 Interrelationships

Interrelationships arise from the interaction between the impacts and proposed mitigation for one discipline with another associated discipline. An example of this would be the provision of noise barriers to mitigate the impacts of noise on the surrounding environment could have a negative impact in terms of landscape and visual impact.

The impacts and the mitigation provided has been considered by all disciplines to ensure all the interactions have been fully considered within this EIAR.

Table 17.1 shows the principal interrelationships identified for the proposed development and they are described in Sections 17.3.1 to 17.3.11.

Table 17.1 Matrix of Key Interrelationships

Receptor Activity	Traffic	Population and Human Health	Biodiversity	Soils and Geology	Hydrogeology	Hydrology	Landscape and Visual	Noise and Vibration	Air Quality and Climate	Archaeological and Cultural Heritage	Architectural Heritage	Material Assets and Land
Traffic	■	✓	✓					✓	✓			✓
Population and Human Health	✓	■	✓									
Biodiversity		✓	■	✓		✓	✓	✓				✓
Soils and Geology	✓	✓	✓	■	✓	✓	✓	✓	✓	✓	✓	✓
Hydrogeology					■							
Hydrology		✓	✓			■	✓					✓
Landscape and Visual		✓	✓				■			✓		✓
Noise and Vibration		✓	✓				✓	■				✓
Air Quality and Climate		✓	✓						■			✓
Archaeological and Cultural Heritage		✓								■		
Architectural Heritage											■	
Material Assets and Land		✓			✓	✓	✓					■

17.3.1 Traffic Will Interact / Interrelate with the Following:

Population and Human Health

During the construction stage, the haulage of materials to and from the site will interrelate with road users and residents along Trinity Street, adding to the noise and vibration, air quality and visual impacts. However, restricted haulage routes have been outlined as part of this EIAR to ensure that the population along Wexford Quays is not affected by increased traffic volumes as a result of construction traffic.

Operation stage traffic will also interact with population on Trinity Street including residents and road users. A new road junction layout has been developed to accommodate traffic accessing the site which will remove 16 no car park spaces, however the analysis of car parking demands in the area has been undertaken as part of Chapter 05 Traffic Analysis of this EIAR and has found there to be sufficient parking within the area.

The boardwalk link to Paul Quay will result in positive effects on population and human health, providing a pedestrian and cyclist friendly access to the site, incorporating a link to the town centre. The promotion of walking and cycling will have a positive human health effect on future Trinity Wharf users, providing a direct link to Wexford Town which benefits from improved safety and scenic views.

Biodiversity

The impact of construction traffic including piling barges and machines required for sheet piling have been assessed in Chapter 07 Biodiversity for their impact on the biodiversity within Wexford Harbour and the surrounding European and nationally designated sites. Air quality and dust emissions as a result of construction traffic and the potential for interactions with designated sites have also been assessed in Chapter 13 Air Quality and Climate. Air quality mitigation measures including a Dust Minimisation Plan, will reduce impacts on the biodiversity of the area as a result of construction traffic.

Operational traffic will increase noise levels within the site which has potential to adversely impact biodiversity. However, the road layout will bring the majority of vehicles straight to the multi-story carpark, containing most of the traffic to one area of the site which will keep noise levels low along the perimeter, thereby reducing noise impacts for biodiversity.

Noise and Vibration

Noise and vibration levels will increase as a result of construction traffic. Mitigation measures, as well as compliance with measures outlined in the Outline Construction Environmental Management Plan (CEMP) in Appendix 4.1 of this EIAR, will be put in place during construction to reduce the short-term noise impacts of construction traffic. Operation stage traffic will increase noise and vibration levels within the surrounding area. The assessment of the impacts on noise and vibration levels is detailed in Chapter 12 Noise and Vibration of this EIAR and has taken into account the predicted traffic levels modelled for operation stage.

Air Quality and Climate

Air pollutant emissions will also increase during the construction stage as a result of construction traffic. Mitigation measures such as a Dust Minimisation Plan have been developed and are presented in Chapter 13 Air Quality and Climate of this EIAR to mitigate potential short-term air quality impacts from construction traffic.

The increase in operation stage traffic levels will result in an increase in air quality emissions within the project location and its surrounding area. The assessment of the impacts on air quality and climate is detailed in Chapter 13 Air Quality and Climate and has taken into account the predicted traffic levels modelled for operation stage.

Material Assets and Land

The construction phase of the development will require the construction of a new access to the site and a new junction layout on Trinity Street to accommodate traffic entering the site. Short term impacts on users of Trinity Street will arise due to road works on Trinity Street. The impact of this on road users is addressed in Chapter 16 Material Assets and Land.

The new traffic layout on Trinity Street will impact on local infrastructure, resulting in the removal of 16 no. parking spaces along Trinity Street, while the boardwalk tie-in on Paul Quay will require the removal of 21 no. parking spaces. The impact of this requirement on the demand for parking within the area has been addressed in Chapter 05 Traffic Analysis and Chapter 16 Material Assets and Land.

17.3.2 Population and Human Health Will Interact / Interrelate with the Following:

Traffic Analysis

The construction stage of the development will increase traffic visiting the site as a result of the workforce. The impact of these traffic movements have been incorporated in the traffic assessment.

The introduction of mixed-use land-use into the site and general area of Trinity Street will increase traffic counts entering and exiting the site. The workforce employed within the 3 no. new office buildings, residents of the housing units and visitors to both the hotel and cultural centre / events space will result in vehicles accessing the site at peak hours. The impact of this increased traffic has been assessed in Chapter 5 Traffic Analysis of this EIAR.

Biodiversity

Increased visitors to the site during operation will alter the existing setting of the site and will result in potential impacts on the receiving biodiversity environment. Impacts on the biodiversity of the site are assessed in Chapter 7 Biodiversity of this EIAR.

17.3.3 Biodiversity Will Interact / Interrelate with the Following:

Population and Human Health

The removal of Invasive Alien Species (IAS) from the site will remove the risk of spreading of IAS in its current state by population and human beings visiting the site during both construction and operation stages. Therefore, the resultant risk of damage to nearby properties and infrastructure will be removed and the site will be more appealing to the population. An Invasive Species Management Plan is in place at the site and is presented in Appendix 7.4 of this EIAR.

Soils and Geology

The removal of IAS from the site will improve the soil quality and remove the risk of IAS spreading across the site.

Hydrology

The removal of IAS will also reduce the risk of spread of IAS through the Slaney River, upstream or throughout Wexford Harbour.

Landscape and Visual

The existing biodiversity and coastal character of the site has been incorporated into the Landscape Design Statement for the site which is included in Appendix 4.6 of this EIAR. Planting species that can withstand the harsh maritime environment have been selected to be included within the landscape plan to ensure the robust landscape plan compliments the site's unique location on the water.

Noise and Vibration

It is expected that biodiversity will reduce noise and vibration impacts as the sensitivity of migratory fish to noise and vibration impacts has resulted in the implementation of noise and vibration mitigation measures. For example, reduced working hours for piling operations are required to reduce noise and vibration impacts on migratory fish.

Material Assets and Land

The removal of IAS will remove the threat of spread to neighbouring properties. The presence of IAS can devalue and degrade properties and land. An Invasive Species Management Plan will be put in place at the site and is presented in Appendix 7.4 of this EIAR.

17.3.4 Soils and Geology Will Interact / Interrelate with the Following:

Traffic Analysis

Construction traffic will arise from the earthworks stage of development from the removal of waste material off site and the importation of infill required to raise the site. Traffic counts have been predicted for the earthworks stage of construction and have been assessed in Chapter 5 Traffic Analysis.

Population and Human Health

The excavation and removal of asbestos containing materials from the site will be controlled by specific mitigation measures, as outlined in Chapter 4 Description of the Proposed Development and Chapter 8 Soils and Geology of this EIAR. The appointed asbestos contractor will be required to ensure all construction workers have the required training, personal protective equipment and management strategies in place to reduce the risk of being exposed to asbestos containing materials. The development of the site will remove the risk of impacts to human health through remediation of both asbestos and contaminated land within the site. This will have a positive impact during the operation stage of the development, making the site a safer place to live and work.

The construction stage will have the potential to have adverse population and human health impacts within the area due to earthworks, the transport of material to and from the site and the installation of foundations which will include piling. The impacts on population and human health have been assessed in the respective specialists' chapters and Chapter 06 Population and Human Health of this EIAR. These chapters have taken increases in noise and vibration, and air quality and climate impacts into account due to the movement of construction material.

Biodiversity

Earthworks during the construction stage have the potential to impact on the Slaney River Valley Special Area of Conservation (SAC) and the Wexford Harbour and Slobs Special Protection Area (SPA) through construction site runoff, the risk of release of contaminants from the ground, noise and vibration, and air quality impacts. A suite of best practice techniques, mitigation measures and guidelines have been outlined in Chapter 09 Hydrogeology, Chapter 10 Hydrology, Chapter 07 Biodiversity and the Outline CEMP and Environmental Operating Plan (EOP) presented in Appendices 4.1 and 4.2 of this EIAR to mitigate impacts on the European and nationally designated sites within Wexford Harbour.

The operation of the development will enhance the biodiversity of the. The importation of clean fill and the use of native species which have been developed by the landscape architect and the project ecologist, will enhance the biodiversity within the site during the operational stage.

Hydrogeology

Earthworks such as localised excavations, where required, will have positive impacts on hydrogeology by removing contaminated soils from the site and reducing the risk of contamination of groundwater. Sheet piling has the potential to release contaminants to the surface which is discussed in Chapter 09 Hydrogeology of this EIAR.

Hydrology

Earthworks during construction have the potential to impact on the water quality of the Slaney River and Estuary. A suite of mitigation measures has been proposed to mitigate water quality impacts due to earthworks, as contained in Chapter 7 Biodiversity, Chapter 10 Hydrology and within the Outline CEMP presented in Appendix 4.1 of this EIAR.

Landscape and Visual

Earthworks on site will have an impact on the landscape of the site during the construction stage however the site is already a brownfield site with mounds of rubble and is not of particular landscape importance. Any landscape and visual impacts due to earthworks and the movement of material will be short term and hoarding will be provided during construction to mitigate impacts. Landscape and visual effects have been assessed in Chapter 11 Landscape and Visual Analysis of this EIAR.

Noise and Vibration

Earthworks activities and the movement of construction materials will have potential for short term impacts on noise and vibration during construction. Earthworks machinery have been included in a noise model and mitigation measures have been included in Chapter 12 Noise and Vibration and in the Outline CEMP to mitigate noise and vibration impacts due to earthworks and the movement of construction materials where possible.

Air Quality and Climate

Earthworks and the movement of construction materials have the potential to create airborne dust. A Dust Minimisation Plan is presented in Appendix 13.3 of this EIAR and aims to mitigate this short term potential impact.

Archaeological and Cultural Heritage

Earthworks have the potential to impact on unidentified archaeological sites during excavation and construction. The location of known archaeological sites have been assessed and mitigation measures have been put in place. The dockyard walls will be recorded prior to removal and an underwater archaeology impact assessment will be undertaken prior to construction. Impacts and mitigation measures proposed for the earthworks stage are discussed further in Chapter 14 Archaeological and Cultural Heritage of this EIAR.

Architectural Heritage

The construction of the sheet pile wall and clearance of the site will require the removal of old stone walls within the site. The significance of this impact and mitigation measures put in place are discussed in Chapter 15 Architectural Heritage of this EIAR.

Material Assets and Land

Earthworks during the construction stage have the potential to impact on water quality within the SAC if not mitigated. Active aquaculture licences are operational within Wexford Harbour and would be affected if sediment movement was to occur as a result of the project within the Lower Slaney Estuary. Mitigation measures have been put in place to prevent sediment entering the surface water through site runoff during construction. The potential for impacts on aquaculture licences is discussed in Chapter 16 Material Assets and Land while mitigation measures for preventing impacts to the Lower Slaney Estuary are outlined in Chapters 7 Biodiversity and 10 Hydrology while also being outlined in the Outline CEMP attached as Appendix 4.1 of this EIAR.

17.3.5 Hydrology Will Interact / Interrelate with the Following:

Population and Human Health

The proposed development has been designed to avoid the potential for flooding through the provision of a steel sheet pile sea wall, breakwater and rock armour, thereby avoiding the impact of flooding on population and human health.

Biodiversity

Construction activities have potential to pose a risk to watercourses, particularly if contaminated surface water was to enter the River Slaney. Chapter 7, Chapter 10 and the Outline CEMP set out measures to prevent the runoff of contaminants during construction. These measures will mitigate the risk to biodiversity within the Lower Slaney Estuary and the European sites.

The proposed drainage system has been designed to avoid or minimise the water quality impact to the River Slaney by means of SuDS treatment and attenuation prior to discharge.

Landscape and Visual

During the operation of the proposed development, SuDS features, such as swales, will be incorporated into the Landscaping Strategy (see Appendix 4.6) and will create landscaped areas which will be integrated into the planting and surface finishes.

Material Assets and Land

The provision of a SuDS surface water drainage system will provide treatment to surface water runoff from the site during operation. There is currently no surface water drainage system within the Trinity Wharf site with runoff draining directly to the Lower Slaney Estuary. The SuDs system will ensure that no sediment will runoff directly into the Slaney Estuary as per the existing situation, avoiding potential impacts on aquaculture licences.

17.3.6 Landscape and Visual Will Interact / Interrelate with the Following:

Population and Human Health

The development of a public realm and landscaping design as detailed in Chapter 4 of this EIAR and included in Appendix 4.6 will provide positive impacts on population and human health during the operation stage. The use of native plants and species and settings which incorporate the current setting of the site will help mitigate the impact of the development as a whole and will also create a modern urban quarter for the population and visitors to enjoy.

Biodiversity

The Landscaping Strategy (see Appendix 4.6) encourages the use of native tree species and has been developed in conjunction with the recommendations of the project ecologist. Species have been chosen for the site and for the green roofs to enhance and support biodiversity within the site. Pollinator friendly species and coastal grasses have been selected to enhance the biodiversity of the site as part of the landscaping scheme. These mitigation and enhancement measures are provided in Chapter 7 Biodiversity and Chapter 11 Landscape and Visual Analysis of this EIAR.

Archaeological and Cultural Heritage

Visual impacts due to the construction and operation of the proposed development may impact on the setting of archaeological sites. However, mitigation measures, including information boards, will improve the archaeological setting and raise awareness among site users of the archaeological history of the site during the operational phase.

Material Assets and Land

During operation, landscape mitigation measures will help create a modern urban quarter which will attract visitors and tourists to the area, representing a positive impact on material assets and land.

17.3.7 Noise and Vibration Will Interact / Interrelate with the Following:

Population and Human Health

Noise and vibration impacts will interact with population and human health during the construction stage due to construction noise. Operation stage noise and vibration levels will also interact with population and human health. Potential population and human health impacts as a result of noise and vibration increases have been assessed in Chapter 12 Noise and Vibration and Chapter 06 Population and Human Health of this EIAR.

Biodiversity

During construction and operation, noise and vibration impacts have potential to interact with the biodiversity within Wexford Harbour, in particular that of the Slaney River Valley SAC and the Wexford Harbour and Slobs SPA. The predicted impacts are discussed in Chapter 07 Biodiversity and mitigation measures have been included in the Outline CEMP located in Appendix 4.1 of this EIAR.

Landscape and Visual

Noise mitigation measures during construction has potential to positively interact with landscape and visual impacts. The use of high quality noise mitigating hoarding around the site during construction will help mitigate the visual impacts of the construction stage.

Material Assets and Land

Noise and vibration levels during construction stage will also interact with Material Assets and Land. Businesses along Trinity Street may be subject to indirect impacts during construction and operation as a result of noise and vibration increases.

17.3.8 Air Quality and Climate Will Interact / Interrelate with the Following:

Population and Human Health

Increases in air pollutant and dust emissions have potential to impact on population and human health. Impacts associated with air pollutant and dust emissions during both the construction and operation stages are discussed in Chapter 13 Air Quality and Climate and Chapter 06 Population and Human Health of this EIAR.

Biodiversity

Air pollutant and dust emissions have the potential to interact with the biodiversity of the area due to pollutant deposition. The potential for deposits on the Slaney River Valley SAC and Wexford Harbour and Slobs SPA are assessed in Chapter 13 Air Quality and Climate of this EIAR.

Material Assets and Land

Dust generated from construction activities may cause annoyance or nuisance to businesses within the area. Measures to control the production of dust such as the Dust Minimisation Plan, which has been prepared as part of this EIAR, will be put in place by the contractors to reduce any potential impacts experienced by receptors. Good communication between the contractors and business owners in the proximity of construction activities will facilitate on-going operations.

17.3.9 Archaeological and Cultural Heritage Will Interact / Interrelate with the Following

Population and Human Health

Information boards proposed as per the mitigation for Archaeological and Cultural Heritage will create a cultural element to the coastal walkway around the site for Population and visitors to enjoy, enhancing the visitors experience.

17.3.10 Material Assets and Land Will Interact / Interrelate with the Following:

Population and Human Health

The Trinity Wharf development, including the marina, will result in positive Population and Human Health impacts, providing public realm facilities and leisure opportunities for locals and visitors to enjoy. The redevelopment of the site will provide jobs and will help redevelop the Trinity Street area, bringing increased business and footfall to local businesses.

Hydrogeology

The provision of improved utilities such as a surface water drainage system across the site will have a positive impact on the hydrogeology of the area. There are currently no drainage facilities within the site and rainwater runs off into the Lower Slaney Estuary with infiltration also occurring throughout the site.

Hydrology

There are no current utilities within the site. Surface water and foul water facilities will be provided as part of the development to service the site. Surface water drainage and foul drainage designs have been incorporated into the design of the proposed development to prevent any foul or surface water runoff directly entering the River Slaney. Foul water is directed to a pumping station which connects to Wexford Town's foul drainage system and all of the surface water is attenuated prior to direct discharge to the estuary.

Landscape and Visual

The development of the land will have an impact on the Landscape and Visual setting of the site. The impact as a result of the development of the site from a brownfield site to a mixed use development providing public realm facilities, a marina and boardwalk is contained in Chapter 11 Landscape and Visual.

17.4 Major Accidents and Disasters

17.4.1 Potential for Major Accidents and Disasters

In the absence of national guidance on assessment of major accidents and disasters, the following methodology has been developed:

- Identifying hazards;
- Screening these hazards;
- Defining the impact;
- Assessing the likelihood of occurrence; and
- Assessing the remaining risks.

17.4.2 Stage 1 Assessment

A copy of the long list of major accident and disaster events is provided in Appendix 17.1 of this EIAR. Although the majority of these major events are already considered under other legislative or design requirements, this is not considered to be sufficient reason to eliminate them from further consideration. However, where it is concluded that the need for compliance is so fundamental, and the risk of any receptors being affected so remote, such major events have not been included on the shortlist.

Likewise, it is considered reasonable and proportionate to exclude certain receptor groups from the outset. Construction workers, as a receptor, can be excluded from the assessment, because existing legal protection is sufficient to minimise any risk from major events to a reasonable level.

Another potential source of major events related to the proposed scheme is road traffic accidents during its operation. These can clearly impact on people though fatalities and serious injury, but can also impact on the environment through the spillage of fuel and hazardous loads. However, for the proposed development, Chapter 5 Traffic Analysis of this EIAR has included elements in its design to minimise this risk.

As such, although the EIAR will still consider the risk of spillages, as part of the assessment of surface water drainage and the water environment (See Chapter 10 Hydrology of this EIAR), the potential for such accidents to affect people, as receptors under the topic of human health, is not considered further.

17.4.3 Stage 2 Assessment

In general, major accident and disaster events, as they relate to the proposed development, will fall into three categories:

- Events that could not realistically occur, due to the type of development or its location;
- Events that could realistically occur, but for which the proposed development, and associated receptors, are no more vulnerable than any other development; and

- Events that could occur, and to which the proposed development is particularly vulnerable, or which the proposed development has a particular capacity to exacerbate.

The screening stage was undertaken primarily to identify this third group of major events, which would then form the shortlist of events to be taken forward for further consideration. The results of the screening exercise undertaken for the long list of events are provided in Appendix 17.1 of this EIAR.

17.4.4 Stage 3 Assessment

Stage 3 of the assessment requires more detailed consideration of the short list of major events developed during Stage 2, though this may only mean that the risk needs to remain on the design risk register until it is closed out through design. Major events that were included on the short list and which have subsequently been considered in more detail are presented in Table 17.2.

Table 17.2 Assessment of Remaining Risks Associated with the Proposed Development

Major Event	Reason for consideration on Short List	Potential Receptors	Mitigation	Residual Significance
Floods	The Trinity Wharf site currently floods occasionally in its existing brownfield state. The preliminary flood risk assessment (PFRA) map at the proposed development location indicates that the site is located within the 1 in 200 year and extreme coastal flood extents. The PFRA mapping shows the 1 in 100 year and extreme pluvial flood extents immediately to the south east of the site. The vulnerability of the project to flooding is covered in the Flood Risk Identification as reported in Chapter 10 Hydrology of the EIAR in terms of the risk to the proposed scheme.	Road users, property and people in areas of increased flood risk.	A review of the previous flood risk assessments and the study carried out for this project has determined that a minimum ground floor level of 2.64mOD should be adopted for all buildings within the development. The local roads within the site should have a minimum level of 2.34mOD. These satisfy the requirements of the Office of Public Works' (OPW's) Flood Risk Management Guidelines for Local Authorities and the Wexford Town and Environs Development Plan (2009 – 2015) as extended. The lowest proposed finished floor level for the development has been set at 3.00mOD while the lowest road level will be at 2.80mOD. In addition to raising the floor level, a new steel sheet pile sea wall is to be provided along the north-western and north-eastern edges of the site as part of the development, while the south-eastern side will comprise of sheet piled wall and the placement of rock armour to provide wave attenuation. The marina will also be sheltered by a breakwater on the seaward side. A Wave Climate assessment undertaken by RPS in the Trinity Wharf Marina Feasibility Report found that the proposed marina option and floating breakwater would result in the height and period of incident waves under all weather conditions to be within the wave height accepted threshold conditions as per the guidelines published by the Yacht Harbour Association and the Australian Standard (AS3962) '*Guidelines for design of Marinas'*. The proposed marina breakwater, sea wall and rock armour revetment along the perimeter of the site will protect the development against storm surge and wave action. This assessment accounted for a 1 in 100 year storm and a 1 in 50 year storm event from the north-east. Chapter 10 of the EIAR concludes that the proposed mitigation measures outlined above indicate that the risk associated with flooding can be reduced from moderate/significant to slight.	Not significant

Major Event	Reason for consideration on Short List	Potential Receptors	Mitigation	Residual Significance
Road Accidents	The risk posed by spillage from hazardous loads as a result of a road traffic accident, e.g. fuel tankers, is considered in the Hydrology and Hydrogeology chapters of this EIAR. The proposed development will introduce these types of vehicles to the site.	Road users, aquatic environment.	As described in Chapter 05 Traffic Analysis, a stage 1 Road Safety Audit has been carried out for the site. The circular route around the development is proposed as a pedestrian priority shared surface and will cater for one-way vehicular traffic only. Low traffic speeds will be achieved with entry and exit ramps, use of traffic calming pavement, street furniture and landscaping and narrow carriageway widths with tight corner radii in accordance with the Design Manual for Urban Roads and Streets (DMURS). Current collision statistics have shown that only 3 incidents have occurred on Trinity Street and William Street Lower in the ten year period between 2005 and 2014. Therefore it is expected that spillages as a result of traffic accidents will be unlikely due to speed reduction measures etc. Chapter 10 Hydrology of this EIAR has looked at spillage events during construction such as accidental spillages of hydrocarbons, concrete, cement products etc. Mitigation measures have been included in Chapter 10 Hydrology and in the Outline CEMP and Outline EOP prepared for the development which will, as a minimum, require the development to be formulated in consideration of standard best practice. An Outline Incident Response Plan has also been included in the Outline EOP for the construction stage.Mitigation measures for the operation stage to deal with impacts from runoff include SuDS components which will convey runoff to the Lower Slaney Estuary with very limited infiltration to ground, while attenuation will be provided for the 1 in 100 year six hour event plus a climate change factor (between tidal cycles). These mitigation measures will attenuate and cleanse the surface water runoff from the site prior to discharge to the sea through multiple locations along the extent of the proposed sea wall.	Not significant

Major Event	Reason for consideration on Short List	Potential Receptors	Mitigation	Residual Significance
Rail Accidents	The risk of rail accidents is considered as the access to the proposed development requires crossing of the Dublin to Rosslare railway line. As the passenger trains that traverse this line are travelling at a reduced speed on approach to Wexford Town, the risk of accident is reduced. A level crossing which will be used by fuel tankers etc. will pose risk of spillage from hazardous loads if an accident was to occur as a result of the railway crossing.	Road users, aquatic environment.	The road network will be connected to Trinity Street via a new road to be constructed perpendicular to the Trinity Street that will cross the railway line by means of a level crossing. This will be the main vehicular access to the site. The proposed link road into the development site will form a new level crossing with the Dublin to Rosslare railway line. Iarnród Éireann have agreed, in principle, to the design of the level crossing which will consist of signalised automatic-controlled boom barriers. A temporary level railway crossing will be established for the duration of the construction works for the access road. Towards the end of the construction phase, this crossing will be made permanent. Pavement works will be constructed on the railway and temporary accommodation arrangement for Iarnród Eireann flag man and look-out staff who will control the crossing for the duration of the works. Exact arrangements of this crossing will have to be agreed with Iarnród Eireann. The maintenance and operation of the level railway crossing at the main site access road will be taken over directly by Iarnród Eireann including the operation of the signalling, and maintenance of the barriers and mechanical and electrical equipment. New signalling equipment will be installed at the remote-control centre where signalling personnel can monitor and control the level crossing in use and new equipment will be installed along the railway on each approach to the level crossing.	Not Significant

Major Event	Reason for consideration on Short List	Potential Receptors	Mitigation	Residual Significance
Building Failure or Fire	There are a number of buildings on the site with up to 6 storeys including a multi-storey carpark. The buildings have been designed to the most recent design regulations and fire exits have been incorporated into the designs.	Building users and population	Once the proposed development is in operation, it is not likely to cause any major accidents and/or disasters due to the nature of the development. In the event of a fire or emergency, Wexford County Council's Fire Officer has been involved in the design to ensure that standard requirements are met. **Emergency / Fire Tender Access:** Wexford County Council's Fire Officer was satisfied that the vehicular circulation system provides a clear route and access around more that 50% of the buildings. However, they also asked for that the perimeter cycle/footpath be designed to allow additional fire tender access to the buildings facing the waterfront and a reinforced grass area to the side of the hotel. An inlet pipe from the estuary will be provided as per the designs in Chapter 4 and Figure 4.19 of Volume 3 of this EIAR, which will provide adequate water supply for fire-fighting, as required. **Evacuation:** The two principle routes from the site are the main entrance road from Trinity Street and the pedestrian/cycle boardwalk. Due to the size of the site and form of development, the site is large enough also for people to move to different areas within the overall site, from which there is scope for gradual evacuation. **Buildings**: All buildings are designed to comply with Building Regulations Technical Guidance Documents (TGD) Part B – Fire Safety (2006). At this stage, the main focus has been with regard to B1 'Means of Escape in Case of Fire' and B5 'Access and Facilities for the Fire Service'. Buildings have been considered in terms of vertical and horizontal compartmentation, internal travel distances, stair core locations, etc. Consideration has also been given to B4: 'External Fire Spread' in terms of building separation distances and materials.	Not Significant

Major Event	Reason for consideration on Short List	Potential Receptors	Mitigation	Residual Significance
			For the residential building the design has worked to comply with BS5588 Part 1, for offices BS5588 Part II, and for the cultural/performance centre to comply with BS5588 Part 6. Buildings can be provided with either wet or dry risers – however hydrants are to be located around the site and building heights are limited with top floor levels under 20m above ground level.	
Utilities failure (gas, electricity, water, sewage, oil, communications)	The release of foul sewage to the Slaney Valley SAC in the event of infrastructure failure could have significant impacts.	Biodiversity of Wexford Harbour and Slaney Estuary	The foul pumping station which will be installed will have standby pumps in the event of main pump failure. The pumping station will also have capacity to provide 24-hour effluent storage in the event of standby pump failure. Further to these measures, if overflow did occur, foul water would not discharge directly into the SAC. It would pond on the surface of the site, where it would travel through the swales and permeable paving which would provide some level of treatment and attenuation to the foul water. This would allow the relevant authority some time to address the overflow issue prior to the foul water making it into the SAC.	Not Significant
Animal and Plant disease	There is currently IAS within the brownfield site which will be dealt with before construction. However biosecurity will be considered in the construction and operational phases for both the landside developments and the marina.	Land-users, biodiversity	An Invasive Alien Species Management Plan (see Appendix 7.4) has been put in place by Envirico Ltd. on behalf of Wexford County Council since 2017 to eradicate the IAS within the site prior to construction. A site survey will be carried out prior to development to ensure that IAS have been eradicated as per the Management Plan and that no regrowth has occurred. The contractors will be in charge of the management of IAS during construction and where eradication has not been successful they will need to put in place a Management Plan for the treatment of any remaining IAS.	Not significant

The likelihood of the proposed development causing major accidents and /or disasters is very small and is not significant.

17.5 Cumulative Effects

Cumulative effects are effects that result from incremental changes caused by other existing or approved projects together with the proposed development of Trinity Wharf. Cumulative effects were assessed by looking at all previous developments and current developments for which planning has been received.

Plans and projects which were identified and may be of significance are discussed below.

17.5.1 Irish Water (Planning Reference: 20151160)

Permission for the installation of a new outfall pipe to serve Wexford Wastewater Treatment Works was granted to Irish Water in February 2016. The permission included the installation of a 900mm diameter high-density polyethylene outfall pipeline to be constructed adjacent to the existing outfall pipeline from the shoreline to the existing outfall point in Wexford Harbour. A Natura Impact Statement (NIS) was submitted as part of the planning application which found that all impacts would not be significant and would be temporary. The works were scheduled from April to September to avoid the main wintering season for birds and were scheduled to be completed by September 2016. This work was only recently carried out in September 2018, however the works did not require the installation of a new pipe and repair works were carried out to the existing pipe instead.

As the location of the outfall pipe is 2km downstream of the proposed Trinity Wharf site, the Trinity Wharf site was assessed as one of two possible compound locations to be used during the works. As new pipes were not required however, the Trinity Wharf site was not needed as a compound. Taking into consideration the distance of the work from the proposed Trinity Wharf Development, the predicted short term of the effects and the temporal duration between the two projects, no cumulative effects are predicted as a result of the two projects.

17.5.2 Wexford Creamery Extensions

Glanbia Ingredients Ireland Limited

<u>Alterations to Existing Plant Rooms (Planning Reference: 20150576)</u>

Permission to carry out alterations to existing plant rooms in order to accommodate new natural gas fuelled boilers was granted in July 2015. The proposal consists of the removal of an existing canopy structure, an extension at ground floor level, the replacement of a roof at an increased height incorporating a penthouse structure of 10.125m as well as 3 new boiler stacks at a total height of 13.125m. An Appropriate Assessment (AA) was carried out for this planning application and found that during both the construction and operational phases, there would be no likely significant effects on the surrounding area. Therefore, no cumulative effects are predicted as a result of this project and the proposed Trinity Wharf Development.

<u>Extension of production facilities (Planning Reference: 20160176)</u>

A further application for the extension and modification of the existing production facilities at Wexford Creamery was granted in April 2016, subject to conditions. The modifications involved the replacement of the existing low-level roof from 5m to an increased height of 16.5m, an extension to accommodate new storage and dispatch areas and the removal of an existing penthouse structure along with all associated site works and drainage within the site complex. Although the site is located only 800m away from the proposed development and the site entrance is located on the R730, it was found that there would be no likely significant impact. An AA Screening found that the extension was not considered to have any significant impact on Natura 2000 sites due to the nature and scale of the development. Furthermore, a Planning and Environmental Considerations Report identified that any significant environmental impacts would be managed through design considerations and mitigation measures. As a result, there are no likely significant cumulative impacts predicted as a result of the expansion and the proposed Trinity Wharf development.

Nutricia Infant Nutricia Ltd

Water Tank and Pump House (Planning Reference: 20150569)

Planning was granted for the construction of a 10.5m high water storage tank and an associated single storey pump house which will be used for the provision of a new fire prevention sprinkler system. The AA found that there will be no change to the overall surface water drainage system at the site. Therefore, no cumulative effects are predicted as a result of this project and the proposed Trinity Wharf Development.

Extension to existing production & warehouse facilities (Planning Reference: W2011083)

The development of an extension to existing production and warehousing buildings to accommodate an extended parking facility underwent AA Screening and Environmental Assessment in 2011. The Environmental Assessment Report found that the development will have no significant impact on the surrounding environment while the AA Screening found that the development would not result in likely significant direct or indirect impacts to Natura 2000 sites within 10km. Therefore, no cumulative effects are predicted as a result of this project and the proposed Trinity Wharf development.

Wexford Creamery EPA Licence Amendment (IED Licence No. P0794-01)

An EIAR was carried out for the Industrial Emissions Licence Review required as a result of production expansion (Industrial Emissions Directive (IED) licence P0794-01). The EIAR assessed the impact of the increase in production and increase in operational emission limits on the surrounding environment. The EIAR was submitted in November 2018 alongside a NIS. The NIS and EIAR found that there would be no significant effects to ecological and environmental receptors as a result of the plant upgrade and that with the mitigation measures proposed, the expansion of production will not cause significant adverse impacts on the flora and fauna within the receiving environment. It also found that compliance with the future IED Licence P0794-02 and the Trade Effluent Discharge Licence (SS/W182/05/16R1) will ensure that the potential impacts on surface or groundwater water resources as a result of the plant upgrade will not be significant. It is therefore considered that cumulative impacts are not predicted as a result of the existing production in Wexford Creamery and the proposed Trinity Wharf Development.

17.5.3 COANT Entertainments Ltd (Planning Reference: 20180589)

Planning permission was granted to COANT Entertainments Ltd in October 2018 for a development at Commercial Quay, Charlotte Street and 84 North Main Street in Wexford Town. The site is approximately 1km north of the Trinity Wharf Development on a vacant brownfield site along the Wexford Quays opposite the Wexford Bridge. The development consists of the demolition of all existing structures on the site and redevelopment of the site including an 8-storey mixed use development accommodating a hotel fronting to Commercial Quay, a retail space and 9 residential units. This application was granted permission subject to conditions by Wexford County Council in October 2018 but has subsequently been appealed to An Bord Pleanála in November 2018. Due to the distance, the proposed development is not likely to have any cumulative effects with the proposed Trinity Wharf Development.

17.5.4 Colm Neville Construction Unlimited Co. (Planning Ref: 20171297)

Colm Neville Construction was granted permission for the extension and modification to their previous planning application W2010012 which they held under their previous name Orchard Lane Investments. The original application was refused by Wexford County Council and subsequently granted by An Bord Pleanála in 2010 following appeal. It comprised permission for 189 no. dwellings and 1 no. creche with all connections to existing public services, demolition of an existing agricultural building and construction of a temporary extension to be located on a cul de sac on Mulgannon Rd, Mulgannon, Co. Wexford. Modifications were granted to the application in March 2011 which allowed for the extension of the site area, inclusion of an additional 6.no houses, and possible future roundabout. Extension of the above planning permission for 5 years was granted in 2016.

The proposed housing development is located approximately 1km south west of the proposed development and due to the distance and difference in topography, is not likely to have any cumulative effects.

17.5.5 Morrowpoint Properties Limited (Planning References: 20181215 and 20181216)

Two planning applications from Morrowpoint Properties are currently with Wexford County Council for review, following submission in October 2018 for a mixed-use development along the Rosslare Road in Roxborough, approximately 1.8 km from the proposed development. Permission for Phase 1 (Planning Reference: 20181215) includes for the construction of a mixed-use and residential development comprising of the following; 71 no. residential units to include 62 semi-detached houses and a three-story apartment block comprising the remainder; a single storey creche/childcare facility building; a new access onto the R730 public road; and ancillary drainage works including foul water pumping station, site attenuation and rising main connection to existing Wexford town Wastewater Treatment Plant.

Permission for Phase 2 (Planning Reference: 20181216) comprises permission for the construction of 71 no. Residential units including detached, semi-detached and terraced dwellings; shared access with Phase 1 onto the R730 and shared ancillary drainage works, as described above.

While permission is currently with Wexford County Council, the NIS for phases 1 and 2 concluded that as a result of the mitigation proposed, the proposed development will have no adverse effects on key habitats or species and the overall integrity of the Natura 2000 sites. As part of the application, a Traffic and Transport Impact Assessment was also provided which, when assuming worst case scenario and including future development of additional zoned lands, found it will have minimal impact on other road users and the local road network well into the future. Considering the above assessments and the distance from the development, it is concluded that there will be no significant cumulative impacts from these planning applications with the proposed development.

17.5.6 WRM Investments (Planning Reference: 20170283)

Permission for the erection of a warehouse facility with ancillary two storey office block (6564m^2), external signage, a heavy goods vehicle (HGV) trailer park and all associated site development works was granted in June 2017. The development will be located off the Rosslare Road, east of the existing Omniplex building, approximately 2.2km from the proposed Trinity Wharf Development. An NIS was submitted with the application which concluded that there would be no adverse impacts on key habitats, species and the overall integrity of nearby Natura 2000 sites as a result of the development while an Environmental Noise Impact Assessment also concluded that there would be no significant increases in noise as a result of the development. Due to the distance from the proposed development and the results of the above assessments, no cumulative impacts are predicted with the proposed Trinity Wharf Development.

17.5.7 M11 bypass Scheme

The M11 Bypass Scheme will realign the N11 national primary road from south of Gorey to south of Enniscorthy, providing 27km of new motorway. The scheme also includes 8km of new single carriageway, to the west of Enniscorthy, linking from the existing Scarawalsh Roundabout to Templescoby on the N30. In addition a further 4 km of new dual carriageway will link those two sections. The scheme also includes a crossing of the River Slaney approximately 3km north east of Enniscorthy. An EIAR and AA was completed for the Scheme and following planning permission being granted it is currently under construction and is programmed to be operational in 2019.

The EIAR found that no significant impacts would occur to watercourses including the Slaney River Valley SAC as a result of the Scheme while the AA concluded that correct implementation of the mitigation measures provided will result in no significant residual impact on the integrity of the SAC. While the EIAR predicted short term changes to water quality and siltation were predicted during watercourse crossing construction, long term impacts on watercourses and biodiversity were found to be not significant.

The completion of the M11 Gorey to Enniscorthy is also anticipated to have a beneficial effect on traffic levels in Wexford Town as commuter traffic will use the new scheme rather than bypass Enniscorthy via Wexford Bridge and the R741, with potential to have positive cumulative effects with the proposed Trinity Wharf Development.

17.5.8 Wexford County Development Plan (2013 – 2019)

The vision set out in the Plan is to create a county which "*offers high quality, sustainable employment opportunities and residential developments*" with "*high quality urban and rural environments supported by excellent sustainable physical and social infrastructure*" and which "*offers visitors a range of high quality experiences*". The Plan's Economic Development Strategy seeks to harness the economic potential of the county's urban areas, in particular the hub of Wexford Town, and maximise the potential for job creation.

The proposed development will support the County Development Plan's vision not only through creating high quality office space for businesses but it will also provide opportunities for tourism development through the proposed hotel and marina and through the potential to connect with the planned coastal walk which is envisaged to travel via the Trinity Wharf site. Therefore, positive cumulative effects are predicted as a result of the proposed development.

17.5.9 Wexford Town and Environs Development Plan (2009-2015) (as extended)

The Trinity Wharf site is zoned as 'Town Centre' under the Wexford Town and Environs Development Plan 2009-2015, as illustrated in Figure 2.1 in (Volume 3 of this EIAR). The proposed development will contribute to a number of key aims within the Wexford

Town and Environs Development Plan as outlined in Chapter 2 of this EIAR. The Trinity Wharf site is also outlined as a '*Key Opportunity Site*' and as a site '*of a scale that they have significant capacity for redevelopment and represent significant opportunities to facilitate enterprise and employment opportunities'.*

The proposed development will support the Development Plan and will result in positive cumulative effects.

17.5.10 Wexford Local Economic and Community Plan (2016-2021)

The Wexford Local Economic and Community Plan has highlighted the issue of unemployment as a concern in County Wexford. The development of Trinity Wharf will support a number of objectives within the Plan, including specific objectives for the rejuvenation of the Trinity Wharf lands, creating positive cumulative effects. The proposed development will therefore result in positive cumulative impacts in respect of the Wexford Local Economic and Community Plan.

17.5.11 Wexford Quay Economic Development and Spatial Implementation Plan (2018)

The Wexford Quay Economic Development and Spatial Implementation Plan provides a strategic vision for revitalising and regenerating the Wexford Quays area, including the redevelopment of the Trinity Wharf site. The Plan also includes a number of Actions and Outcomes for the Trinity Wharf site focusing on the development of the site as a new urban mixed-use business quarter within walking distance of the town centre. The proposed development will strive to satisfy the outcomes of the Plan, by fulfilling the actions outlined. The proposed development will therefore result in positive cumulative impacts in respect of the Wexford Quay Economic Development and Spatial Implementation Plan.

17.6 Conclusion

Interrelationships

The interrelationships between the individual environmental disciplines have been considered and assessed. It is concluded that once relevant mitigation measures are implemented, no residual likely significant effects will exist as a result of the construction or operation of the Trinity Wharf Development.

Major Accidents and Disasters

The design of the proposed development has taken account of the potential for flooding, road and rail accidents, spillages, building failure or fire and on site and animal and plant disease in the design of the development and the construction methodology. In relation to accidents resulting in a spillage of polluting material, the risk of these occurring will not be significant. The likelihood of the proposed development causing major accidents and /or disasters is therefore found to be slight and is not significant.

Cumulative Impacts

Although it is acknowledged in Chapter 11 that the proposed development will result in adverse landscape and visual effects of certain localised views along the coastline it is not considered that there is potential for significant negative cumulative impacts arising in combination with any of the other assessed plans or projects. Positive cumulative impacts are predicted with strategic plans for the area as the proposed development supports various objectives of these plans.

Based on the above, it can be objectively concluded, in view of best scientific knowledge, on the basis of objective information and provided effective mitigation is in place, that the proposed development, either individually or in combination with other plans and projects, will not have a significant adverse effect on the receiving environment.

Appendix 17.1 Stage 2 Assessment of Major Accidents and Natural Disasters

ROD
ROUGHAN & O'DONOVAN

Stage 1 Assessment for Accidents and Disasters

		Relevant for long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Covered already in EIAR? If so, where?	Continue to Stage 3 (see Chapter 4)?
Natural Disasters						
1 Geological Disasters						
1.1	Avalanches and landslides	Yes	Landslides have been considered as a fundamental part of the design. This will ensure that the risk is designed out, both in terms of the vulnerability of the proposed scheme to these types of event, and also in terms of the potential for the proposed scheme to increase the risk of such an event happening. There is considered to be no receptor that could therefore be of greater risk.	N/A	N/A	No
1.2	Earthquakes	No	The site is not in a geologically active area and as such, earthquakes are not considered to be a real risk or serious possibility.	N/A	N/A	No
1.3	Sinkholes	No	The geology of the study area is not prone to sinkholes.	N/A	N/A	No
2 Hydrological Disasters						
2.1	Floods	Yes	Both the vulnerability of the project to flooding, and its potential to exacerbate flooding, have been covered in the Hydrology Chapter and has been reported on in the EIAR, both in terms of the risk to the scheme and increased risk due to the scheme.	The proposed development, railway line and adjacent Goodtide Harbour.	Yes - Chapter 10: Hydrology	Yes
2.2	Tsunami / Storm surge	Yes	The site is exposed to sea levels and the effect of storm surges have been considered in the assessment of Flood Risk. See Item 2.1 above.	N/A	Yes - Chapter 10: Hydrology	No

		Relevant for long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Covered already in EIAR? If so, where?	Continue to Stage 3 (see Chapter 4)?
3 Meteorological Disasters						
3.1	Blizzards	No	Blizzard conditions could affect users of the development, however the risk is no different from other coastal developments in Ireland. As part of the Masterplan for the site, Wind and Microclimatic Analysis was carried out for the proposed layout to determine the predicted performance of the buildings and their impact on their surrounding environment in terms of microclimate.	Population	N/A	No
3.2	Cyclonic storms	No	No - not applicable.	N/A	N/A	No
3.3	Droughts	No	Droughts are only considered as a disaster due to water shortages for essential services and where there are indirect impacts on food production, loss of soils etc. The proposed scheme is not considered to be vulnerable to drought.	N/A	N/A	No
3.4	Thunderstorms	Yes	The proposed building designs will consider the potential risk of lightning strikes, though the risk is not considered to be any greater than any other buildings.	Population	No	No
3.5	Hailstorms	No	No	N/A	N/A	No
3.6	Heat waves	Yes	The building and pavement design will consider the effect of high temperatures; however the proposed mixed-use development will be no more vulnerable than any other development.	N/A	N/A	No
3.7	Tornadoes	No	Although there are tornadoes in Ireland, their destructive force tends to be much less than in other parts of the world and the proposed scheme is not particularly vulnerable to any potential effects.	N/A	No	No
3.8	Wildfires	Yes	The landscaping proposed for the propose development will not be very dense, however the risk of wildfires is thought to be no greater than the existing urban developments.	Development users, habitats and species.	No	No
3.9	Air Quality Events	Yes	Although relevant, as vehicles emissions can contribute to poor air quality, it is not considered necessary to undertake any more assessment than is already proposed for the Air Quality assessment.	Population	Yes - Chapter 13: Air Quality & Climate	No

		Relevant for long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Covered already in EIAR? If so, where?	Continue to Stage 3 (see Chapter 4)?
4 Space Disasters						
4.1	Impact events and airburst	No	The proposed scheme is considered to be no more vulnerable than any other development.	N/A	N/A	No
4.2	Solar flare	No	The proposed development is considered to be no more vulnerable than any other development.	N/A	N/A	No
5 Transport						
5.1	Road Accidents	Yes	The risk posed by spillage from hazardous loads as a result of a road traffic accident e.g. fuel tankers will be considered in the Hydrology and Hydrogeology Chapters.	Road users, aquatic environment.	Yes - Chapter 9: Hydrogeology and Chapter 10: Hydrology	Yes
5.2	Rail Accidents	Yes	Access to the proposed development requires the crossing of a live railway. A level crossing will be put in place to provide an access.	Road users, aquatic environment.	No	Yes
5.3	Aircraft Disasters	No	There is not considered to be an increased risk to road users or building occupants, or members of the public.	Road users, pilots and aircraft.	N/A	No
5.4	Maritime Disasters	Yes	The proposed development is located adjacent to the sea. The marina is the most vulnerable aspect of the development which would be subject to maritime disasters. The Marina Feasibility Study carried out by RPS Group modelled for the effect of extreme tidal levels, wave and wind conditions in designing the marina.	Material Assets, Population	Yes – Trinity Wharf Development, Marina Feasibility Study	No
6 Engineering Accidents/Failures						
6.1	Bridge Failure	Yes	The pedestrian boardwalk to Paul Quay will comprise the only bridge proposed as part of the development. This will be designed to modern safety standards.	Population	No	No
6.2	Tunnel Failure or Fire	No	No proposed tunnels.	N/A	N/A	No
6.3	Dam Failure	No	There are no dams that would affect the proposed scheme.	N/A	N/A	No

		Relevant for long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Covered already in EIAR? If so, where?	Continue to Stage 3 (see Chapter 4)?
6.4	Flood Defence Failure	Yes	The site has been designed to protect against flooding by means of raising the height of the site and constructing a sheet piled sea wall. This sea wall has been designed to the required standards and a stone revetment will be placed on the outer side of this sea wall on the southern side of the site to attenuate any incoming waves.	N/A	Chatper 4: Description of the Proposed Development	No
6.5	Mast and Tower Collapse	Yes	Roadside signs and lighting will be part of the scheme. They will be designed to modern design standards.	Road users	No	No
6.6	Building failure or fire	Yes	Buildings have been designed to the latest design standards and measures as requested by Wexford County Council's fire officers have been incorporated into the development.	Population, Biodiversity	Chapter 4: Description of the Proposed Development	Yes
6.7	Utilities failure (gas, electricity, water, sewage, oil, communications)	Yes	Utilities including water and wastewater provisions have been designed and will be provided as part of the proposed development. These include provision of freshwater and sewage facilities for the marina users.	Hydrology, Hydrogeology	Chapter 04: Description of the Proposed Development Chapter 09: Biodiversity	No
7 Industrial Accidents						
7.1	Defence industry	No	None in the study area	N/A	No	No
7.1	Energy Industry (fossil fuel)	No	None in the study area	N/A	No	No
7.1	Oil and gas refinery / storage	No	None in the study area	N/A	No	No
7.1	Food Industry	Yes	A restaurant is proposed as part of the development. Health and Safety will be implemented by the occupier when appointed. Wexford Creamery is located approximately 800m south of the proposed development. The proposed scheme is not within the area and is unlikely to be affected in such events.	Population, Biodiversity	No	No
7.1	Chemical Industry	No	None nearby	N/A		

		Relevant for long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Covered already in EIAR? If so, where?	Continue to Stage 3 (see Chapter 4)?
7.1	Manufacturing Industry	No	None nearby	N/A	N/A	No
7.1	Mining Industry	Yes	None nearby	N/A	No	No
8 Crime/Civil Unrest						
8.1	Crime or Civil Unrest	No	No more vulnerable than any other developments.	N/A	No	No
8.2	Cyber attacks	Yes	No more vulnerable than any other developments.	N/A	No	No
9 Disease						
9.1	Human disease	No	No more vulnerable than any other infrastructure.	N/A	No	No
9.2	Animal and Plant disease	Yes	The removal of onsite Invasive species is required to permit development. Biosecurity will be considered in the construction and operational phases.	Biodiversity	Chapter 07 Biodiversity	Yes

Chapter 18:
Mitigation Measures

ROUGHAN & O'DONOVAN

Chapter 18 Mitigation Measures

18.1 Introduction

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

This chapter provides a summary of the mitigation measures for the Trinity Wharf Development as contained within chapters 4 – 17 of the Environmental Impact Assessment Report (EIAR). This is a summarised version stating only the mitigation measures to be provided and does not discuss the requirement for the measure to be applied or the residual impacts. This chapter also deals only with mitigation measures to be applied to the Trinity Wharf Development and does not address the avoidance or reduction mitigation which has been applied through the design development.

18.2 General Mitigation and Monitoring Measures

Table 18.1 General Mitigation and Monitoring Measures

No.	Description
1.1	**Site Preparation Works** Prior to any work commencing on the development site, a boundary security will be required to be established around the site to prevent unauthorised access.
1.1.1	Further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site. The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractor.
1.1.2	All site clearance and excavation works will be required to follow the mitigation measures of this EIAR (Chapter 4 and 8) as well as any future mitigation measures to be detailed in the Remediation Strategy. For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the 'measures for working with asbestos'. Any ACMs discovered will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.
1.2	The '**Asbestos Survey and Remediation Strategy'** are currently in progress at the time of writing this EIAR. The following sections detail the stages involved in undertaking the Asbestos Survey and Remediation Strategy, any recommendations or mitigation from these surveys and reports will be required to be incorporated into the CEMP at construction stages. The Asbestos Survey and subsequent Remediation Strategy, as recommended by RSK (detailed in Appendix 8.1 of this EIAR) will be required to be undertaken as follows:
1.2.1	Prior to the start of any construction works, a site specific intrusive asbestos survey will be undertaken by a suitably qualified, licenced and experienced contractor to work with asbestos – that is being progressed at the time of writing this EIAR. The aim of the asbestos survey report is to determine the full extent, type and location of all surface and near surface ACMs and will include representative sampling as appropriate. A number of stages will occur as recommended by RSK walkover survey (detailed in Appendix 8.1) and will occur in the following order:

No.	Description
	a) Undertake an intrusive investigation including representative sampling as appropriate to identify any potential sub-surface asbestos contamination within the demolition material stockpiled in various locations across the site. b) Undertake a target intrusive investigation comprising trial pits and / or slit trenches to determine the extent of any possible asbestos in fill material and below floor slabs across the site. The site investigation will be required to be scoped to cause minimal disturbance to any surface ACMs identified and all suitable control measure implemented to prevent exposure to asbestos throughout the works. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on site of this nature.
1.2.2	Develop a Remedial Strategy for the site on completion of the survey and investigations to detail the work required to mitigate the risks associated with asbestos contamination identified and to prevent the potential release of asbestos fibres during the proposed development works. The appointed contractor will be required to have the appropriately qualified and experienced to work with asbestos. a) A method statement and evidence of competencies will be required to be provided to WCC in advance of undertaking such the remedial strategy.
1.2.3	Remediation Verification Report: All mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.
1.3	**Measures for Working with Asbestos** All construction works will be undertaken in line with the Control of Asbestos Regulations (CAR) 2012 which requires actions to ensure the protection of workers and general public from asbestos exposures relating to work activities. CIRIA SP168 "Asbestos in soil and made ground: A guide to understanding and managing risks" as well as all relevant waste management legislation will also be adhered to by contractors. During the site clearance works and the construction stage of the proposed development, the following mitigation measures are to be implemented, which will be in addition to standard health and safety practices on construction sites: **Training –** All personnel removing, overseeing, directing, inspecting and/or disturbing ACMs and asbestos-contaminated soil will have, as a minimum and as appropriate to the activity, relevant training and experience in working with asbestos and/or asbestos in soils awareness. **Personal Protective Equipment (PPE)** – All personnel working with or in the vicinity of areas where asbestos is suspected or has been previously identified must wear personal protective equipment to include disposable category 5 coveralls. **Air monitoring** will be conducted during the disturbance of suspected ACMs as part of the site clearance works and during construction works. Where air monitoring is required it must be carried out by a UKAS accredited analyst in accordance with the method set out in HSG248 Asbestos; The Analysts' Guide for Sampling Analysis and Clearance Procedures. **Dust Suppressant** – Asbestos and Vehicle Management will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Where material is to be stored on site it will be kept covered with polyethylene sheeting or sprayed with sufficient amounts of water to prevent drying out and dust generation. **Access and Vehicle Management** – A site wide traffic management system will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Internal site routes will be agreed with the Main Contractor and asbestos contractor in advance of the works and all surfaces will be subject to regular inspection. Any haulage trucks transporting ACMs must be properly covered and sealed to ensure that no spillages can occur en-route. All haulage trucks must be inspected by the asbestos supervisor prior to transport and leaving site.

No.	Description
	Decontamination of Plant - All plant and machinery, which is to be used in the removal of surface ACMs or disturbance of soils containing asbestos, will be fully decontaminated before leaving the area. No plant will be allowed to leave the works area until it has been decontaminated and passed a visual assessment by a competent person. **Decontamination of Personnel** - It must be assumed that clothing and equipment that has come into contact with asbestos is contaminated and must be treated as such. A designated area with appropriate welfare facilities should be provided for personnel to change into PPE and RPE prior to any asbestos remedial works commencing. **Waste Management** - Any handpicked asbestos debris and used coveralls, disposable masks and filters will be double-bagged in red and clear bags, labelled appropriately and stored in a designated container on site. The container will be secured and kept locked at all times. All asbestos waste will be removed by an appropriately licensed waste contractor. All waste transfer documentation will be retained by the contractor and copies provided to the Project Manager and appointed environmental consultant. Any waste from the cleaning down and decontamination of plant and equipment will also be disposed of to a suitable licensed facility. **Unexpected discovery of asbestos** – If suspect asbestos-contaminated soils or materials are discovered during the construction phase in areas not previously identified or suspected, or in quantities not previously identified or suspected, the contractor will stop work immediately and leave the area until specialist advice is sought by the appointed asbestos consultant that is suitably qualified, experienced and licenced. The area will be demarcated with barrier tape, or other means, and access restricted. During the construction phase, these measures are to apply to elements of the works that are likely to encounter ACMs during its construction, such as the foul water pumping station, breaking up of the existing sea wall (where necessary) and the excavation works required to construct foul drains and other elements of the main site works.
1.4	**Design Approach to Asbestos Risk Mitigation** The approach taken to the management of risk of ACMs on the Trinity Wharf site is to minimise exposure to ACM materials by design. In so far as is possible, the development has been designed, and will be detailed, to avoid disturbance of buried ACMs and to leave them in-situ. Some design decisions that will achieve this aim are summarised as follows: • Advance clearance works by a specialist asbestos contractor to remove all surface asbestos fragments; • Cap the existing site with a barrier layer and fill above (to average total of c. 1.5m depth) with granular imported fill material; • Foundations for all buildings will be constructed on driven piles, thereby avoiding exposure to potentially asbestos-contaminated arisings; • Service trenches will be generally shallow and will be within the granular fill layer. During the detailed design stage, the locations of deeper trenches or chambers will avoid areas of asbestos contamination, where possible; and • Pending receipt of intrusive investigation data, it is assumed that there is asbestos present below existing concrete floor slabs visible on the site. Therefore, it is proposed that these concrete slabs will be left in-situ, in so far as is possible, in order to minimise the potential health hazards involved in breaking the slab. The asbestos surveys and the remediation strategy (described above) will confirm the required approach at detailed design stage. Where ACM disturbance is unavoidable, e.g. if buried ACMs are discovered at the location of the foul pumping station or deeper service trenches, excavation will be carried out by a suitably qualified, experience and licenced contractor under the supervision of the Site Environmental Manager (SEM) and the excavations made safe to prevent exposure of subsequent construction workers to ACM risk. In the event of ACMs having to be

No.	Description
	excavated, these will be dealt with in accordance with best practice standards by suitably qualified and trained personnel and disposed of to a licenced facility, as required.
1.5	**Construction Environmental Management Plan** Prior to any demolition, excavation or construction a Construction Environmental Management Plan (CEMP) will be produced by the successful contractors for each element of the proposed development. The CEMP will set out the Contractor's overall management and administration of a construction project. An Outline Construction Environmental Management Plan has also been prepared as part of this EIAR, see Appendix 4.1. The CEMP will be prepared by the Contractors during the pre-construction phase, to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the Construction Erosion and Sediment Control Plan (CESCP), Environmental Operating Plan (EOP) and the Construction and Demolition Waste Management Plan (C&D WMP). The Contractors will be required to include details under the following headings: • Details of working hours and days; • Details of emergency plan – in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services; • Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages); • Details of construction plant storage, temporary offices; • Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements; • Truck wheel wash details (including measures to reduce and treat runoff); • Dust management to prevent nuisance (demolition & construction); • Site run-off management; • Noise and vibration management to prevent nuisance (demolition & construction); • Landscape management; • Management of all contaminated land including asbestos and assessment of risk for same by suitably qualified, trained and licenced personnel; • Management of demolition of all structures and assessment of risks for same; • Stockpiles; • Project procedures & method statements for; o Site clearance, site investigations, excavations and working with asbestos containing materials (ACMS); o Management and removal of ACMs; o Demolition & removal of buildings, services, pipelines (including risk assessment and disposal); o Diversion of services; o Excavation and blasting (through peat, soils & bedrock); o Piling; o Construction of pipelines; o Temporary hoarding & lighting; o Borrow Pits & location of crushing plant; o Storage and Treatment of peat and soft soils; o Disposal of surplus geological material (peat, soils, rock etc.);

No.	Description
	o Earthworks material improvement; o Protection of watercourses from contamination and silting during construction; • Site Compounds. The production of the CEMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.
1.6	**Environmental Operating Plan** The Environmental Operating Plan (EOP) is defined as a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of a construction project. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractors during the project construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of An Bord Pleanála's decision will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment. Before any works commence on site, the Contractor will be required to prepare an Environmental Operating Plan (EOP) in accordance with the TII/NRA *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. The EOP will set out the Contractors approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include: • All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services as well as a method documenting compliance with the measures; • A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and • Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment. To oversee the implementation of the EOP, the Contractor will be required to appoint a person to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.
1.7	The TII/NRA Environmental and Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction on National Road Schemes for the following: • Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes; • Guidelines for the Treatment of Bats during the Construction of National Road Schemes; • Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes; • Guidelines 1.6.1for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes; • Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes; • Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes; • Guidelines on the Management of Noxious Weeds on National Roads; • Guidelines for the Treatment of Noise and Vibration in National Road Schemes;

No.	Description
	• Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes; • Guidelines for the Management of Waste from National Road Construction Projects; • Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan. This is a non-exhaustive list and relevant guidance current at the time of construction will be followed. It is proposed to employ these guidelines, as and where relevant, on the Trinity Wharf project.
1.8	Included within the EOP will be the Construction & Demolition Waste Management Plan (C&D WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline C&D WMP has been prepared for the proposed road development. The C&D WMP is a live document that will be amended and updated to reflect current conditions on site as the project progress. The obligation to develop, maintain and operate a Waste Management Plan will form part of the contract documents for the project. The plan itself will contain (but not be limited to) the following measures: • Details of waste storage to be provided for different waste; • Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility; • Details of storage areas for waste materials and containers; • Details of how unsuitable excess materials will be disposed of where necessary; Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

18.3 Mitigation and Monitoring Measures for Traffic and Transport

Table 18.2 Mitigation and Monitoring Measures for Traffic and Transport

No.	Description
2.1	**Transportation Mobility Management Plan** A Mobility Management Plan has been prepared for the proposed development. The purpose of the Mobility Management Plan is to assist the tenants achieve a modal shift away from single occupant vehicles as a means of getting to and from work. A modal shift will ease the pressure on traffic and car parking facilities surrounding the site. The primary elements of the Transportation Mobility Management Plan are; • An assessment of the development in terms of its accessibility by all modes of transport, • Recommendations consisting of physical measures and good working practices that encourage and make it easier for staff and visitors to travel to the site by public transport, car sharing, walking or cycling, • Setting modal split targets with on-going monitoring and assessment.
2.2	**An Accessibility Implementation Plan** will be prepared by the organisers if an event held at the cultural performance building coincides with office working hours. The objective of the Accessibility Implementation Plan is to ease transport and parking pressures on the site and on the surrounding network. The main elements of the Accessibility Implementation Plan will; • Implement the VMS system at the site entrance to provide real time information on the availability of parking within the site.

No.	Description
	• Provide details of alternative Town Centre car parks. The plan will ensure that event attendees are advised of other events in the town centre that may affect the availability of Town Centre car parking. • Notify attendees of the on-site parking limitations and encourage the use of alternative modes of transport such as public transport. The plan will ensure adequate public transport is scheduled to service the event. • Plan coach parking arrangements.
2.3	**A Construction Environmental Management Plan (CEMP)** in accordance with the Outline CEMP provided as Appendix 4.1 of this EIAR and an associated Construction Traffic Management Plan (CTMP) will be prepared by contractor(s) in consultation with the developer and Wexford County Council to confirm the nature of any and all mitigating road works; the programme for deliveries during the construction period; and, any and all mitigating traffic management measures, prior to commencing any works at the proposed development site. The CTMP will detail environmental measures aimed at minimising adverse environmental effects associated with traffic and transport during construction. Maintaining access for emergency services during the course of the construction programme will also be considered and included as part of the Construction Traffic Management Plan. It is acknowledged that the Construction Traffic Management Plan will include a requirement that the condition of the road infrastructure on the access routes to and from the site via the urban road network will be recorded before and after completion of the construction phase. Visual inspections will also be undertaken and recorded at regular, frequent intervals, to ensure that the existing road infrastructure remains in an acceptable condition throughout the duration of construction activities, or, should evidence of any defects arise during the construction period, remedial actions and/or works can be put in hand forthwith. Wheel washes for construction vehicles will be provided (if necessary) at the development site to prevent mud and dust being brought onto the public road. The site entrance, the access road and Trinity Street will be monitored and swept clean when necessary. Construction vehicles and site personnel will be required to adhere to the approved access routes and timing restrictions. Construction plant, equipment and vehicles will be parked onsite. No vehicles associated with the proposed development will be parked on the public roads. Additional measures will also be required to minimise potentially significant environmental effects occurring from the transportation of construction materials such as: • Ensuring the proper transport of materials e.g. vehicle loads will be enclosed or covered with tarpaulin to restrict the escape of particulate matter; and • Proper servicing and maintenance of vehicles will be undertaken to avoid any leaks or spills of oil, petrol or concrete.

18.4 Mitigation and Monitoring Measures for Population and Human Health

Table 18.3 Mitigation and Monitoring Measures for Population and Human Health

No.	Description
3.1	All mitigation measures detailed in Chapter 4 Description of the Proposed Development of this EIAR will be required to be implemented. A CEMP and an associated Construction Traffic Management Plan will be developed to address all modes of transport and will be agreed with Wexford County Council prior to the

No.	Description
	construction stage. The TMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties. • The Construction Traffic Management Plan will be required to maximise the safety of the workforce and the public and to minimise traffic delays, disruption and maintain access to properties; • The Construction Traffic Management Plan will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points; • The Construction Traffic Management Plan will be developed and agreed with Irish Rail; • The contractor will provide an appropriate information campaign for the duration of the construction works; and • The Construction Traffic Management Plan will be required to minimise disruption to economic amenities, marine users and residential amenities. The Plan will be approved by Wexford County Council prior to construction and will ensure access is maintained along Trinity Street for vehicles, pedestrians, cyclists and economic operators at all times.
3.2	Appropriate measures relating to working at heights and near water will be included as part of the EOP. Ringbuoys will be installed and maintained as part of construction design stage in consultation with search and rescue organisations in the area;
3.3	The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the CESCP, EOP and the CDWMP;
3.4	A Transportation Mobility Management Plan will be developed and will address all modes of transport required as part of the construction stages i.e. road and Wexford Harbour. This will include details regarding haulage routes and construction compounds;
3.5	The contractor will be required to develop and implement a Stakeholder Management and Communication Plan which will be agreed with Wexford County Council prior to the construction stage. • All stakeholders will be required to be agreed with Wexford County Council prior to construction commencing; and • Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed of the nature and duration of construction works;
3.6	In order to minimise air quality impacts within the community, a Dust Management Plan will be implemented. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of this plan, as detailed in Chapter 13 Air Quality and Climate in this EIAR;
3.7	Noise and vibration mitigation measures are discussed in detail in Chapter 12 Noise and Vibration of this EIAR. A comprehensive Construction Management Plan, which includes adopting appropriate mitigation measures, will manage the risk of noise impacting the local community. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities, including the application of binding noise limits and hours of operation. These measures will ensure that noise and vibration impacts will be reduced as far as possible.
3.8	The contractor will be required to implement a vibration monitoring programme at a select number of the nearest residential properties during the most critical phase(s) of construction e.g. pile driving.
3.9	An Accessibility Implementation Plan (AIP) will be prepared by the organisers if an event is held at the cultural performance building which coincides with office working hours. The objective of the AIP is to ease transport and parking pressures on the

No.	Description
	site and on the surrounding network. The AIP will involve a Variable Message Sign (VMS) system which can provide real time information on the availability of parking within the site and provide details of alternative car parks elsewhere. The plan will be required to ensure adequate public transport is scheduled to service the event.
3.10	A Transportation Mobility Management Plan will be developed in order to identify the measures that will be implemented to promote sustainable modes of transport and reduce the use of the private car in accordance with Smarter Travel Policy. This should include details of Workplace Travel Plans to encourage employers and employees to take steps to reduce dependency on the car and to take alternative transport options.
3.11	The recommended mitigation measures detailed in Chapter 10 Hydrology of this EIAR will be implemented to address the potential risk of flooding.

18.5 Mitigation and Monitoring Measures for Biodiversity

Table 18.4 Mitigation and Monitoring Measures for Biodiversity

No.	Description
4.1	**Mitigation by Avoidance** The proposed development minimises landtake from ecologically sensitive areas and has been constraints-led from the initial phase, through an iterative design process; and, into the final proposed development. The design has followed the basic principles outlined below to eliminate the potential for ecological impacts on Key Ecological Receptors where possible and to minimise such impacts where total elimination is not possible. The proposed development has been selected to avoid, as far as possible, direct, in-direct or secondary adverse impacts on Natura 2000 sites or other sites designated for nature conservation. The proposed development has been designed to minimise direct or indirect impacts on any habitats or species or other ecological features that were classified as being of Local Importance (Higher Value) or above. All piling within the Harbour will be restricted to the periods between the 1st June and the 31st January to avoid impacts on migratory fish.
4.2	**Mitigation by Design** The proposed development has been developed having regard to European and national legislation and all relevant guidelines in relation to ecology and engineering best practice for the planning and construction of proposed developments. These guidelines and best practice provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment. The following is an overview of the design measures that will be employed to minimise and avoid significant impacts on the ecological receptors within the Zone of Influence:
4.2.1	An Outline Construction and Environmental Management Plan (OCEMP) has been produced to ensure that the construction does not lead to any unanticipated negative impacts on the environment. A Construction Environmental Management Plan (CEMP) and Environmental Management Plan will be completed by each Contractor in line with Appendices 4.1 and 4.2 of this EIAR prior to construction works commencing.
4.2.2	Vibratory driven sheet piles forming the sea wall on the site perimeter and the option of tubular steel piles, screw piles (helical anchors), or, weighted anchors with chains for the foundation of the marina and boardwalk elements (to be decided during detailed design) have been selected as their installation minimises disturbance and landtake from benthic habitats and mudflats.
4.2.3	The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak

No.	**Description**
	wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.
4.2.4	Street lights will be located so that the rear shields are adjacent to the estuary and planted areas or optics are selected that stop back light.
4.2.5	The drainage has been designed to provide a high level of attenuation and water quality controls, as described in detail in Chapter 04: Description of the Proposed Development.
4.2.6	The buildings will have blue-green roofs. Species will include native coastal species and a variety of sedums which are pollinator friendly. The landscaping of the site will include trees, shrubs and a wildflower meadow which will provide opportunities for nesting and foraging birds. Details of the Planting Plan are in Appendix 4.6 which includes Drawing No. L-PP-01.
4.2.7	A suitably qualified Project Ecologist and Marine Mammal Observer (this can be the same person) will be appointed by Wexford County Council for the duration of the proposed development.
4.2.8	Each contractor will appoint a Site Environmental Manager to carry out environmental monitoring and to ensure that the mitigation measures proposed in this EIAR is followed.
Specific Mitigation Measures	
	Key Ecological Receptor 1 & 2 – Mudflats and Benthic Habitats & River Slaney/ Wexford Harbour Waterbody
4.3	**Habitat Loss** The loss of estuarine habitats cannot be mitigated for. In spite of the permanent loss of these habitats, this impact is considered insignificant given the total area is small (2302m^2 or <0.024% of these habitats within Wexford Harbour), has low faunal diversity (ASU, 2018) and is not an important area for wintering birds (Natura, 2016). Water will still be allowed to circulate underneath the marina and boardwalk and the new hard surfaces to which epifauna and seaweeds will attach, will add to the species diversity in the area (ASU, 2018).
4.4	**Water Quality** ***Construction Phase***
4.4.1	*Sedimentation and surface water run-off* • In order to attenuate flows and minimise sediment input into the River Slaney from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged. • Sheet piling for the new seaward site boundary shall be installed prior to any excavation on the landward side (other than the access road and level crossing) and demolition of the existing wharf boundary. This will form an effective barrier to run-off from the site during construction. • Any material stockpiled shall be located a minimum of 30 m from the seaward boundary of the site and shall also be covered and remain stockpiled for as short a time as possible. • The Contractors shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in Wexford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events. • The placing of anchor blocks (if required) shall be undertaking so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed

No.	Description
	be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.
4.4.2	*Cementitious materials* The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Slaney from the landside elements of the construction. However, the following measures shall also apply: • All shuttering shall be securely installed and inspected for leaks prior to concrete being poured and all pouring operations shall be supervised monitored for spills and leaks at all times. • In order to eliminate any remaining risk of input of cementitious material into the River Slaney, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather. • In order to prevent input of cementitious materials into the River Slaney from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible. • Where concrete or other wet materials are to be used over water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials. • Any such materials collected on these platforms shall be disposed of in accordance with the Construction and Demolition Waste Management Plan (CDWMP) (Appendix 4.1).
4.4.3	*Hydrocarbons and other chemicals (See also Chapter 09 and 10 of this EIAR)* • Land-based vehicles and plant shall be refuelled off-site, where possible. • All land-based fuelling of machinery shall be undertaken on an impermeable base in bunded areas at least 50 m from the seaward boundary of the site. • Marine based fuelling will only be undertaken using specifically designed nozzles to prevent spillages and spill kits will be available. • All fuelling equipment shall be regularly inspected and serviced. • Any petrol- or diesel-fuelled pumps or other machinery shall be located within temporary bunded units. • All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impermeable base which shall be bunded to 110% capacity and appropriately secured. • All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery. • Spill kits shall be available on site during construction, including on the jack-up barge during pile driving. • All waste oils, empty oil containers and hazardous wastes shall be disposed of in accordance with the Waste Management Act, 1996 (as amended). • Owing to the presence of contaminants within the construction site, excavation shall be limited to the absolute minimum necessary.
4.4.4	*Painting of the boardwalk* • Paints containing organotin compounds, e.g. TBT, shall not be permitted. • In order to minimise the risk of paint spillage into Wexford Harbour, the majority of the deck shall be painted over land, prior to be lifted into position over the estuary, and painting of the remaining sections (mostly at joining points) shall be carried out above bunded platforms which will capture any spilled paint.

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4.5	**Water Quality** *Operational Phase* The surface water drainage of the proposed development will include blue-green roofs, rain gardens at building perimeters and soft landscaping features such as vegetated swales. The surface water drainage design will allow for storage during a 1-in-100-year flood event. The surface water drainage for the development site comprises a Sustainable Drainage System (SuDS) approach. The surface water drainage network will drain by gravity to the outfall locations around the site and will be designed to store the 1 in 100-year 6-hour rainfall event plus climate change (between tidal cycles). Surface water run-off from the proposed multi-storey car park will pass through a hydrocarbon interceptor. Details of the drainage for the proposed development are presented in Section 4.3.4.4 of Chapter 04. The foul sewer will be directed to the public wastewater infrastructure. The risk to the River Slaney has been found to be low and the potential impact assessment is deemed to be imperceptible. See further impact assessment in Chapter 09 Hydrogeology. The bye-laws listed in the Wexford County Council Harbour and Piers Bye-Laws 2014 will apply to vessels using the proposed marina.
4.6	**Lighting and Shade** *Construction Phase* Turning off construction lighting over the river outside of working hours will eliminate any risk of these impacts outside of those hours. This will eliminate the risk of such impacts occurring during the months of April to September, inclusive, and restrict such impacts to before 7:00 pm and after 7:00 am on weekdays and before 4:30 pm and after 8:00 am on Saturdays during the months of October to March, inclusive. This would ensure at least 12 hours free of artificial light every night of the year and more at weekends. Construction lighting within 10m of the estuary shall be turned off outside of working hours. In addition, construction lighting will be limited to the minimum area required to be lit. The Project Ecologist will ensure that these measures are adhered to during the construction stage.
4.7	**Lighting and Shade** *Operational Phase* The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths, and onto the estuary (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife. Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Slaney.
	Key Ecological Receptor 2 – Migratory Fish
4.8	***Noise and Vibration*** The following are the mitigation measures which will apply to all pile driving for the marina, boardwalk and outer sea wall: • There shall be no pile driving of the marina, boardwalk and sea wall permitted in the period beginning on 1st February and ending on 31st May in any year. • All pile driving of the marina, boardwalk and sea wall shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays. • Pile driving shall be restricted to between 7:00 am and 7:00 pm from 1st June to 30th September, inclusive, and to between 8:00 am and 6:00 pm from 1st October to 31st January, inclusive.

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	• All breaks between pile driving of the marina and boardwalk shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent. This measure shall not apply to vibratory driven piles for the sea wall. • A 30-minute soft-start/ramp-up procedure shall apply to each pile drive. This measure shall not apply to vibratory driven piles for the sea wall. • A trained and experienced Marine Mammal Observer (MMO) shall be appointed by WCC to perform that function in accordance with DAHG (2014) and the MMRA which is included in Appendix 7.3. • If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCC, the NPWS and IFI. • All of the above measures shall be enforced by the WCC Project Ecologist and the SEM appointed by each Contractor.
	Key Ecological Receptor 3 – Otter
4.9	**Pre-construction Otter Survey** Prior to any works being carried out, a pre-construction otter survey will be undertaken to ensure that no otters have taken up residence within 150m of the proposed development.
	Key Ecological Receptor 4 – Marine Mammals
4.10	• A qualified and experienced Marine Mammal Observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms. • Unless further information specific to the location and proposed development is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with WCC, NPWS and IFI, pile driving activity shall not commence if marine mammals are detected within a 500m radial distance of the pile driving sound source. • **Pre-Start Monitoring** Pile driving activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO. The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO. This prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO. • **Ramp-Up Procedure** In commencing a pile driving operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds 170 dB re: 1µPa @1m an appropriate Ramp-up Procedure (i.e., "soft-start") must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information (see section 3 of Appendix 7.3 of the EIAR).

No.	Description
	Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period. Where the measures outlined in the previous steps are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment. Once an appropriate and effective Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone. • **Breaks in sound output** If there is a break in pile driving sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken. For higher output pile driving operations which have the potential to produce injurious levels of underwater sound (see Appendix 7.3 MMRA sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up. • Reporting Full reporting on MMO operations and mitigation undertaken must be provided to the NPWS. • Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. These seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines. • Signage at the marina will provide information to boat owners about the importance of Wexford Harbour for seals. It will also give information on how to avoid disturbance and signs of disturbance (head up etc).
	Key Ecological Receptor 6 – Bats
4.11	Lighting during the construction phase will avoid direct illumination of the estuary. Follow the removal of vegetation within the sites, new areas will be planted which will include pollinator friendly, and therefore bat friendly species. The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.
	Key Ecological Receptor 7 – Invasive Species
4.12	• Prior to any works being carried out, a pre-construction invasive species survey will be undertaken to ensure that additional invasive have not been introduced to

No.	Description
	areas within or close to the proposed development footprint. The Invasive Species Management Plan that is currently in place is presented in Appendix 7.4. • Vessels associated with the construction of the sea walls, the boardwalk and the marina have the potential to introduce invasive species to Wexford Harbour. Vessels should adhere to the industry recommended guidelines for preventing the introduction of non-native marine species. UKMarineSAC (2009) recommends that vessels comply with International Maritime Organisation guidance wherever possible, seek guidance from the Wexford Harbour authority regarding areas where ballast water uptake should be avoided (e.g. near sewage outfalls), encourage the exchange of ballast water in the open ocean, and discourage/prohibit the unnecessary discharge of ballast water in the harbour area. • Signage will be put in place at the marina informing the public of the marine invasive species that are associated with small craft and marinas and the importance of boat maintenance.
	Key Ecological Receptor 8 – Birds
4.13	The protection of bird breeding habitats during the breeding season (1st March to 31st August, inclusive), are set out in the Wildlife Acts. Any removal of vegetation within this period will require the supervision of a suitably qualified and experienced ecologist to ensure no breeding birds are present. As part of the landscaping of the site, trees, shrubs, a hedgerow and a wildflower meadow will be planted (Appendix 4.6, Drawing No. L-PP-01 (Planting Plan). This will provide nesting and feeding opportunities for birds. Bird-friendly glass (e.g. www.ornilux.com), which will reduce the reflectivity of glass facades and windows, will be used on all buildings.
4.14	**Ecological Enhancements** • Eight No. 17A Schwegler Swift Nest Boxes (triple cavity) will be incorporated into the development. These will be positioned on the north faces of the buildings out of the prevailing wind and at least 4.5m high. The type and position should be confirmed by the Project Ecologist. *Notes on the Common Swift and Setting up nest boxes* (Linda Huxley, 2014) provides guidance on setting up swift boxes. • Ten bird boxes will be placed around the site. These should include boxes for a variety of species and should be placed out of direct sunlight and the prevailing wind. The positioning of the bird boxes should be decided by the Project Ecologist. • Signage with information relating to the biodiversity of Wexford Harbour will be installed at the proposed development location to encourage an understanding and respect for the natural environment of the area. This will refer specifically to disturbance by boats and loose dogs.

18.6 Mitigation and Monitoring Measures for Soils and Geology

Table 18.5 Mitigation and Monitoring Measures for Soils and Geology

No.	Description
5.1	Prior to the start of any construction works further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site. The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractors.
5.2	All site clearance and excavation works will be required to follow the mitigation measures of this EIAR in this Chapter and those (detailed in Chapter 4 and 8) as

No.	Description
	well as any future mitigation measures to be detailed in the Remediation Strategy (to be completed). For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the 'measures for working with asbestos'. Any ACMs discovered in areas required for excavation, will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.
5.3	The 'Asbestos Survey and Remediation Strategy' will be undertaken prior to construction. All mitigation measures/ recommendations from these surveys and the remediation strategy will be required to be implemented as part of the proposed development.
5.4	Remediation Verification Report will be produced to demonstrate that all mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.
5.5	'Measures for working with asbestos' as detailed in Chapter 4 shall be implemented by contractors as appropriate as part of the construction phase.
5.6	The specialist contractor will ensure secure containment and transport of all contaminated materials to the appropriate licenced waste disposal facility.
5.7	Contractors shall be required to submit and adhere to a Construction Method Statement indicating the extent of areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works. All associated hazardous waste residuals will also be stored within temporary bunded storage areas prior to removal by an appropriate EPA approved waste management contractor for off-site treatment/recycling/disposal. Any other building waste will be disposed of within on-site skips for removal by a licensed waste management contractor. The contractor will be required to submit a Construction and Demolition Waste Management Plan to the Council for approval which will address all types of materials to be disposed and the location of the licenced waste disposal facilities that will be used, as appropriate.
5.8	Imported good-quality granular soils materials and rock armour revetment will be imported from local sources where possible. The nearest suitable licensed quarries are outlined in the Section 4.4.10 of the Chapter 4.
5.9	To minimise any impact on the underlying subsurface strata from material spillages, all fuels, oils, solvents and paints used during construction these will be stored within specially constructed temporary bunded areas or within dedicated bunded containers. Spill kits and hydrocarbon adsorbent packs will be stored on the site compound and operators will be fully trained in the use of this equipment. Fuel for vehicles will be stored in a mobile double skinned tank.
5.10	In order limit the risk to human health and the surrounding aquatic environment by exposure to contaminated material through excavation, it is proposed to retain the majority of the made ground in place. The current ground level across the entire site will be raised for the proposed development (1.5m raise on average), using imported good quality granular material. It is also proposed that the uppermost 250mm of this material will comprise of compacted clay with a low permeability of 1 x 10-7 ms-1 to limit infiltration to percolating water. A minor volume of excavated material planned to be excavated pertaining to the foul sewage pump-out station and any deep service trenches or chambers will be identified during detailed design. Temporary works design and monitoring will ensure that the there are no unacceptable ground movements and settlements of the adjacent ground. This material will be required to be tested for contaminants.
5.11	All buildings will rely on driven piles for foundations. This will minimise the need for the excavation and handling of the made ground layer and soft alluvial layers beneath it, as no in-situ ground needs to be displaced or handled during the execution of this type of piles.

No.	Description
5.12	Sheet piles forming the sea wall on the site perimeter and the option of either bored piles or tubular steel piles and screw piles (helical anchors) for the foundation of the marina and boardwalk elements (to be decided during detailed design) are also selected as their installation requires no excavation or dredging. A sheet-piled wall will provide a new sea wall for the site, raising the site level to meet flood requirements and providing a barrier to contain contaminated material within the site.
5.13	The rock armour revetment and the armour underlayer will be placed directly on in-situ riverbed silt, in order to avoid the need for the handling and removal of contaminated silt.

18.7 Mitigation and Monitoring Measures for Hydrogeology

Table 18.6 Mitigation and Monitoring Measures for Hydrogeology

No.	Description
6.1	A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors for the development in line with the Outline CEMP and EOP appended to this EIAR (see Appendices 4.1 and 4.2). For the phased elements, it will be maintained by the separate Contractors for the duration of the construction phase. The EOP CEMP will cover all potentially polluting activities and include an emergency Incident Response Plan procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice.
6.2	Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding.
6.3	Runoff will be controlled and treated to minimise impacts to surface and groundwater.
6.4	Prior to any works taking place on-site, a comprehensive and detailed ground investigation programme shall be undertaken to fully quantify the nature and extent of contaminated material present at the site
6.5	All material excavated at the site shall be assumed to be contaminated. Appropriate testing of this material by a suitably qualified and licenced waste contractor shall take place for all aspects of ground contamination and the material shall be disposed of off-site to a suitably licenced waste facility. Temporary storage of any contaminated material on-site shall be carefully managed so as to limit any risk of contaminated surface water runoff to the River Slaney Estuary. The material shall be stored at least 25m away from the high-water mark in the estuary. Runoff from the material shall be directed to lined pond or temporary sewer/tank and the water shall be disposed of off-site for treatment at an appropriate licenced facility. Alternatively, the material shall be covered while stored to remove the risk of surface water contamination.
6.6	Excavations into the existing ground for the installation of the foul drainage network, foul pumping station, deep service trenches and surface water drainage network serving the proposed access road off Trinity Street and the swale along the southern boundary of the site will be required. The material removed will be assumed to be contaminated and will be appropriately disposed of (as outlined in the point above). Suitable backfill material to the pipes will be imported to site. A 250mm layer of imported clay will be placed beneath the swale to prevent the infiltration of rainwater to the underlying subsoil and therefore prevent mobilisation of contaminants into the underlying gravels and weathered bedrock.
6.7	Where temporary pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.

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6.8	All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase.
6.9	Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction.
6.10	Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering Wexford Harbour.

18.8 Mitigation and Monitoring Measures for Hydrology

Table 18.7 Mitigation and Monitoring Measures for Hydrology

No.	Description
7.1	A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors appointed for the development following the Outline CEMP attached as Appendices 4.1 and 4.2 to this EIAR. The CEMP will list any difficulties encountered and it will be maintained by each Contractor for the duration of the construction phase. The CEMP and EOP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice. The following will be implemented as part of this plan: • A draft Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of license or other such risks that could lead to a pollution incident, including flood risks; • All necessary permits and licenses for in stream construction work for provision of the sea walls, boardwalk and marina works will be obtained prior to commencement of construction; and • Inform and consult with Inland Fisheries Ireland (IFI) and Waterways Ireland (WI). The draft CEMP and EOP will be developed by the selected construction contractors to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team.
7.2	During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water. • Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board) • Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers. • CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors. • CIRIA C648 Control of Water Pollution from Constructional Sites. • Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA/TII, 2006).
7.3	Based on the above guidance documents concerning control of constructional impacts on the water environment, the following outlines the principal mitigation measures that will be prescribed for the construction phase in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts: • Exposure of contaminated material shall be minimised by placing the low permeability clay capping layer immediately following initial site grading and clearance works. Grading works shall progress in a manner which always allows

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	runoff to be directed towards a temporary treatment facility without surface ponding. This will minimise contact time between the contaminated material and surface water and thus limit the opportunity for contamination to occur. Runoff which has been in contact with exposed contaminated material will be captured and directed to a temporary lined facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to Wexford Harbour. • Should temporary dewatering be required during deep excavations within the contaminated material, strict control measures will be put in place for disposal of same. Water pumped from excavations within the contaminated material shall either be passed through the temporary surface water treatment/attenuation facilities before discharge to Wexford Harbour or discharged to a foul sewer. Should very heavily contaminated groundwater be encountered during deep excavations and pumping be required of same, temporary dewatering shall be either collected and discharged to a foul sewer via tanker or treated on-site by way of a temporary water treatment works. Groundwater samples shall be taken from boreholes across the site in advance of construction works taking place to determine which method of disposal is required. Specialist advice will be sought as to the most appropriate form of treatment required as determined by the pre-construction groundwater sampling results. The works shall be planned in an appropriate manner so as to minimise the need for construction dewatering. Where excavation into contaminated material does take place, control measures to limit or prevent surface water runoff from entering the excavation shall be incorporated. These measures may include shoring, sheet piling, benching/battering or embankment of the excavation perimeters. • All construction compound areas will be required to be set back a minimum of 50m from the seaward boundary of the site. Protection of waterbodies from silt load will be carried out through use of grassed buffer areas, timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses. • In order to attenuate flows and minimise sediment input into Wexford Harbour through run-off, all surface water run-off from the construction site shall be directed to a temporary facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to Wexford Harbour. An impermeable membrane overlaid with suitable fill will be provided to storage areas to prevent contamination or pollution of the groundwater. • Settlement ponds, silt traps and bunds will be used where appropriate and construction within watercourses will be minimised. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap. General Constructional Compounds will not be permitted within 50m of Slaney River Valley SAC and Wexford Harbour and Slobs SPA. It may, however, be necessary to locate temporary storage areas adjacent to the Slaney Estuary when the marina and flood protection works are being undertaken. Measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the estuary. This will primarily be in the form of silt fences which will be installed along the compound boundary to stop 'dirty' surface water runoff from entering the estuary without treatment. • Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuelling locations will be contained within bunded areas and set back a minimum of 50m from watercourses. • All construction machinery operating in-stream should be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery shall be steam cleaned and

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	checked prior to commencement of in-stream works to avoid spread of invasive species. • Oil booms and oil soakage pads should be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. • No refuelling of construction plant shall be undertaken while the vehicles are in or adjacent to watercourses, as this could lead to contamination of the watercourse through spillage of fuel. In addition, all construction vehicles entering the watercourse should be in good condition, and be provided with drip trays to prevent pollution through dripping of oil or fuel from the vehicle. • Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution; • The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses; • Any surface water abstracted from a watercourse for use during construction will be through a pump fitted with a filter to prevent intake of fish. • The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Washout from concrete mixing plant will be carried out only in a designated contained impermeable area. • All shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times. • All pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather. • Any concrete used in or over the estuary shall be pre-cast, where possible. • Where concrete or other wet materials are to be used over water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials. • A geotextile screen and boom with oil barrier will be required around such marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as boring in overburden or rock from polluting the river. • Any materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the CDWMP. • The placing of anchor blocs (if required) shall be undertaken so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.
7.4	**Morphological Changes to Surface Watercourses & Drainage Patterns** SuDS components will convey runoff to the Lower Slaney Estuary, while attenuation will be provided for the 1 in 100 year 6-hour event. The conveyance of runoff to the Lower Slaney Estuary will generally follow the existing site topography. The implementation of these proposed mitigation measures reduces the impact to imperceptible.
7.5	**Hardstanding Runoff** As a result of the increase in hardstanding areas, runoff from the site will increase. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall. Whilst the base of the permeable paving and grassed swales will allow some limited percolation to the underlying subsoils, the portion percolating portion is expected to be minimal due to the incorporation of a low permeability clay layer across the entire site. The surface water drainage system will be designed to store the 1 in 100 year 6 hour-rainfall event plus a climate change factor (between tidal cycles). The OPW

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	FSU Portal calculates this rainfall depth to be 80.76mm. Attenuation of surface water runoff will occur within a layer of coarse graded clean aggregate material installed below the permeable paving which will have a voids ratio of typically 30%. These proposed mitigation measures reduced the associated impact from hardstanding runoff from moderate/significant to slight. The provision of permeable paving within the development will negate the need to provide numerous individual petrol interceptors throughout the development. Treatment to runoff generated will be provided within the pavement layers through the processes of filtration, biodegradation, adsorption of pollutants and the settlement and retention of solids within the pavement layers.
7.6	**Foul Drainage Infrastructure** In the event of a pump failure at the proposed foul pumping station, mitigation measures have been proposed. The pumping station has been designed to provide 24-hour effluent storage in case of failure. Standby pumps will also be provided.
7.7	**Implications for Designated Sites** It is proposed that surface water from the proposed development discharges to the Slaney Estuary, which is an environmentally sensitive area. Mitigation measures that will be implemented include the design of a surface water drainage system to serve the proposed development. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall (with some limited percolation into the subsoil). The incorporation of a SuDS based approach will ensure that discharge will be controlled, and treatment of runoff will take place within the SuDS components. The implementation of these mitigation measures will reduce the associated impact from moderate/significant to imperceptible.
7.8	**Flood Risk Mitigation** The flood risk associated with the proposed development is deemed to be moderate to significant. As discussed in Section 10.4.3, the following minimum levels will be required within the site: • To satisfy the Wexford Town and Environs Development Plan 2009-2015 (as extended) all buildings as part of the proposed development must have a minimum floor level of 2.64mOD. • As per the OPWs Flood Risk Management Guidelines for Local Authorities (2009) "Less vulnerable developments" such as local transport infrastructure must have a minimum level of 2.34mOD. The lowest proposed finished floor level for the development is 3.3mOD, while the lowest road level will be at 2.80mOD (generally 3.5mOD). In addition to the flood risk measures above, a new steel sheet pile sea wall is to be provided along the northern, southern and eastern edges of the site as part of the development, while sections of the northern, eastern and southern sides will comprise a combined sheet pile/rock armour revetment wall. A sheet pile driving rig will mobilise and begin driving sheet piles in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The existing wall will remain in place until the sheet pile wall is correctly installed and only then will be demolished and removed from the site. Construction of the rock armour revetment will involve suitable boulders being placed directly onto the silt/sediment of the seabed. The marina will also be sheltered by a breakwater on the seaward side. This will involve driving pile sockets for the breakwater units and the pontoon walkways into the seabed. Vertical steel piles will then be grouted into the pile sockets to give good line and plumbness. Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units and pontoon walkways and finger berths.

No.	Description
	The actual method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to ground investigations during detailed design phase. The proposed marina breakwater, sea wall and rock armour revetment along the perimeter of the site will protect the development against storm surge and wave action.

18.9 Mitigation and Monitoring Measures for Landscape and Visual Analysis

Table 18.8 Mitigation and Monitoring Measures for Landscape and Visual Analysis

No.	Description
8.1	**Construction Phase** The measures proposed revolve around the implementation of appropriate site management procedures – such as the control of site lighting, storage of materials, placement of compounds, delivery of materials, car parking, etc. Visual impact during the construction phase will be mitigated somewhat through appropriate site management measures and work practices to ensure the site is kept tidy, dust is kept to a minimum, and that any publicly accessible areas are kept free from building material and site rubbish. Site hoarding will be appropriately scaled, finished and maintained for the period of construction of each section of the works as appropriate. To reduce the potential negative impacts during the construction phase, good site management and housekeeping practices will be adhered to. The visual impact of the site compound(s) and scaffolding visible during the construction phase are of a temporary nature only and therefore require no remedial action other than as stated above. General construction measures are outlined in the Outline Construction Environmental Management Plan and Outline Environmental Operating Plan as per Appendices 4.1 and 4.2 of this EIAR which must be undertaken by all contractors.
8.2	**Operational Phase** Mitigation measures were largely included in the design of the project. The design statement refers to the design rationale, and extensive analysis was undertaken to arrive at the proposed design. The design process analysed the buildings and streetscape in the vicinity of the site and design responses took into account the following; • The proposed development is in the context of the Wexford Quays Economic Action and Spatial Implementation Plan which aims to connect the site to the Crescent and Paul Quay area and has a number of aims for the surrounding town. • The scale and height of the buildings (5-6 storeys) was designed to relate to the existing buildings along Paul Quay, particularly when seen from the Ferrybank and Wexford Bridge areas. It was decided that buildings taller than this would have a greater visual effect on the overall harbour. • The scheme creates connectivity to the town centre and allow for public access by linking Trinity Wharf to Paul Quay via a boardwalk, and also proposed public realm improvements in the Paul Quay area. Other options which connected to the Trinity Wharf site along the railway line were considered but this would have required security fencing and barriers for the railway line, so the connection of a boardwalk at Paul Quay is considered to be preferable and results in a more visually attractive connection that maximises the waterfront location. • The design of the proposed hotel building was amended and re-oriented to maximise public access to the waterfront in the location with the most remarkable views on the site

No.	Description
	• The proposed design includes provision of public spaces and walkways including a waterside route and viewpoints, to enhance the views from the site and thus enhance a key characteristic of the site. • The landscape plan proposed to enhance the site's character with tree and shrub planting to emphasise the natural character and setting of the site and create a buffer of suitable and robust vegetation along the railway line to integrate development into wider landscape. The landscape design strategy included in Appendix 4.6 of the EIAR will be implemented as part of the design.

18.10 Mitigation and Monitoring Measures for Noise and Vibration

Table 18.9 Mitigation and Monitoring Measures for Noise and Vibration

No.	Description
9.1	It is recommended that the contract documents should clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS5228-1 2009. These measures will typically include:
9.1.1	No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
9.1.2	The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
9.1.3	All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
9.1.4	Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
9.1.5	Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
9.1.6	Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
9.1.7	Location of plant shall consider the likely noise propagation to nearby sensitive receptors.
9.1.8	During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 2 using methods outlined in BS5228:2009 Part 1.
9.2	**Working Hours** Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:00 Saturday. Works other than the pumping out of excavations, security and emergency works should be avoided outside of these periods.
9.3	**Emergency Work** The emergency work may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.
9.4	A suitable perimeter hoarding around the site on three sides will provide an effective method of reducing noise propagation from the site. This hoarding will need to be phased as it can only be constructed along the northern and southern boundaries once the sea wall and anchors in those locations have been constructed. It shall be erected along the railway boundary as soon as practicable during site setup. The hoarding shall be regularly inspected by the Site Environmental Manager and a Site

No.	Description
	Engineer to ensure the adequacy of the hoarding from a noise and visual perspective. Technical specifications on the acoustic performance of suitable hoardings can be found the UK's Design Manual for Roads and Bridges HA 66/95 which gives guidance on acoustic performance, forms of construction and physical properties of materials.
9.5	A vibration monitoring programme will be required to be adopted at a select number of the nearest residential properties during the most critical phase(s) of construction e.g. pile driving, etc.
9.6	A general noise management strategy will be required to be developed as part of the development and management of the marina and café/ restaurant uses including hours of operation, training for staff and signage to notify the public of the potential effect their activities, particularly at night, may have on nearby residents.

18.11 Mitigation and Monitoring Measures for Air Quality and Climate

Table 18.10 Mitigation and Monitoring Measures for Air Quality and Climate

No.	Description
10.1	**Air Quality** The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 13.3 and includes the following: • The specification and circulation of a dust management plan for the site and the identification of persons responsible for managing dust control and any potential issues; • The development of a documented system for managing site practices with regard to dust control; • The development of a means by which the performance of the dust management plan can be monitored and assessed; • The specification of effective measures to deal with any complaints received. At all times, the procedures within the plan will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.
10.2	**Climate** Construction traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works, the impact on climate will not be significant. Nevertheless, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular the prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.
10.3	**Monitoring** Monitoring of construction dust deposition at nearby sensitive receptors (residential dwellings) during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the

No.	Description
	German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

18.12 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

Table 18.11 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

No.	Description
11.1	The avoidance of direct or indirect impacts on archaeological heritage is the preferred mitigation measures. Where this is not possible the following archaeological mitigation measures are proposed:
Pre-Construction Measures	
11.2	**Archaeological Testing or Monitoring** Dependent on the nature of foundations proposed for individual structures within the proposed development archaeological testing or archaeological monitoring may be required where sub-surface development works are to be undertaken. This is particularly important in the northern corner of the site where it is possible that the remains of the nineteenth century dock infrastructure still exist below the current ground surface and at the site of the holy well (RMP WX037-038) where it is possible that features survive below ground.
11.3	**Underwater Archaeological Impact Assessment** An underwater archaeology walkover inspection was undertaken by ADCO on the 11th December 2018 at Low Water. The mitigation measures included in their report are reproduced here while their full report is included in Appendix 14.3.
11.3.1	An Underwater Archaeology Impact Assessment (UAIA) of the area to be impacted by the proposed marina and boardwalk will be carried out prior to any construction works. Such work is licensed by the National Monuments Service. The work will be carried out as part of the required UAIA, which will inspect the known underwater archaeological elements adjacent to the development area.
11.3.2	In the event that the underwater assessment identifies features that will be impacted by the construction phase, further archaeological mitigation will be required and may include investigation and excavation.
11.3.3	An Archaeological Topographic Survey of the reclaimed land area and associated intertidal elements is required to capture a detailed pre-disturbance record of the existing land surfaces. The work will prepare detailed topographic mapping that enables metrically accurate 1:20 plan, elevation and section drawings. It will be necessary to capture an above ground stone-by-stone record of the dockyard walls and fabric. The record will serve as the permanent record of this element that will be destroyed or otherwise permanently buried by the development.
Construction Phase Measures	
11.4	A review of the site investigation logs to assess the nature of the buried strata will be undertaken.
11.5	**Archaeological Monitoring of Ground and Seabed Disturbance** Archaeological Monitoring of Ground and Seabed Disturbance activities during the construction phase and associated elements, with the proviso to fully resolve any archaeological features identified. Such work is licensed by the National Monuments Service.

No.	Description
11.6	**Archaeological Excavation and Preservation In Situ** Should the results of the mitigations outlined above indicate the requirement for archaeological excavation and/or preservation *in situ*; this will be undertaken as per best practice and in consultation with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht.
Project Management Measures	
11.7	AN ARCHAEOLOGICAL CONSULTANT experienced in and specialising in maritime archaeology should be appointed to the project to advise the design team on archaeological matters, liaise with the state regulators, prepare archaeological licence applications and complete archaeological site work.
11.8	ARCHAEOLGICAL MONITORING is licensed by the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht. The application for such a licence requires a detailed method statement, outlining the procedures to be adopted to monitor, record and recover material of archaeological interest during such work. Licence applications take four (4) working weeks to be processed and must be granted before archaeological-related work can commence.
11.9	THE TIME SCALE for the project should be made available to the archaeologist, with information on where and when the various elements and ground disturbances will take place.
11.10	SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of works commencing. This will allow for prompt arrival on site to undertake additional surveys and to monitor ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.
11.11	DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.
11.12	ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.
11.13	ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team, including an archaeological dive team, be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.
11.14	SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.
11.15	SECURE WET AND DRY STORAGE for artefacts recovered during the course of the monitoring and related work should be provided on or near those sites where excavation is required.
11.16	ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.
11.17	MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.
11.18	SPOIL should not be dumped on any of the selected sites or their environs.

No.	Description
11.19	POST-CONSTRUCTION PROJECT REPORT AND ARCHIVE. It is a condition of archaeological licensing that a detailed project report is lodged with the DCHG within twelve (12) months of the completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland.
11.20	The recommendations listed above are subject to the approval of the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.

18.13 Mitigation and Monitoring Measures for Architectural Heritage

Table 18.12 Mitigation and Monitoring Measures for Architectural Heritage

No.	Description
12.1	Avoidance of architectural heritage is the preferred mitigation measure, however either direct or indirect impacts on architectural heritage is likely to occur as a result of the development where avoidance is not possible. Mitigation by architectural record involves the production of a written account generally supplemented by measured drawing and a photographic survey. The level of recording will depend on the significance of the structure in question. Any architectural features within the site including the former boundary wall (BH 10) running northeast-southwest through the site and the stone wall (BH 11) along the western boundary of the site should be subject to architectural recording prior to their removal.

18.14 Mitigation and Monitoring Measures for Material Assets and Land

Table 18.13 Mitigation and Monitoring Measures for Material Assets and Land

No.	Description
13.1	There are no specific mitigation measures in relation to Material Assets. The design of the development has accommodated the necessary improvements in infrastructure to service the site, without having impacts on infrastructure along Trinity Street. The provision of the proposed utilities and services will facilitate the required needs of the development without impacting on any existing utilities.

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