ENVIRONMENTAL IMPACT ASSESSMENT REPORT

For

Brexit Infrastructure at Dublin Port

Prepared for

Office of Public Works

Oifig na
nOibreacha Poiblí
Office of Public Works

By AWN Consulting
The Tecpro Building
IDA Business and Technology Park
Clonshaugh,
Dublin 17

June 2020

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Non – Technical Summary

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NON-TECHNICAL SUMMARY

1.0 INTRODUCTION

This is the non-technical summary of an Environmental Impact Assessment (EIA) Report which has been prepared on behalf of the Minister for Public Expenditure and Reform (herein referred as 'the Applicant') to comply with the requirements for such a development under Section 181 of the Planning and Development Act 2000 as outlined in the emergency order provisions of S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019 for Brexit Infrastructure at Dublin Port.

The Commissioners of Public Works will be the developer of this proposed development (herein referred to as 'OPW' and/or 'the Developer'). The development will be operated by The Revenue Commissioners, The Health Service Executive's Environmental Health Service (EHS) and the Department of Agriculture, Food and the Marine and their facilities management consultants (herein referred to as 'the Operator'). The location of the proposed development is shown in Figure 1.1.

Figure 1.1 Site layout plan of the proposed development (Source: OPW February 2020)

A full description of the Proposed Development is provided in Chapter 2 (Description of the Proposed Development).

Requirement for an EIA

The Minister proposes to make an order under section 181(2)(a) of the Planning and Development Act 2000 (as amended) to provide that the Act shall not apply to the proposed development. The Ministerial Order will be made by the Minister for Public Expenditure and Reform and will be required as a result of the withdrawal of the United Kingdom from the European Union and the expiry of the transition period on 31 December 2020.

The proposed development is being treated in accordance with the requirements outlined in S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019. S.I. No. 418/2019 amends as specified the Planning and Development Act 2000. Of particular relevance to the proposed development, are the insertions of subsections after subsection (2). In accordance with these subsections, an Environmental Impact Assessment Report and Natura Impact Statement are being submitted to ABP for approval in respect of the proposed development.

This EIA Report has been prepared in accordance with the requirements of the 2014 EIA Directive (2014/52/EU) and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018. It is prepared in the Grouped Format Structure as set down in the Environmental Protection Agency (EPA) Draft “Guidelines on the Information to be Contained in Environmental Impact Assessment Reports” (2017). In general, the EIA Report follows the framework presented in the EPA Draft “Advice Notes for Preparing Environmental Impact Statements” (2015).

Consultation

OPW and the EIAR project team has liaised with the ABP in advance of lodgment of this application. A pre-planning meeting was held with ABP on 5th November 2019.

In addition, OPW and members of the EIAR team has liaised with the Dublin Port Company and relevant consultees.

The EIA contributors/authors have incorporated advice and comments received from consultees into the relevant chapters of this EIA Report.

Contributors to the EIA Report

The preparation and co-ordination of the EIA Report has been completed by AWN Consulting in conjunction with suitably qualified experts. The role and responsibility of each contributor are detailed in Chapter 1 (Introduction) of the EIA Report.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Site Location & History

The subject sites are c. 5.4 hectares in extent and are located at Bond Drive Extension and Promenade Road, Dublin Port, Dublin 3,(See Figure 1.1).

The proposed development would be developed at existing commercial sites which currently comprise warehouse buildings, existing hardstanding areas, and truck and car parking areas. All have current connection to the public sewer network and the Dublin

Port Surface Water drainage system. Internal drainage upgrades to include attenuation and interceptors will be undertaken as part of the development works.

The sites are bounded by Dublin Bay and developed industrial Dublin Port lands. The nearest residential noise sensitive locations are located some 500m across the Tolka Estuary to the north of the sites. The nearest European sites are South Dublin Bay and River Tolka Estuary SPA (Site Code 004024), North Bull Island SPA (Site Code 004006). Also, within relatively close proximity to the proposed site are North Dublin Bay SAC (Site Code 000206) and South Dublin Bay SAC (Site Code 000210).

Dublin Port is the main seaport and point of entry for ferry and container traffic into the Republic of Ireland. It is located east of the city centre. It is equipped with a ferry terminal, container terminals and storage facilities, as well as supporting infrastructure, including public roads.

Description of the Proposed Development

A site layout plan of the proposed development is provided in Figure 2.1.

Figure 2.1 Site layout plan of the proposed development (Source: OPW February 2020)

A full description is included in chapter 2 and summarised below. Visually the appearance of the proposed development is intended to complement the commercial and industrial developments in the environs (Chapter 11 Landscape and Visual Impact).

The proposed development will consist of:

<u>Various Sites along Bond Drive Extension, Dublin Port, Dublin 3</u>

The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 5 single storey porta-cabin structures totalling 375m^2 (75m^2 each) to provide an import office, a facilities management office and driver welfare facilities;

Resurfacing and amalgamation of 8 existing yards including the modification of existing drainage and lighting infrastructure;

Parking for 175 heavy goods vehicles, 62 cars and 48 bicycles;

Gates, signage and all ancillary site works.

Former Bord na Mona site on Yard 3, Bond Drive Extension, Dublin Port, Dublin 3, D03 F9C1
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 2 single storey porta-cabin structures totalling 150m^2 (75m^2 each) to provide an export office and sanitary facilities;

Parking for 30 heavy goods vehicles and 10 cars;

Gates, signage and all ancillary site works.

Former O'Toole Transport site on Yard 4, Promenade Road, Dublin Port, Dublin 3, D03 F9C1
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Extension (the floor area of which extension is approximately 1760m^2) and refurbishment of an existing industrial building on Promenade Road to provide inspection facilities for customs, sanitary and phytosanitary (SPS) and health checks and controls;

Parking for 3 cars and 28 bicycles;

Gates, signage and all ancillary site works.

The overall planning application site area is approximately 5.4 hectares.

Existence of the Project

Under the current Draft EPA Guidelines on the information to be contained in EIA Reports, the description of the existence of the project is required to define all aspects of the proposed lifecycle of the Proposed Development under the following headings:

- Construction;
- Commissioning;
- Operation;
- Changes to the Project; an
- Description of Other Developments.

Each chapter of the EIA Report assesses the potential impact of the construction and operation of the Proposed Development on the receiving environment and summaries of the impacts and effects are detailed under the specific headings below:

Construction
It is estimated that the civil and commissioning works will take approximately 9 -12 months. The total peak construction population on site is estimated to be of the order of c. 180 staff (average 90 - 110).

Contractors will be required to submit and adhere to a Construction Environmental Management Plan (CEMP). An Outline CEMP included in Appendix 1.1).

The primary potential effects from construction are all temporary to short term effects less than one year) and are anticipated to include;

- Effects in terms of nuisances relating to the air quality of the environs due to dust from excavation works,
- Effects on the noise environment due to plant and equipment involved in construction.
- Effects on traffic management.

Each chapter of the EIA Report assesses the potential impact of the construction and operation of the Proposed Development on the receiving environment and summaries of the impacts and effects are detailed below.

Commissioning
Once the porta cabins and EHS & Revenue building is constructed, contractors will be mobilised to complete the commissioning of any electrical and mechanical equipment and services and related plant. Commissioning will be ongoing on a phased basis as each building is completed.

Operation
Once operational, up to c. 128 full time employees will be present on site during the day, including external staff, maintenance contractors and visitors, as required. Staff will be present on a shift basis, so numbers will vary throughout the day.

Changes to the Project
The proposed development is a permanent installation which is designed to have an approximate lifespan of 50 years overall for the building structures. The components and fittings are expected to have an approximate lifespan of 10 – 30 years and the mechanical and electrical fixtures are expected to have a lifespan of approximately 10 – 15 years. It is likely that regular maintenance and periodic upgrading of the facility over time will enable it to continue to meet future demands.

Upon closure all buildings, plant, equipment, drainage networks etc. at the site will be fully decontaminated and decommissioned in accordance with prevailing best practice. The buildings once rendered environmentally safe will more than likely be retained and sold on for future use following closure.

Descriptions of Other Developments
A list of the other developments in the vicinity of the proposed development is provided in Chapter 3 (Planning and Development Context) of this EIA Report.

Other Nearby Brexit Related Developments
Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m^2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017).

Major Accidents/Disasters
The 2014 EIA Directive and associated Draft EPA EIA Guidelines (2017) and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, require that the vulnerability of the project to major accidents and/or natural disasters (such as earthquakes, landslides, flooding, sea level rise etc.) is considered in the EIA Report. The site has been assessed in relation to the following external natural disasters; landslides, seismic activity, volcanic activity and sea level rise/flooding. The potential for major accidents to occur at the site of the Proposed Development has also been considered with reference to Seveso/Control of Major Accident Hazards (COMAH) Regulations. No significant effects were identified.

3.0 PLANNING AND DEVELOPMENT CONTEXT

The site for the proposed development is situated within the administrative area of Dublin City Council, and therefore the Planning and Development Framework with which the development complies is defined by the Dublin City Development Plan 2016 – 2022. A review of the Dublin City Development Plan 2016 – 2022 shows the proposed development lands zoned as “Z7 – Employment (Heavy)”.

The proposed development will also be guided by the Dublin Port Masterplan 2012 - 2040 (Reviewed 2018). According to this document, the proposed development site is zoned as lands currently used for Non-Core Activity for Future Redevelopment.

The proposed development will be in keeping with all of the aspects of the relevant policy documents (as set out in Chapter 3) and DCC’s stated policies and objectives to conserve, protect and enhance the environmental resources and assets of the region will not be contravened by the Proposed Development as described in the relevant chapters within the EIA Report.

4.0 ALTERNATIVES

EIA legislation and the prevailing EPA Draft Guidelines (August 2017) and best practice require that EIA Reports consider ‘alternatives’ for projects with regard to their environmental effects.

Do Nothing Alternative

The United Kingdom has withdrawn from the European Union and will withdraw from the EU single market and customs union once the transition period expires(currently 31st December 2020). As a non-EU country, goods entering the State from the United Kingdom will require checks and controls in line with EU legislation. Certain goods and trade consignments being exported to, or through, the United Kingdom will also need interventions that must be carried out at the port. The proposed development will provide the infrastructure for the relevant State agencies to carry out these checks and controls.

The relevant EU legislation states that the necessary checks and controls must be carried out at a designated point of entry for those goods. Dublin Port is currently a designated point of entry for non-EU goods and there are facilities in place within the port to carry out the checks and controls on those goods. However, the volume and type of goods which currently enter the State from the UK mean that the current facilities for non-EU trade would not be sufficient to cope with the increased volumes.

In this scenario, the “do nothing alternative” cannot be considered a viable alternative. The State has an obligation to protect the integrity of the European Single Market. In order to do so, the State must ensure that there is sufficient infrastructure in place so that the necessary checks and controls can be effectively managed. Furthermore, any shortfall in facilities would lead to a backlog of consignments needing clearance before exiting the Port. This could lead to widespread disruption of traffic within the Port, within the wider road network and on the seas.

Alternative Project Locations

The proposed development is required to facilitate checks and controls on goods entering and exiting Ireland to and from the United Kingdom and other third countries via Dublin Port. Under the relevant EU legislation, the Border Control Post must be situated at the designated point of entry which, in this case, means it must be located within the confines of Dublin Port. The site is currently zoned for Employment (Heavy) use and is therefore in keeping with the policies and objectives of the Dublin City Council Development Plan (see Chapter 3). The site is zoned as “lands currently used for Non-Core Activity for Future Redevelopment” and “Multi Purpose Transit Storage” in the Dublin Port Masterplan 2018 – 2040 and as such is highly in keeping with the proposed development. The site has the required infrastructure readily available for the development.

As part of the planning application for the proposed development, the Commissioners of Public Works in Ireland, on behalf of the Applicant, undertook an assessment of a number of potential alternative project locations in order to determine the most appropriate location for the proposed development. This assessment was limited to sites within Dublin Port, as per the EU regulations.

The location of the proposed development within Dublin Port was selected due to the area of available land at the chosen development site to facilitate he required HGV parking spaces, as well as warehouse facilities, public offices, administrative buildings and other facilities required. At 5.4 hectares, the proposed development site provides sufficient space to provide for these aspects of the proposed development. Furthermore, it should be highlighted that there were no other sites available in Dublin Port within the strict timeline with this quantum of land available for development, and that there is little prospect of additional landholdings becoming available due to active leaseholds being held on the sites. The selected site is therefore the only viable location on which to develop the required infrastructure.

Alternative Design/Layouts

The chosen layout was selected due to its efficient use of the available land on site. It was deemed that there was no significant environmental effect associated with any arrangement of the facilities on site, and as such the chosen layout was selected in terms of providing efficiency in terms of turnaround of vehicles entering for customs, SPS, checks and controls.

Alternative Processes
Processes at the proposed development will consist of the necessary checks and controls on trade to ensure Ireland can meet its obligations following the end of the transition period. These checks and controls will be carried out in accordance with relevant EU Regulations and national legislation. Technological solutions, such as the use of Automated Number Plate Recognition systems, will run in tandem with the infrastructure developments to ensure maximum efficiency and flexibility.

Alternative Mitigation
For each aspect of the environment, each specialist has considered the existing environment, likely impacts of the proposed development and reviewed feasible mitigation measures to identify the most suitable measure appropriate to the environmental setting of the project design. In each case, the specialist has reviewed the possible mitigation measures available and considered the use of the mitigation in terms of the likely residual impact on the environment. The four established strategies for mitigation of effects have been considered: avoidance, prevention, reduction and offsetting (not required in this development). Mitigation measures have also been considered based on the effect on quality, duration of impact, probability and significance of effects.

5.0 HUMAN HEALTH AND POPULATION

This chapter evaluated the impacts, if any, of the Proposed Development on population and human health with specific focus on Employment, Human Health and Amenity. Human health in this context is addressed through a review of expected effects on air quality and climate, noise and vibration and traffic.

There will be a temporary, imperceptible, positive effect on local business with the presence of c. 180 construction workers (average 90 - 110) using local facilities during the construction phase. The positive impact during the operational phase will be less with c. 128 no. full time employees anticipated on site throughout any 24 hours period. It is also anticipated that the proposed development will have indirect positive effects on employment in terms of construction material manufacture, maintenance contracts, equipment supply, landscaping etc.

The main potential impacts on human beings and human health associated with the proposed development will be during the construction stage. Mitigation measures, such as dust management, noise management and traffic management, will be put in place during construction of the Proposed Development which will ensure that the impact of the Proposed Development complies with all EU ambient air quality legislative limit values (see Chapter 8), which are based on the protection of human health and noise limits (see Chapter 9) meet adopted noise limit values which are based with due consideration of the effect on human health.

Overall, it is expected that the proposed development will have numerous direct and indirect benefits on a regional and national scale, and will have an overall positive effect on the local, regional and national population in terms of providing key infrastructure to ameliorate the effects of the exit of the United Kingdom from the European Union

6.0 HYDROLOGY

Chapter 6 of the EIA Report assesses and evaluates the potential impacts of the proposed development on the hydrological environment.

Within the proposed Bond Drive Extension site, two of the eight existing sites are well surfaced with extensive positive drainage systems taking discharge across their full area with oil interceptors. The remaining six sites which make up the proposed Bond Drive Extension site have varying amounts of positive surface water drainage on site primarily focused on the portion of sites adjacent to Bond Drive Extension. Within the proposed Yard 3 & 4 site, there are two existing sites. These are both hardstanding with existing surface water drainage systems in place.

In accordance with the WFD, each river catchment was assessed by the EPA and a water management plan detailing the programme of measures was put in place for each. The Tolka Estuary to the north is classified as being '*At risk of not achieving good status'.*

A Stage 1 Flood Risk Assessment was completed and is included within the Engineering Report prepared by OPW and provided with this EIAR. The flood assessment has considered climate change scenarios following OPW guidelines and the assessment has confirmed that all the sites are suitable for this type of development.

Rainwater runoff from building roofs, yards and the proposed access roads will be collected in new and existing storm water networks and discharged at a restricted rate to the relevant existing surface water sewer. Any flows over the allowable discharge rate will be attenuated on site. The attenuation storage provided will comprise underground storage tanks. Bond Drive Extension site will require total attenuation of 1970 m^3 while Yard 3 & 4 site will require total attenuation of $1000m^3$. Oil interceptors will be located on all outfalls prior to discharge to the Dublin Port surface water drainage network. The latter incorporates additional treatment through interceptors prior to discharge.

During operation, there is minimal storage of bulk chemicals on site – primary storage is within contained belly tanks of back up diesel generators. Any accidental leaks from vehicles will be diverted into the stormwater infrastructure and treated within oil interceptors. During construction there is potential for an accidental discharge from contractor vehicles and cement works. The contractor will be required to operate in compliance with a CEMP which includes measures for management of any accidental leaks from construction vehicles or temporary oil storage and run-off water.

Following implementation of mitigation measures detailed in Chapter 6 of the EIA Report, the predicted impact during construction of the proposed development will be short term, imperceptible and neutral during construction and long term imperceptible and neutral during operation.

7.0 BIODIVERSITY

This chapter provides an assessment of the impacts of the proposed development in question on the ecological environment, i.e. flora and fauna. The development sites are predominately comprised of artificial surfaces and are of relatively low ecological value, but the surrounding marine habitat of Dublin Bay is of high ecological value. The nearest

European sites to the proposed development are the South Dublin Bay and River Tolka Estuary SPA located c. 25m to the nearest northern boundary of the site.

The site of the proposed development comprises two relatively small areas of open gravelled surfaces (ED2) and artificial surfaces and buildings (BL3). None of the qualifying habitats or species of the European sites occur under the footprint of the proposed works areas.

There are no rare or protected habitats recorded in the study area. The site may be considered of Low Local Ecological Value.

Japanese Knotweed previously recorded and mapped within and adjacent to the proposed development site is being addressed in an Invasive Species Management Plan.

There are no suitable habitats for terrestrial mammals in the proposed development area and none were recorded.

Consultation with IWDG Consulting supported the assessment that it is unlikely that these proposed works will have any significant impacts on marine mammals in the vicinity of the works.

The Avian Impact Assessment has determined that the proposed development will have no impact on tern species. Additionally, the numbers of birds occurring actually within the site of the proposed development are insignificant. While the possibility for disturbance (both during construction and operation) to waterbirds within the SPA has been noted, this will be a short-term negligible impact. Even if minor disturbance occurs, there are large areas of suitable estuarine habitats within more distant parts of the SPA that will be available to SCI species.

When in operation, the site will be subject to truck traffic and truck parking, the same as the current use of at least some of these areas, so that it can be said that the operational phase of the development will result in little or no change from the status quo.

Any potential minor impact via contaminated surface water runoff will be mitigated by standard design SuDS features such as attenuation, updates to the surface water drainage and sewerage network and petrol interception that are included in the Project design.

The development is located in an area of low local ecological value and, as such, is predicted to have a *neutral* and *imperceptible* effect on biodiversity and no long-term cumulative impacts.

The conclusion of the Project NIS is that the possibility of any adverse effects on the integrity of the European Sites considered in the NIS, or on the integrity of any other European Site (having regard to their conservation objectives), arising from the proposed development, either alone or in combination with other plans or projects, can be excluded beyond a reasonable scientific doubt.

8.0 LAND, SOILS, GEOLOGY AND HYDROGEOLOGY

Chapter 8 of the EIA Report assesses and evaluates the potential impacts of the proposed development on the land, geological and hydrogeological environment.

The site is underlain by > 4.5 m of made ground comprising mostly of sandy silty Gravels with fragments of redbrick concrete and other fill material. Beneath this to circa 12.5 m to 10 m older fill material most likely from the reclaiming of this part of Dublin Port from the Liffey Estuary in the early 1900's consisting mostly of sandy silty gravels with clays and sandy, silty, gravelly clays. This is underlain by a *Locally Important* limestone (Calp) aquifer, The Groundwater Body (GWB) underlying the site is the Dublin GWB (EU Groundwater Body Code: IE_EA_G_008). Currently, the EPA (2018) classifies the Dublin GWB as having 'Good Status', with a Ground Waterbody Risk score of *'not at risk'.*

There are no areas of geological heritage or likely impacts on groundwater dependent wetlands or drinking supplies within the zone of influence of the development. There are no requirements for discharge to ground or abstraction from groundwater.

Representative soil sampling for chemicals of concern, confirmed localized contamination in the made ground. Comparison with relevant guidelines based on impact on environment and human health (LQMS/CIEH S4UIs) showed two of the nineteen samples analysed exceeded levels suitable for commercial land use. Waste acceptance criteria (WAC) analysis confirmed that soil (at locations where the inert WAC criteria is exceeded) can be disposed of a non-hazardous land fill apart from one location which exceeded hazardous limits for TOC only. Approximately 32,208 m^3 of soils will be excavated to facilitate construction of the development and soil sampling will be undertaken prior to disposal off site to a suitably licenced facility.

During operation, there is minimal storage of bulk chemicals on site – primary storage is within contained belly tanks of back up diesel generators. Any accidental leaks from vehicles will be diverted into the stormwater infrastructure and treated within oil interceptors. The presence of hardstand minimises any potential for discharge to ground and therefore a very low risk to the underlying aquifer. During construction there is potential for an accidental discharge from contractor vehicles and cement works. The contractor will be required to operate in compliance with a CEMP which includes measures for management of any accidental leaks from construction vehicles or temporary oil storage and run-off water.

There development is in accordance with the planning zonation for the area.

Following implementation of mitigation measures detailed in Chapter 8 of the EIA Report, the predicted impact during construction of the proposed development will be *short term*, *imperceptible* and *neutral* during construction and *long term imperceptible* and *neutral* during operation.

9.0 AIR QUALITY AND CLIMATE

In terms of the existing air quality environment, baseline data and data available from similar environments indicates that levels of nitrogen dioxide, carbon monoxide, particulate matter less than 10 microns and less than 2.5 microns and benzene are generally well below the National and European Union (EU) ambient air quality standards.

The existing climate baseline can be determined by reference to data from the EPA on Ireland's total greenhouse gas (GHG) emissions and compliance with European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC). The EPA state that Ireland had total GHG emissions of 60.74 Mt CO2eq in 2017. This is 2.94 Mt CO2eq higher than Ireland's annual target for emissions in 2017. Emissions are predicted to continue to exceed the targets in future years, therefore, reduction measures are required in all sectors.

Impacts to air quality and climate can occur during both the construction and operational phases of the proposed development. With regard to the construction stage the greatest potential for air quality impacts is from fugitive dust emissions impacting nearby sensitive receptors. Impacts to climate can occur as a result of vehicle and machinery emissions. In terms of the operational stage air quality and climate impacts will predominantly occur as a result of the change in traffic flows or congestion on the road links near the proposed development.

The sensitivity of the area to dust soiling and human health impacts is considered low. The ecological sensitivity of the area to dust impacts is considered high due to the proximity of the site to the South Dublin Bay and River Tolka Estuary SPA and North Dublin Bay pNHA. Any potential dust impacts during the construction stage can be mitigated through the use of best practice and minimisation measures. Measures associated with a medium level of dust control are outlined in this report. Therefore, dust impacts will be short-term, negative and not significant at all nearby sensitive receptors. It is not predicted that significant impacts to climate will occur during the construction stage due to the nature and scale of the development.

The operational stage changes in added that levels of traffic-derived air pollutants resulting from 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 Transport Infrastructure Ireland’s guidance document ‘Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes’ the impact of the development in terms of PM10 and PM2.5 and is long-term, negative and imperceptible. In terms of NO2 the impact is considered long-term, slight and negative. However, there are no high sensitivity receptors within the assessment study area, all receptors assessed are of medium to low sensitivity.

Potential impacts as a result of nitrogen deposition from operational phase traffic emissions on the nearby designated sites has been scoped out of a detailed assessment based on the UK Highways Agency scoping criteria. Detailed assessments are not required for areas that are not sensitive to nitrogen deposition such as those with geological features or watercourses. As the SPA is designated for the protection for a number of bird species it can be scoped out and the impact is considered imperceptible.

The proposed development is not predicted to significantly impact climate during the operational stage. Increases in traffic derived levels of CO2 have been assessed against Ireland’s obligations under the EU Targets and emissions ceilings set out by Decision (EU) 2017/1471 and Regulation (EU) 2018/842. Impacts to climate are deemed imperceptible, negative and long-term with regard to CO2 emissions.

As the National and EU standards for air quality are based on the protection of human health, and concentrations of pollutants for both the construction and operational stages of the proposed development are predicted to be in compliance with these standards, the impact to human health is predicted to be negative and imperceptible in the short and long term.

There are no highly sensitive receptors in relation to air quality within the assessment study area. All receptors are considered medium to low sensitivity and as such changes in air quality will have a lesser impact. No significant impacts to either air quality or climate are predicted during the construction or operational phases of the proposed development.

10.0 NOISE AND VIBRATION

The following methodology has been adopted to assess the potential for noise and vibration impacts associated with the proposed development:

- Review of relevant guidance to identify appropriate noise and vibration criteria for the development, where relevant;
- Review of baseline noise data in the vicinity of the site, to identify existing levels of noise in the receiving environment;
- Noise emissions have been predicted at the nearest noise sensitive locations for the operational phase in accordance with best practice methodologies and guidance;
- Predicted noise levels have been compared against the appropriate criteria and existing noise levels, and;
- An assessment of the mitigation measures required has been completed.

Baseline Environment

The nearest noise sensitive locations to the development site are residential dwellings located along the Clontarf Road ~530m to the north of the site.

The noise environment in the vicinity of the nearest noise sensitive locations is dominated by road traffic. During night-time periods, noise levels are reduced in line with reduced traffic flows on both local and national roads in the surrounding environment.

Construction Noise and Vibration Impacts

During the construction phase of the project there is the potential for temporary noise impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum as far as practicable. For the duration of the construction period, construction noise impacts will be short-term, negative and slight to moderate. Vibration impacts during the construction phase will be short-term, neutral and negligible.

Operational Noise and Vibration Impacts

The potential noise impacts associated with the normal day to day operation of the proposed development have been determined to be from building services and HGV and light vehicle movements.

The contribution from the operational noise sources has been predicted at the nearest noise sensitive locations and compared against relevant noise criteria.

The results of the assessment confirm the operation of the development is not expected to exceed with the relevant noise limits at the nearest noise sensitive locations.

The contribution of the assessed operational noise sources has been determined to be *long-term, not significant* significance *with a neutral* impact on noise and vibration.

There are no vibration sources associated with the proposed development.

11.0 LANDSCAPE AND VISUAL

The proposed development site is located with the northern part of the Dublin Port lands at the eastern edge of Dublin City and centrally within the Harbour. Dublin Port is the largest port in Ireland, providing both passenger and freight services to the city and country.

The northern part of Dublin Port is the largest part of the port, extending to over 200 hectares and spanning from the River Liffey to the Tolka Estuary on the south and north respectively, and eastwards from the East Wall Road into the harbour. Road access to the port is from the southern end of the M50 via Promenade Road, and also from the East Wall Road via Alexandra Road.

The wider context of Dublin Port includes the North Lotts, IFSC and city centre to the west; the established residential areas of East Wall, Fairview and Clontarf to the northwest and north with the Tolka Estuary typically providing 400-500m separation between the northern edge of Dublin Port and the Clontarf Road and Promenade; the North Bull Island to the northeast, and the Poolbeg Peninsula to the south of the River Liffey. The Poolbeg Peninsula is to the south of the River Liffey and includes the southern Dublin Port lands, the Pigeon House Power Station with its iconic chimneys rising to over 200m in height at the mouth of the harbour, as well as the Dublin Waste Water Treatment Plant, the Covanta Waste to Energy facility, Irishtown Nature Reserve, and the Seán Moore Park adjacent to the residential area of Ringsend.

The North Bull Wall and the Great South Wall extend from Dublin Port and the Poolbeg Peninsula into Dublin Bay and define the harbour area. Both walls are popular amenity facilities for walking, fishing and bathing.

The northern edge of Dublin Port, where it adjoins the Tolka Estuary, has a strong and established landscape berm with tree and shrub planting that provides a buffer and an element of visual screening to the estuary and from Clontarf Road and promenade.

The development site is along the northern side of these lands adjoining the Tolka Estuary, and comprises three distinct but proximate site areas within the port, namely, Bond Road Extension and Yards 3 & 4. These site areas currently comprise a range of established logistics, transport and storage compounds, with extensive marshalling areas and a mix of porta cabin and warehouse facilities. Individual compounds are typically defined and secured by palisade type fencing and have no landscape features. Compounds are consistent with other compounds that occupy the northern part of the port, and present an overarching industrial character. There are no national landscape or visual designations pertaining to the sites.

The proposed development will be consistent in character and operation with the existing and established industrial type facilities at the part of the port. The scale and intensity of built elements will also be consistent with existing facilities. The layout of the Bond Drive Extension and Yards 3 & 4 compounds permits the incorporation of areas of tree, hedge and shrub planting within the compounds that will provide a more ordered appearance and a higher standard of presentation of these compounds than other compounds in the port.

Outside of the port area, the appearance of the proposed development, if visible, will be consistent with the existing facilities, and will be substantially screened or absorbed within the wider and larger port setting. The most sensitive location is the area north of the Tolka Estuary, comprising the Clontarf Road and promenade extending from Fairview to the North Bull Island. The existing landscape berm and tree planting along the northern edge of the port will continue to screen the Bond Drive Extension and Yards 3 & 4 compounds as at present.

The landscape and visual impact of the development, during construction and upon completion, will be *slight and neutral* as the scale of the proposed strictures are generally small and will not be readily visible or distinguishable from the general port-related infrastructure and facility at Dublin Port. A series of photomontages have been prepared from representative locations and are included in *Appendix 11.1* of the EIAR.

12.0 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

This chapter assesses the predicted impacts of the proposed development on archaeological, architectural and cultural heritage using a number of sources including the Record of Monuments and Places, the National Inventory of Architectural Heritage, the topographical files of the National Museum of Ireland, the Excavations Database, aerial photography, cartographic and documentary sources.

The entire site is underlain by infill dating to the reclamation of the land from 1958 onwards. However, the original foreshore sediments lie underneath this infill, and this area was a main shipping route for centuries. Therefore, only excavation beneath the infill (which is limited based on the nature of the development) into the foreshore sediments has the potential to impact on archaeological features or finds (for example, fish traps, kishes or ships timbers), should they exist.

In order to mitigate the impact of the proposed development, the following mitigation strategy will be implemented. A suitably qualified archaeological consultant will monitor groundworks in areas where excavations are deeper than the post-1958 infill, under license to the National Monuments Service Section of the Department of the Culture, Heritage and the Gaeltacht. Should any archaeological material be encountered mechanical excavation will cease and the City Archaeologist and National Monuments Service shall be notified. Further work will then only be carried out following consultations with the City Archaeologist and the National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

13.0 TRAFFIC AND TRANSPORTATION

The key handling area for non-EU freight vehicles is referred to as the Bond Drive Extension Site located at the Bond Drive Extension. This and four other sites will be used by the various Government Agencies within the port complex to review and process incoming and outgoing non-EU originating freight vehicles.

Existing Road Access

The various sites are accessed from the Dublin Port internal road network which has generally been developed to reflect the predominant use by heavy goods vehicles. Promenade Road provides the main access for the majority of the traffic flow into and out of the port.

The roads system in the vicinity of the sites is currently being improved and altered as part of the Port Roads improvement project including the Greenway scheme (DCC planning reference 3084/16) which include construction of improved junction layouts, widening and construction of roads, road signage, wayfinding and improved cycle and pedestrian facilities, which serve the various parts of the development.

Traffic Generation and Distribution

Given the unique nature of the development, the projected trip generation has been derived based on the Government Agencies anticipated operating methodologies. Based on the current programme the development will be operational from the end of the post-Brexit transitional arrangements, i.e. the beginning of 2021. The various Government

Agencies have identified the anticipated number of vehicles which will have to be assessed upon arrival in Ireland.

The development facilities have been designed to process a peak number of reviews occurring upon the arrival between 05.30-06.00 daily. The methodology of vehicle assessment is such that approximately half will travel through the port and onward to the external road network as they have done historically. The number of vehicles to be processed further total 193 at the various Combined Government Services sites for the peak period out of approximately 400 commercial vehicles entering the port from sea at the peak hour. These vehicles will be routed to the various yards/terminals using the internal port roads and will then proceed to the external road network once processed. In generating the anticipated number trips certain assumptions were made in order to provide a robust assessment.

The trips which will have the greatest impact on the receiving environment will be the freight vehicles processed by the development. Whilst the morning inward peak generates the greatest number of trips, to check the sensitivity of the proposals on the receiving network and assessment also considered a ferry arriving during the evening peak on the internal roads network.

Two junctions were identified as being affected by the additional generated development trips:

- Junction 10 – Promenade Road/Bond Drive Roundabout (known colloquially as ‘Circle K Roundabout’); and
- Junction 17 – Tolka Quay Road/Bond Drive roundabout junction (at time of opening).

The reassignment of traffic in the vicinity of Junctions 10 and 17 due to the Greenway project/T10 Link Road has a positive impact on the junction capacities for 2021.

The assessment established that Junction 10 will have sufficient reserve capacity for both the year of opening – 2021 and a fifteen-year design horizon.

Whilst the Junction 17 will exceed its theoretical maximum capacity in the 15-year design horizon. However, the capacity is only slightly exceeded the attendant queuing is anticipated to be minimal and would be acceptable.

Impact Assessment

Minimal demolition and construction works are required as part of the proposed project works at each of the sites. The proposed development works do not require any significant construction works; therefore, the impact of construction works will be short term, imperceptible and neutral.

The proposed development will have an impact on the roads within the port, in particular the junctions in the proximity of the various elements of the development. The receiving road facilities are being upgraded to accommodate the overall traffic growth predicted at the port which will mitigate the impact of the development. The scheme includes measures to provide onsite cycle and pedestrian facilities to align the works with improvements for such facilities in the broader port environment in the in terms of sustainability. At the year of opening the development will have an imperceptible impact on the roads network, whilst it will be only approaching the 15 year horizon that there will be a slight significance with a negative impact on transportation quality in the port, primarily due to the relatively high growth rates of traffic in the port.

14.0 MATERIAL ASSETS

This chapter evaluates the impacts, if any, which the Proposed Development may have on Material Assets. The Draft EPA EIA Guidelines (2017) state that material assets are now taken to mean built services and infrastructure, roads and traffic and waste management. The EPA Draft Advice Notes for Preparing Environmental Impact Statements (2015) also give the following examples of material assets; assimilative capacity of air, ownership and access and tourism. In the EIA Report, the impacts on the various material assets described above have been considered in chapters 4, 8, 12 and 14 of the EIA Report.

The site of the proposed development as described in Chapter 2: Description of the Proposed Development will be leased by the Office of Public Works. A letter of consent, is included in Appendix 14.1.

There is good visibility on approach to all access points as detailed in Chapter 13 Traffic and Transportation.

The proposed development lands are currently serviced with electricity from the existing electrical transmission infrastructure located in Dublin Port. In the event of a loss of power supply i.e. temporary grid blackout, diesel powered back-up generators will be provided to maintain power supply. The sites are also serviced by public water supply and sewers with adequate capacity for the proposed development. Drainage within the bond drive and Yard 3 & 4 sites will be upgraded to facilitate attenuation and separation of foul and storm which will ultimately discharge to the Dublin Port infrastructure.

15.0 WASTE MANAGEMENT

This chapter has been prepared to address the issues associated with waste management during the construction and operational phases of the Proposed Development.

An assessment was carried out of the potential impacts associated with waste management during the construction and operational phases of the Proposed Development. The receiving environment is largely defined by DCC as the local authority responsible for setting and administering waste management activities in the area through regional and development zone-specific policies and regulations.

During the demolition and construction phases, typical demolition and construction waste materials will be generated which will be source segregated on-site into appropriate skips/containers and removed from site by suitably permitted waste contractors to authorised waste facilities. Where possible, materials will be reused on-site to minimize raw material consumption. Source segregation of waste materials will improve the re-use opportunities of recyclable materials off-site.

Site preparation, pile foundation excavations and other enabling works required to facilitate construction of foundations, access roads and the installation of services will generate c. 32,208m^3 of made ground and soils and stones. It is currently anticipated that the excavated material will not be required and/or suitable for reuse on-site and will be removed off-site as a waste for reuse/recovery/disposal offsite.

A carefully planned approach to waste management and adherence to the site-specific C&D Waste Management Plan during the construction phase will ensure that the effect on the environment will be *short-term, neutral* and *imperceptible*.

Dedicated areas will be allocated for storage of waste materials generated during the operational phase of the development. The waste storage areas allocated will ensure a convenient and efficient management strategy with source segregation a priority. Waste will be collected from the waste storage areas by permitted waste contractors and removed off-site for re-use, recycling, recovery or disposal.

Provided the mitigation measures outlined in Chapter 15 are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted impact of the operational phase on the environment will be *long-term, neutral* and *imperceptible*.

16.0 INTERACTIONS

This chapter of the EIA Report addresses potential interactions and inter-relationships between the environmental factors discussed in the preceding chapters. This covers both the construction and operational phase of the Proposed Development.

In the main, the majority of EIA Report chapters have already included and described assessments of potential interactions between aspects however this section of the assessment presents a summary and assessment of the identified interactions.

In summary, the majority of interactions are neutral. There are no short term or longterm negative significant impacts however, there are short term (during construction) slight-negative impacts on air and noise to population.

TABLE OF CONTENTS

NON-TECHNICAL SUMMARY

1.0 INTRODUCTION

1.1 PROPOSED DEVELOPMENT

This Environmental Impact Assessment (EIA) Report has been prepared on behalf of the Minister for Public Expenditure and Reform (herein referred to as ‘the Applicant’) to comply with the requirements for such a development outlined in the emergency order provisions of S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019 for Brexit Infrastructure at Dublin Port, North Dock, Dublin 3. The Commissioners of Public Works will be the developer of this proposed development (herein referred to as ‘OPW’ and/or ‘the Developer’). The development will be operated by The Revenue Commissioners, The Health Service Executive and the Department of Agriculture, Food and the Marine (herein referred to as ‘the Operator’). The location of the proposed development is shown in Figure 1.1

The proposed development will consist of:

<u>Various Sites along Bond Drive Extension, Dublin Port, Dublin 3</u>
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 5 single storey porta-cabin structures totalling 375m^2 (75m^2 each) to provide an import office, a facilities management office and driver welfare facilities;

Resurfacing and amalgamation of 8 existing yards including the modification of existing drainage and lighting infrastructure;

Parking for 175 heavy goods vehicles, 62 cars and 48 bicycles;

Gates, signage and all ancillary site works.

<u>Former Bord na Mona site on Yard 3, Bond Drive Extension, Dublin Port, Dublin 3, D03 F9C1</u>
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 2 single storey porta-cabin structures totalling 150m^2 (75m^2 each) to provide an export office and sanitary facilities;

Parking for 30 heavy goods vehicles and 10 cars;

Gates, signage and all ancillary site works.

<u>Former O’Toole Transport site on Yard 4, Promenade Road, Dublin Port, Dublin 3, D03 F9C1</u>
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Extension (the floor area of which extension is approximately 1760m^2) and refurbishment of an existing industrial building on Promenade Road to provide inspection facilities for customs, sanitary and phytosanitary (SPS) and health checks and controls;

Parking for 3 cars and 28 bicycles;

Gates, signage and all ancillary site works.

The overall planning application site area is approximately 5.4 hectares.

A full description of the development is provided in Chapter 2 (Description of the Proposed Development).

Figure 1.1 Location of the proposed development, with the site boundary indicated in red.

1.2 CONTEXT

1.2.1 Planning Pathway of the Proposed Development

As a consequence of Brexit, substantial infrastructure is required for customs, Sanitary Phytosanitary (SPS) and health checks and controls at Dublin Port to ensure that Ireland can effectively manage the new requirements for checks and controls on trade with the UK at the end of the transition period.

The approval for this development is governed by a Ministerial Order issued under the Planning and Development Act 2000 Section 181 (2)(a). The Ministerial Order is made by the Minister for Public Expenditure and Reform and will be required as a result of the withdrawal of the United Kingdom from the European Union and the expiry of the transition period on 31 December 2020.Pursuant to this Order, the provisions of the Planning and Development Act 2000 shall not apply to the development being carried out on behalf of the Minister by the Office of Public Works on the site specified in the text of the Order.

The Ministerial Order includes a requirement for An Bord Pleanala's (ABP) approval of an EIAR or an Appropriate Assessment or both for the proposed development, The proposed development is being treated in accordance with the requirements outlined in S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019. S.I. No. 418/2019 amended as specified in the Planning and Development Act 2000. Of particular relevance to the proposed development, are the insertions of subsections after subsection (2):

> "*(2A)(b) Where development is proposed to be carried out by or on behalf of a Minister concerned pursuant to an order under subsection (2)(a) and the*
>
> *Minister concerned is satisfied, having had regard to Part X and Part XAB, that an environmental impact assessment or an appropriate assessment, or both such assessments of the proposed development is or are required, the Minister concerned shall prepare or cause to be prepared an application for approval, which shall include the documents and information referred to in paragraph (c), in respect of the development and shall apply to the Board for such approval."*
>
> *"(2A)(c) An application for approval referred to in paragraph (b) shall include a draft of the order the Minister concerned proposes to make under subsection (2)(a), the plans, drawings and particulars in relation to the proposed development and, other than where an exemption is granted under subsection (2I), an environmental impact assessment report or Natura impact statement, or both that report and that statement, as the case may be, in respect of the development."*

In accordance with these subsections, an Environmental Impact Assessment Report and Natura Impact Statement are being submitted to ABP for approval in respect of the proposed development.

1.2.2 Legislative Requirements

The requirement for EIA for certain types and scales of development is set out in the EIA Directives (2011/92/EU and 2014/52/EU), European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (the bulk of which came into operation in September 2018), the European Communities (Environmental Impact Assessment) Regulations 1989-2006, Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001-2017. It should be noted that this EIA Report is prepared in accordance with the 2011 EIA Directive (2011/92/EU), as amended by the 2014 EIA Directive.

The EIA Directives list those projects for which an EIA is mandatory (Annex I) and those projects for which an EIA may be required (Annex II). With regard to Annex II projects, Member States can choose to apply thresholds or use case by case examination or a combination of both to assess where EIA is required. In Ireland, a combination of both has been applied.

The project proposed is not listed under Annex I EIA Directives and it is below the relevant threshold as set out in the Planning and Development Regulations 2001-2019 for Annex II projects. The threshold for "*urban development which would involve* greater *than 2 hectares in the case of a business district"* as set out in Part 2 of Schedule 5 of the Regulations was considered to be most relevant threshold in the context of the proposed development in the subject location. Since the proposed development exceeds this threshold, an EIA Report was prepared for the proposed development.

The main objective of an EIA, as set out in Article 3(1) of the 2014 EIA Directive, is to identify, describe and assess the direct and indirect significant impacts of a project on population and human health, biodiversity, land, soils, water, air & climate (including noise), material assets, cultural heritage and the landscape and the interaction between the aforementioned factors. The EIA Report reports on the findings of the EIA process to date and informs the Planning Authority, statutory consultees, other interested parties and the public in general about the likely effects of the project on the environment.
The planning application for the proposed development is being prepared in accordance with the requirements outlined in S.I. No. 418/2019 - European Union

(Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019.

The proposed development is located in Dublin Port, and is within the remit of the Dublin Port Masterplan 2040 (Reviewed 2018). The proposed development will comply with any environmental requirements outlined in the Dublin Port Masterplan 2040 (Reviewed 2018).

1.2.3 Format of the EIA Report

This EIA Report has been prepared in accordance with the requirements of EIA Directives (2011/92/EU and 2014/52/EU). It is prepared in the Grouped Format Structure following the guideline structure set down in the Environmental Protection Agency (EPA) Draft “*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports” (*2017).

The “*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment”* (August 2018) and the European Commission *Guidance on the preparation of the Environmental Impact Assessment Report* have been considered in the preparation of the EIA report.

Using the Grouped Format Structure, the EIA Report examines each environmental aspect in a separate chapter. Each chapter generally covers the following:

- Receiving Environment;
- Characteristics of the Proposed Development;
- Potential Impacts of the Proposed Development;
- Do-Nothing Scenario;
- Remedial and Mitigation Measures;
- Predicted Impacts of the Development; and
- Residual Impacts.

A Non-Technical Summary of the findings of the EIA Report is provided.

An outline CEMP is included in Appendix 1.3. This CEMP will be updated by the contractor for the proposed development prior to commencement of construction.

Cumulative impacts for each environmental topic are assessed in each chapter of this EIA Report.

Interactions i.e. the interrelationship between each environmental aspect, are assessed as they occur in each chapter. The final chapter of the EIA Report, Chapter

16 shows where interactions have been identified and how they have been addressed.

1.2.4 Need for the Development

While the final outcome of the negotiations between the European Union (EU) and the United Kingdom (UK) on a Future Relationship remains to be determined, it is clear that the UK will be leaving the Single Market and Customs Union. This will result in the UK becoming a third country (non-EU country) with customs, Sanitary and Phytosanitary (SPS) and health checks and controls applying to EU/UK trade. These are checks that do not currently apply to EU/UK trade and consequently facilities to conduct import controls need to be enhanced to cater for the increased volume of third country trade.

Live animals, plants, animal and plant products being imported into the European Union must be checked at facilities called Border Control Post (BCP) facilities before they can be released onto the European Single Market. These facilities must meet the detailed infrastructural requirements laid down in European legislation (Commission Implementing Regulation 2019/1014).

In Ireland, SPS checks of animals and animal products for food safety and animal health reasons are carried out by the Department of Agriculture, Food and the Marine (DAFM). DAFM is also responsible for plant health checks on plants and plant products. The Health Service Executive (HSE) is responsible for food safety checks on plant products for human consumption. The Revenue Commissioners are responsible for customs checks.

Substantial infrastructure is required at Dublin Port to ensure that Ireland can effectively manage the new requirements for checks and controls on trade with the UK at the end of the transition period. The additional facilities delivered by this project will supplement the physical infrastructure already put in place in advance of potential disorderly Brexit dates last year and will enable Ireland to meet the obligations for checks and controls following the end of the transition period while maintaining the efficient movement of trade through Dublin Port.

1.3 CONSULTATION

OPW and the EIAR project team have liaised with ABP in advance of lodgment of this application. A pre-planning meeting was held with ABP on 5 November 2019.

In addition, OPW has liaised with the Dublin Port Company at many meetings in the course of the EIA Report preparation. A summary description of the development was provided to the The Manager, Development Applications Unit on 31 Oct 2019. OPW requested a consultation with DCC on 3rd April 2020 but due to COVID 19 procedures a consultation meeting has not been possible to date. A response from the Irish Whale and Dolphin Group was received on April 9th 2020. Phone consultation and email consultation was undertaken with Birdwatch Ireland and attention to a population of Tern was raised and has been considered in the biodiversity assessment undertaken which includes a bird survey.

Copies of correspondence are included in Appendix 1.2.

AWN and the other respective EIA contributors/authors have incorporated advice and comments received from consultees into the relevant chapters of this EIA Report.

1.4 REGULATORY CONTROL

Activities associated with the proposed development are not EPA-regulated activities in terms of the Industrial Emissions Directive 2010/75/EU (which replaced the IPPC directive).

The proposed development will be operated in line with internationally recognised standards, design codes, legislation and good practice.

1.5 CONTRIBUTORS TO THE EIA REPORT

The preparation and co-ordination of this EIA Report has been completed by AWN Consulting in conjunction with specialist subcontractors. Specialist inputs were provided by the following (Table 1.1):

Table 1.1 Roles and Responsibilities in the EIA Report

Role		Company
EIA Project Management		AWN –Teri Hayes BSc MSc PGeol EurGeol
Engineering Design		Commissioners of Public Works
Architectural Design		Commissioners of Public Works
EIA Chapter No.	Chapter Title	Company & Consultant
	Non-Technical Summary	AWN – Input from each specialist
Chapter 1	Introduction	AWN – Emma Carroll BA & Teri Hayes BSc MSc PGeol EurGeol
Chapter 2	Description of the Proposed Development	AWN – Emma Carroll BA & Teri Hayes BSc MSc PGeol EurGeol
Chapter 3	Planning and Development Context	AWN –Sarah Robertson BA & Teri Hayes BSc MSc PGeol EurGeol
Chapter 4	Alternatives	AWN – Emma Carroll BA, Sarah Robertson & Teri Hayes BSc MSc PGeol EurGeol
Chapter 5	Population and Human Health	AWN – Teri Hayes (BSc MSc PGeol EurGeol) / Elaine Neary BA MApplSc MCIWM with specialist input from Damian Kelly and Claire Flynn
Chapter 6	Hydrology	AWN – Teri Hayes BSc MSc PGeol EurGeol / Paul Conaghan BSc MSc
Chapter 7	Biodiversity (including AA Screening Report)	Moore Group – Ger O’Donohoe BSc MSc
Chapter 8	Land, Soils, Geology & Hydrogeology	AWN – Teri Hayes BSc MSc PGeol EurGeol / Paul Conaghan BSc MSc
Chapter 9	Air Quality & Climate	AWN – Dr Edward Porter BSc, PhD, C Chem MRSC MIAQM and Dr Claire Flynn BSc MSc MIAQM
Chapter 10	Noise & Vibration	AWN – Dr. Stephen Smyth BAI PhD
Chapter 11	Landscape and Visual	Brady Shipman Martin - John Kelly BArch (Hons) MRIAI
Chapter 12	Archaeological, Architectural and Cultural Heritage	CRDS Ltd. – Dr. Stephen Mandal MIAI PGeo EurGeo
Chapter 13	Traffic & Transportation	CST Group – Philip Bayfield BE MSc CEng MIEI MICE
Chapter 14	Material Assets	AWN – Elaine Neary BA MApplSc MCIWM & Emma Carroll BA

Chapter 15	Waste Management (including C&D Waste Management Plan)	AWN – Elaine Neary BA MApplSc MCIWM & Emma Carroll BA
Chapter 16	Interactions, Interrelationship between the Aspects	AWN – Teri Hayes BSc MSc PGeol EurGeol

1.6 DESCRIPTION OF EFFECTS

The quality, magnitude and duration of potential effects are defined in accordance with the criteria provided in the EPA Draft *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* (2017) as outlined in Table 1.2.

Table 1.2. Description of Effects as per EPA Guidelines (Draft, 2017)

Effect Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	A change which does not affect the quality of the environment
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An impact capable of measurement but without noticeable consequences
	Not significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging trends
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
	Profound	An impact which obliterates sensitive characteristics
Duration of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting 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
Probability of Effects	Likely Effects	The effects that can reasonably be expected to occur as a result 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 measures are properly implemented.
Type of Effects	Indirect Effects	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	`Worst case' Effects	The effects arising from a project in the case where mitigation measures substantially fail

Effect Characteristic	Term	Description
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant impact is of greater significance than the sum of its constituents

1.7 ADDITIONAL ASSESSMENTS

This section addresses the additional approvals and assessments required under other EU Directives and legislation.

- **Appropriate Assessment Screening Report** – a screening report has been completed for the proposed development, as required under the Habitats and Birds Directive (92/43/EEC and 79/409/EEC) and is included as Appendix 8.1. of this EIA Report;
- **Natura Impact Statement** – a Natura Impact Statement has been completed for the proposed development, as required under the Habitats and Birds Directive (92/43/EEC and 79/409/EEC) and is included as Appendix 8.2. of this EIA Report; and
- **Flood Risk Assessment** - A Stage 1 Flood Risk Assessment has been undertaken for the site by the OPW and is included within the Engineering report submitted and considered within the EIAR report.

1.7.1 FORECASTING METHODS AND DIFFICULTIES IN COMPILING THE SPECIFIED INFORMATION

Forecasting methods and evidence used to identify and assess the significant effects on the environment for each environmental aspect are set out in each chapter.

There were no significant difficulties in compiling the specified information for this EIA Report. Any issues encountered during the assessment of individual factors are noted within the relevant chapters.

1.8 VIEWING THE EIA REPORT

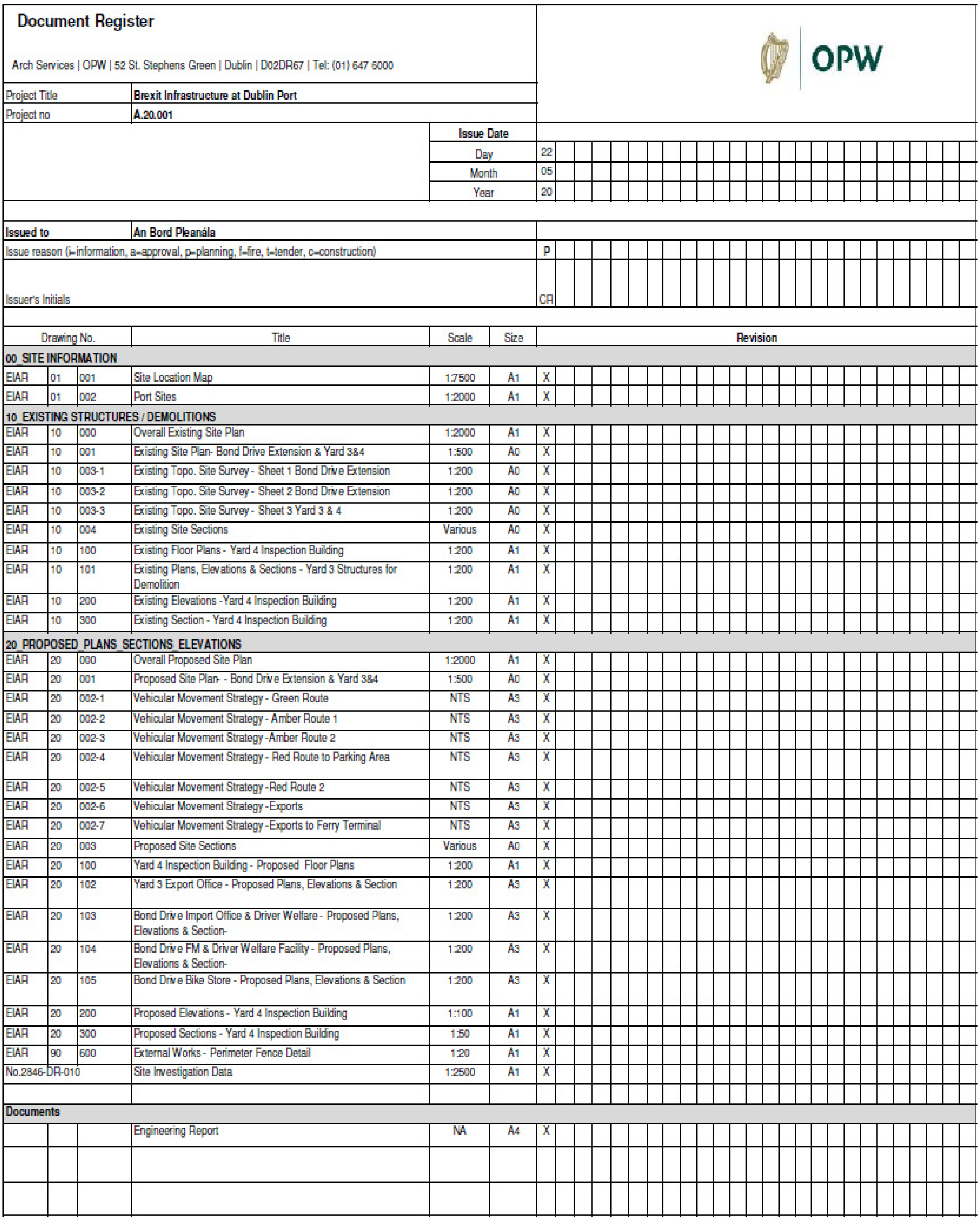
A copy of the application, the Environmental Impact Assessment Report and the Natura Impact Statement may be inspected free of charge or purchased on payment of a specified fee (which shall not exceed the reasonable cost of making such copy) during public opening hours for a period of 30 days at the following locations;

- The Offices of An Bord Pleanála, 64 Marlborough Street, Dublin 1.
- The Office of Public Works, 52 St Stephens Green, Dublin 2.
- The Offices of the Revenue Commissioners, New Custom House, Promenade Road, Dublin Port, Dublin 3.

The EIA Report can be inspected free of charge or purchased upon payment of a specified fee (which shall not exceed the reasonable cost of making such a copy) during public opening hours at the offices of An Bord Pleanála.

APPENDIX 1.1

Schedule of Drawings



Document Register

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OPW

Project Title: **Brexit Infrastructure at Dublin Port**
Project no: **A.20.001**

Issue Date
Day: 22
Month: 05
Year: 20

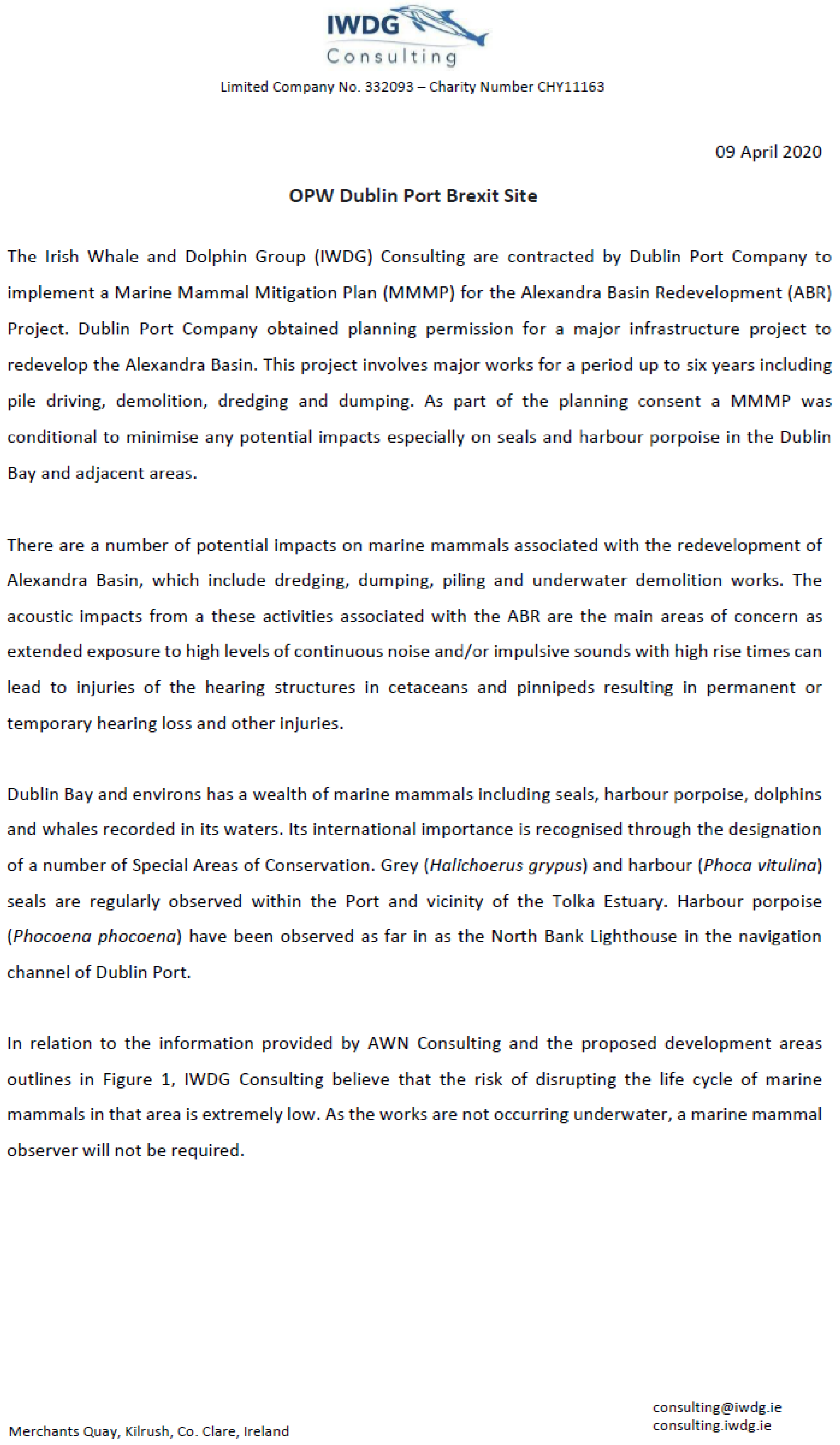
Issued to: **An Bord Pleanála**
Issue reason (i=information, a=approval, p=planning, f=fire, t=tender, c=construction): P
Issuer's Initials: CR

Drawing No.			Title	Scale	Size	**Revision**
00_SITE INFORMATION						
EIAR	01	001	Site Location Map	1:7500	A1	X
EIAR	01	002	Port Sites	1:2000	A1	X
10_EXISTING STRUCTURES / DEMOLITIONS						
EIAR	10	000	Overall Existing Site Plan	1:2000	A1	X
EIAR	10	001	Existing Site Plan- Bond Drive Extension & Yard 3&4	1:500	A0	X
EIAR	10	003-1	Existing Topo. Site Survey - Sheet 1 Bond Drive Extension	1:200	A0	X
EIAR	10	003-2	Existing Topo. Site Survey - Sheet 2 Bond Drive Extension	1:200	A0	X
EIAR	10	003-3	Existing Topo. Site Survey - Sheet 3 Yard 3 & 4	1:200	A0	X
EIAR	10	004	Existing Site Sections	Various	A0	X
EIAR	10	100	Existing Floor Plans - Yard 4 Inspection Building	1:200	A1	X
EIAR	10	101	Existing Plans, Elevations & Sections - Yard 3 Structures for Demolition	1:200	A1	X
EIAR	10	200	Existing Elevations -Yard 4 Inspection Building	1:200	A1	X
EIAR	10	300	Existing Section - Yard 4 Inspection Building	1:200	A1	X
20_PROPOSED_PLANS_SECTIONS_ELEVATIONS						
EIAR	20	000	Overall Proposed Site Plan	1:2000	A1	X
EIAR	20	001	Proposed Site Plan- - Bond Drive Extension & Yard 3&4	1:500	A0	X
EIAR	20	002-1	Vehicular Movement Strategy - Green Route	NTS	A3	X
EIAR	20	002-2	Vehicular Movement Strategy - Amber Route 1	NTS	A3	X
EIAR	20	002-3	Vehicular Movement Strategy -Amber Route 2	NTS	A3	X
EIAR	20	002-4	Vehicular Movement Strategy - Red Route to Parking Area	NTS	A3	X
EIAR	20	002-5	Vehicular Movement Strategy -Red Route 2	NTS	A3	X
EIAR	20	002-6	Vehicular Movement Strategy -Exports	NTS	A3	X
EIAR	20	002-7	Vehicular Movement Strategy -Exports to Ferry Terminal	NTS	A3	X
EIAR	20	003	Proposed Site Sections	Various	A0	X
EIAR	20	100	Yard 4 Inspection Building - Proposed Floor Plans	1:200	A1	X
EIAR	20	102	Yard 3 Export Office - Proposed Plans, Elevations & Section	1:200	A3	X
EIAR	20	103	Bond Drive Import Office & Driver Welfare - Proposed Plans, Elevations & Section-	1:200	A3	X
EIAR	20	104	Bond Drive FM & Driver Welfare Facility - Proposed Plans, Elevations & Section-	1:200	A3	X
EIAR	20	105	Bond Drive Bike Store - Proposed Plans, Elevations & Section	1:200	A3	X
EIAR	20	200	Proposed Elevations - Yard 4 Inspection Building	1:100	A1	X
EIAR	20	300	Proposed Sections - Yard 4 Inspection Building	1:50	A1	X
EIAR	90	600	External Works - Perimeter Fence Detail	1:20	A1	X
No.2846-DR-010			Site Investigation Data	1:2500	A1	X
Documents						
			Engineering Report	NA	A4	X

APPENDIX 1.2

Consultation

RESPONSE FROM IWDG



IWDG Consulting
Limited Company No. 332093 – Charity Number CHY11163

09 April 2020

OPW Dublin Port Brexit Site

The Irish Whale and Dolphin Group (IWDG) Consulting are contracted by Dublin Port Company to implement a Marine Mammal Mitigation Plan (MMMP) for the Alexandra Basin Redevelopment (ABR) Project. Dublin Port Company obtained planning permission for a major infrastructure project to redevelop the Alexandra Basin. This project involves major works for a period up to six years including pile driving, demolition, dredging and dumping. As part of the planning consent a MMMP was conditional to minimise any potential impacts especially on seals and harbour porpoise in the Dublin Bay and adjacent areas.

There are a number of potential impacts on marine mammals associated with the redevelopment of Alexandra Basin, which include dredging, dumping, piling and underwater demolition works. The acoustic impacts from a these activities associated with the ABR are the main areas of concern as extended exposure to high levels of continuous noise and/or impulsive sounds with high rise times can lead to injuries of the hearing structures in cetaceans and pinnipeds resulting in permanent or temporary hearing loss and other injuries.

Dublin Bay and environs has a wealth of marine mammals including seals, harbour porpoise, dolphins and whales recorded in its waters. Its international importance is recognised through the designation of a number of Special Areas of Conservation. Grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are regularly observed within the Port and vicinity of the Tolka Estuary. Harbour porpoise (*Phocoena phocoena*) have been observed as far in as the North Bank Lighthouse in the navigation channel of Dublin Port.

In relation to the information provided by AWN Consulting and the proposed development areas outlines in Figure 1, IWDG Consulting believe that the risk of disrupting the life cycle of marine mammals in that area is extremely low. As the works are not occurring underwater, a marine mammal observer will not be required.

Merchants Quay, Kilrush, Co. Clare, Ireland
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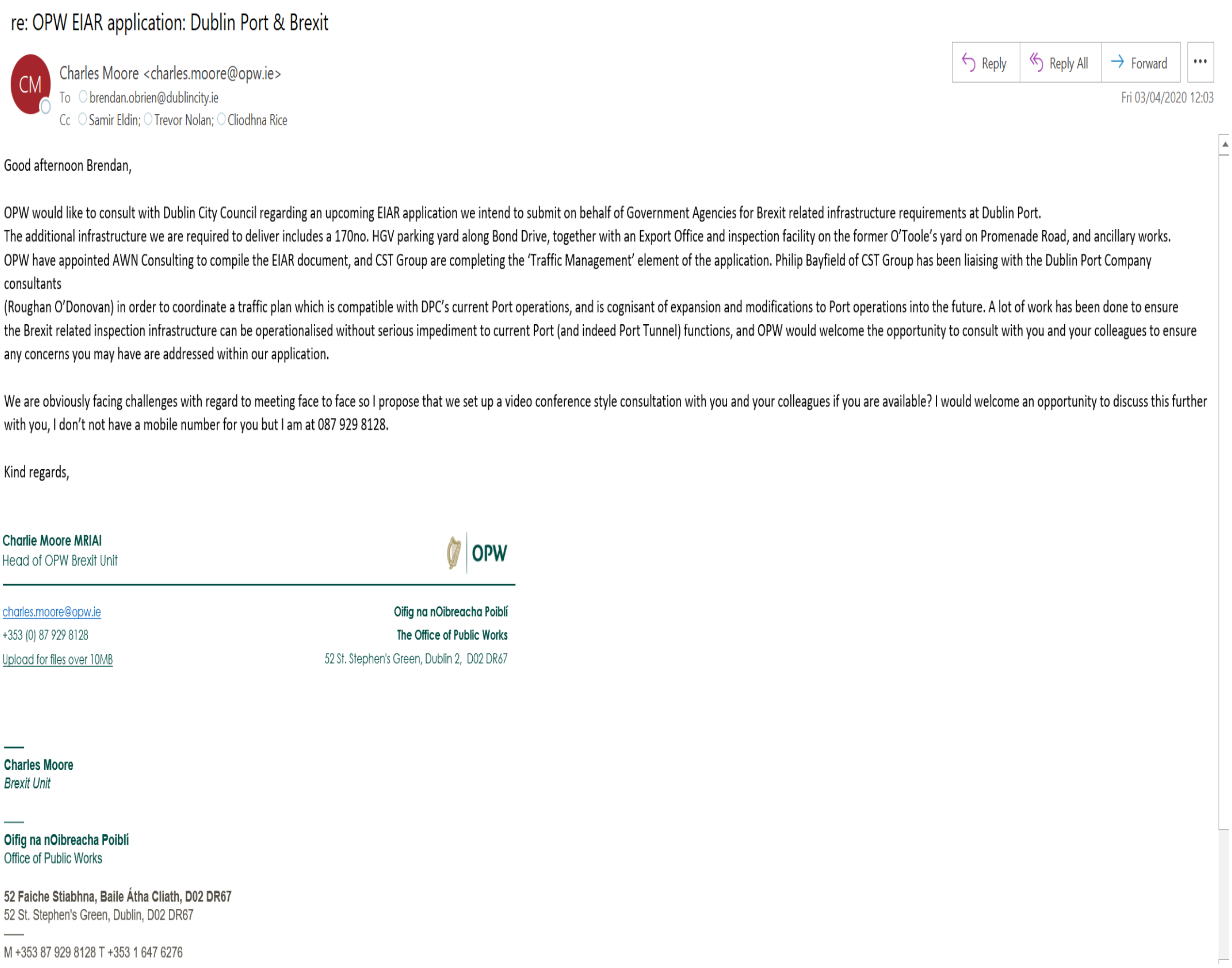
DCC



re: OPW EIAR application: Dublin Port & Brexit

Charles Moore <charles.moore@opw.ie>
To ○ brendan.obrien@dublincity.ie
Cc ○ Samir Eldin; ○ Trevor Nolan; ○ Cliodhna Rice

Fri 03/04/2020 12:03

Good afternoon Brendan,

OPW would like to consult with Dublin City Council regarding an upcoming EIAR application we intend to submit on behalf of Government Agencies for Brexit related infrastructure requirements at Dublin Port.
The additional infrastructure we are required to deliver includes a 170no. HGV parking yard along Bond Drive, together with an Export Office and inspection facility on the former O'Toole's yard on Promenade Road, and ancillary works.
OPW have appointed AWN Consulting to compile the EIAR document, and CST Group are completing the 'Traffic Management' element of the application. Philip Bayfield of CST Group has been liaising with the Dublin Port Company consultants
(Roughan O'Donovan) in order to coordinate a traffic plan which is compatible with DPC's current Port operations, and is cognisant of expansion and modifications to Port operations into the future. A lot of work has been done to ensure the Brexit related inspection infrastructure can be operationalised without serious impediment to current Port (and indeed Port Tunnel) functions, and OPW would welcome the opportunity to consult with you and your colleagues to ensure any concerns you may have are addressed within our application.

We are obviously facing challenges with regard to meeting face to face so I propose that we set up a video conference style consultation with you and your colleagues if you are available? I would welcome an opportunity to discuss this further with you, I don't not have a mobile number for you but I am at 087 929 8128.

Kind regards,

Charlie Moore MRIAI
Head of OPW Brexit Unit

OPW

charles.moore@opw.ie
+353 (0) 87 929 8128
Upload for files over 10MB

Oifig na nOibreacha Poiblí
The Office of Public Works
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Charles Moore
Brexit Unit

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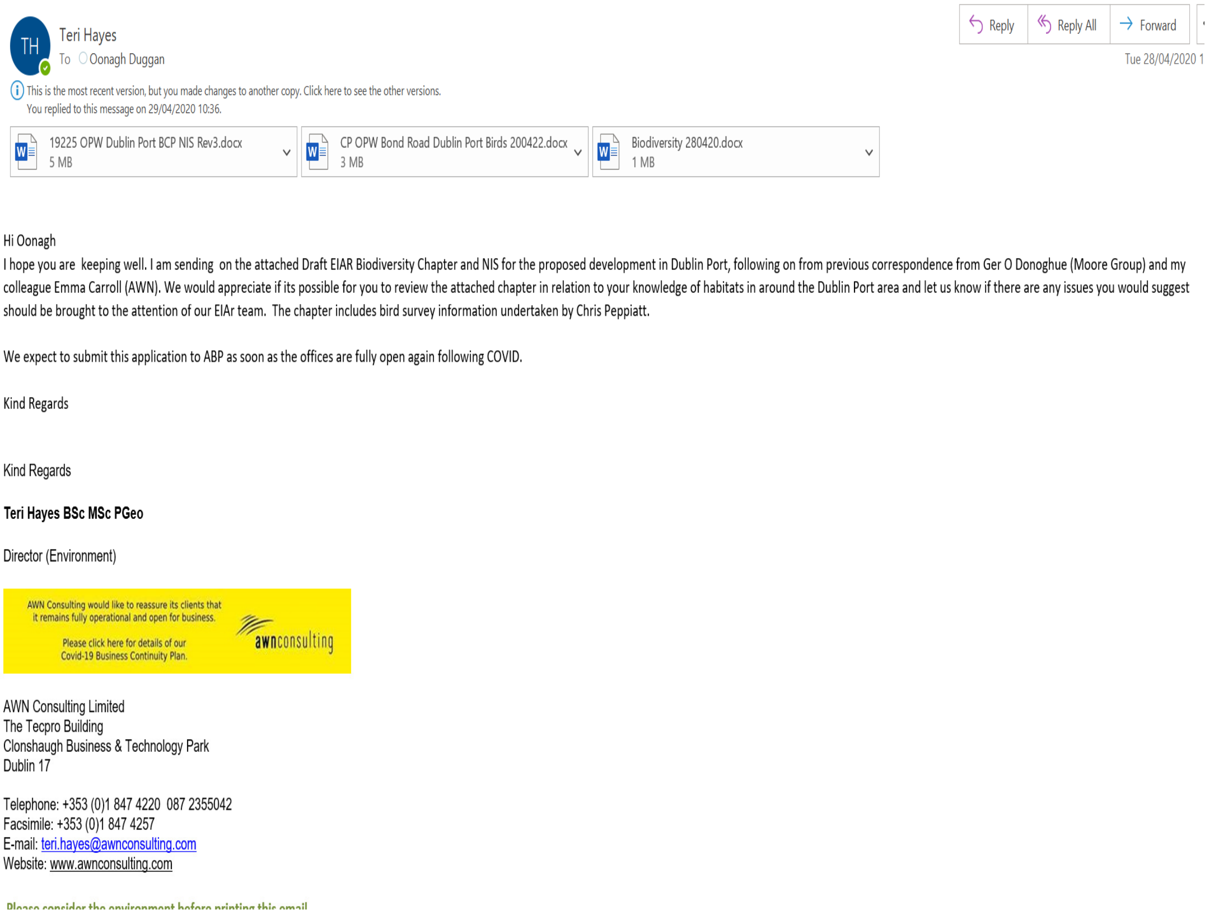
BIRDWATCH IRELAND

WRITTEN AND PHONECALL CONSULTATION



Teri Hayes
To ○ Oonagh Duggan

Tue 28/04/2020 1

This is the most recent version, but you made changes to another copy. Click here to see the other versions.
You replied to this message on 29/04/2020 10:36.

19225 OPW Dublin Port BCP NIS Rev3.docx
5 MB

CP OPW Bond Road Dublin Port Birds 200422.docx
3 MB

Biodiversity 280420.docx
1 MB

Hi Oonagh
I hope you are keeping well. I am sending on the attached Draft EIAR Biodiversity Chapter and NIS for the proposed development in Dublin Port, following on from previous correspondence from Ger O Donoghue (Moore Group) and my colleague Emma Carroll (AWN). We would appreciate if its possible for you to review the attached chapter in relation to your knowledge of habitats in around the Dublin Port area and let us know if there are any issues you would suggest should be brought to the attention of our EIAr team. The chapter includes bird survey information undertaken by Chris Peppiatt.

We expect to submit this application to ABP as soon as the offices are fully open again following COVID.

Kind Regards

Kind Regards

Teri Hayes BSc MSc PGeo

Director (Environment)

AWN Consulting would like to reassure its clients that it remains fully operational and open for business.

Please click here for details of our Covid-19 Business Continuity Plan.

awnconsulting

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Please consider the environment before printing this email

APPENDIX 1.3

Draft Construction Environmental Management Plan

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OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN BREXIT INFRASTRUCTURE AT DUBLIN PORT, NORTH DOCK, DUBLIN 3.

Report Prepared For

Commissioners of Public Works

Report Prepared By

Emma Carroll
Environmental Consultant

Our Reference

EC/19/11148CEMPR01

Date of Issue

30 April 2020

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Document History

Document Reference		Original Issue Date	
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Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature	Emma Carroll	Teri Hayes
Name	Emma Carroll	Teri Hayes
Title	Environmental Consultant	Director
Date	30 April 2020	30 April 2020

CONTENTS Page

1.0 INTRODUCTION

This outline Construction Environmental Management Plan (CEMP) has been prepared by AWN Consulting (AWN) on behalf of Commissioners of Public Works. The proposed development will provide the infrastructure for the relevant State agencies to carry out checks and controls on goods entering the State from the United Kingdom that will be required as a result of the UK withdrawal from the EU single market and customs union.

The CEMP provides a framework to avoid, minimise or mitigate any construction effects on the environment prior to commencement on site. The contractor will then prepare specific method statements which should identify perceived risks to the environment e.g, traffic management etc. These method statements will minimise the risk to the environment.

This CEMP has been prepared to account for activities at the site during the demolition and construction phase of the project.

The main issues that have been considered within this document are as follows;

- Description of works;
- Construction programme and phasing;
- Site logistics;
- Workforce;
- Public relations and community liaison;
- Construction traffic and access; and
- Safety, health and environmental management.

The preparation of this outline CEMP complies with the mitigation measures presented by submitted expert reports, relevant legislation, guidelines, along with best practice. Additional mitigation measures may be added following consultation with relevant consultees in preparation of specific method statements prior to commencement of works.

2.0 DESCRIPTION OF THE PROJECT

Figure 2.1 presents a site layout plan showing the location of the site in Dublin Port. The site is bound by Dublin Bay to the north, and developed industrial Dublin Port lands to the east, west and south.

Figure 2.1 Proposed location of site

The proposed development will include the following:

Bond Drive Extension Road Site

Establishment of a single compound measuring c. 368m x 100m, to provide parking facilities for 175 HGVs, together with associated internal access roads and a staff parking facility. Additional accommodation on site will include five single storey porta cabin structures, of 75m^2 each, for use as a Facilities Management office, two Import Offices, and two Driver Welfare facilities. The existing site boundary palisade fences will be renewed with continuous 3.0m high paladin fencing, and new access and egress gateways. Site lighting will include 6 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways.

Yards 3 & 4

The smaller of the two existing warehouses on site will be demolished, and the larger warehouse along the southern boundary will be refurbished and extended to provide c. 2,953 m^2 for use as an EHS & Revenue Building. Yards 3 & 4 will incorporate loading bays and dock levellers along the northern side of the EHS & Revenue Building, together with 30 HGV parking spaces and associated internal access roads. Two single storey porta cabins, 75m^2 each, will be installed at the northern side boundary for use as Export Offices. Site lighting will include 2 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways.

Landscaping will include ground cover planting in the end bays of the HGV parking aisles and at the south western corner of the side along Promenade Road.

New Permanent Structures:

EHS & Revenue Building: Existing warehouse building (approx. 1193 sq. m) to be refurbished and additional floor area of approx.1760 sq. m to be constructed comprising of (approx. 796 sq. m) ground floor extension to the north of the existing warehouse and an additional first floor area (approx. 964 sq. m) to the existing warehouse. Total proposed overall area approx. 2953 sq. m).

Building to incorporate loading bays with dock levellers, bays to inspect curtain siders with dock levellers, driver accessible WC's, open plan unloading areas, male changing room, female changing room, accessible changing rooms, disinfect area, inspection rooms (c. 2 no. to be temperature controlled), ancillary unloading areas, chilled storage rooms,. Comms. rooms, M&E plant room, secure store, interview rooms, tool room, drying room, cleaners store, no. open plan offices, staff canteen, male toilets, female toilets, accessible WC, welfare room, breakout space, meeting room, conference room, cellular offices, store rooms, external south facing first floor terrace.

The proposed development will include provision for 205 no. HGV parking spaces.

3.0 CONSTRUCTION PROGRAMME AND PHASING

The construction works associated with the development consist of the following principal elements:

3.1 Demolition Phase

Some existing structures will be demolished on Yards 3 & 4 and Bond Drive, as part enabling works contract prior to the construction of the proposed development.

The demolition shall be in full compliance with BS 6187 *"Demolition in Buildings"* and all measure necessary will be taken to protect the adjoining buildings from damage and persons from injury. Prior to the demolition works a Construction and Demolition Waste Management Plan in accordance with the *"Department of the Environment Heritage and Local Government Best Practice Guidelines on the preparation of Waste Management Plans for construction and demolition projects"* will be prepared by the appointed Demolition Contractor.

The demolition will commence with the removal of any hazardous materials by an appropriately qualified contractor for disposal at an appropriate licensed waste collection facility. All non-structural items will then be removed segregated for re-use or re-cycling where possible. The remainder of the building structure will be removed in an approved sequence outlined in a Method Statement prepared by the Demolition Contractor's Structural Engineer.

3.2 Excavation & Construction Phase

The project will involve minor excavation for the installation of structures and piling. The Construction and Demolition Waste Plan prepared by AWN, for the development will be updated by the main contractor and will be in compliance with the requirements of the *"Best Practice Guidelines for the Preparation of Waste Management for the Construction and Demolition Projects"* published by the Department of the Environment Heritage and Local Government will identify and categorise any waste arising from the development.

The plan will also contain the proposals for the minimisation, re-use and re-cycling of site generated waste. As part of this plan separate storage areas will be designated on the site for various types of material in order to maximise the re-use and re-cycling potential. Procedure will also be put in place to ensure that all sub-contractors fulfil the requirements of the Waste Management Plan.

4.0 EXCAVATIONS

4.1 Archaeological and Architectural Heritage

Prior to the commencement of construction works (including enabling works), a suitably qualified archaeological consultant will be required to oversee the works and undertake the required archaeological monitoring and reporting.

Archaeological monitoring (under license to the National Monuments Service) of groundworks will be undertaken in areas where excavation exceeds the depth of the infill material deposited post 1958. The aims of monitoring is to see if any features or finds of archaeological significance are located within the area of the proposed works.

Should archaeological features or material be uncovered during archaeological testing or any phase of construction, ground works will cease immediately and the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht should be informed. Time must be allowed for a suitably qualified archaeologist to inspect and assess any material. If it is established that archaeologically significant material is present, the National Monuments Service may require that further archaeological mitigation be undertaken.

4.2 Ground Conditions

Ground works will be required to facilitate construction of utilities and foundations. The site investigation report produced by Priority Geotechnical Ireland provides a summary of the anticipated stratigraphy of the soil beneath the sites where construction is required. The profile on site comprises thin hardstand overlying > 4.5 m of MADE GROUND comprising mostly of sandy silty Gravels with fragments of redbrick concrete and other fill material. Beneath this to circa 12.5 m to 10 m older fill material most likely from the reclaiming of this part of Dublin Port from the Liffey Estuary in the early 1900’s consisting mostly of sandy silty GRAVELS with clays and sandy, silty, gravelly CLAYS.

It is not anticipated that the development site works, or excavation works will be deep enough to impact the underlying bedrock geology.

Made ground, gravel & clay will be excavated to a shallow level to facilitate construction It is envisioned that most excavated material arising on the site will be removed from the site.

In order to assess any materials, which may be excavated during the site works, in terms of waste classification, a selection of samples collected were analysed for a suite of parameters which allows for the assessment of the soils in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous* (RILTA Suite).

The suite also allows for the assessment of the soils in terms of suitability for placement at inert or stable non-reactive (non-hazardous facilities). The parameter list for the RILTA suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen. The RILTA suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC).

The WAC analysis identifies that 13 pf the 19 samples tested are classified as Category C1 – Stable Non-Reactive mostly relating to elevated levels of sulphate and total dissolved solids (TDS). Five samples TP04 (shallow), TP05 (shallow), TP07 (shallow & deep) and TP9A can be categorised as Inert. The deep sample from TP1A had a total organic carbon (TOC) value of 7.9 % which was the only parameter which would categorise it as Category D – Hazardous. Further analysis of more samples once excavated is recommended to confirm WAC criteria for disposal. Based on the laboratory results and parametric concentrations obtained from the site investigation, material from the sample locations would be acceptable non-hazardous or hazardous waste facility (Category C or D). It should be noted that waste facilities develop facility specific criteria also and this should be considered should any soil/ material to be removed from site in the future. It is anticipated there will be no largescale excavations as part of the proposed development. If excavated material requires removal from site, it should be classified by an experienced and qualified environmental professional to ensure that the waste soil is correctly classified for transportation and recovery/disposal offsite at an appropriately licenced facility.

5.0 SITE LOGISTICS

5.1 Site Establishment and Security

The site office and welfare facilities (site compound) will be established on site. The site compound will be mobile, and will move in line with the phases of the construction across the site.

All of the sub-contractors as well as the main contractor and project managers will occupy offices in the same area.

5.2 Consents and Licenses

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. These will include, but are not limited to:

- Site notices;
- Construction commencement notices; and
- Licence to connect to existing utilities and mains sewers, where required.

5.3 Services and Utilities

Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the proposed development. The offices and site amenities will initially need to have their own power supply (generator), water deliveries and foul water collection until connections are made to the mains networks.

Electrical connections will be made by suitably qualified personnel following consultation with the relevant authorities and will be cognisant of subsequent construction works. High voltage connections will be established for heavy duty equipment and site facilities, as required.

The current electricity facilities on the site of the proposed development are supplied by the ESB through a ring network. All electrical works, including connection to the ESB network will be carried out by a suitably qualified contractor.

Water supply required for welfare facilities, dust suppression and general construction activities will be sourced from the existing public piped supplies running into the site.

Although before connections are re-established to the water supply it may need to be trucked onto site. As with electrical works, this will be carried out by a suitably qualified contractor. It will be necessary to service the site with a reliable and safe water supply.

Site welfare facilities will be established to provide sanitary facilities for construction workers on site. The main contractor will ensure that sufficient facilities are available at all times to accommodate the number of employees on site. Foul water from the offices and welfare facilities on the site will discharge into the existing sewer on site (the cabins may initially need to have the foul water collected by a licensed waste sewerage contractor before connection to the sewer line can be made)

5.4 Material Handling and Storage

Key materials which will be ordered by specific order for the project, a 'Just in Time' delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage.

Where possible it is proposed to source general construction materials from the Dublin area to minimise transportation distances.

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles in the compound area within the site. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications – BS EN 1992-3:2006) to prevent spillage.

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

The majority of construction waste materials generated will be soil from preparation works and demolition. Material will be removed from site regularly to ensure there is minimal need for stockpiling.

5.5 Visitor Management

Visitors will only be allowed to enter the main site compound via the designated pedestrian access gate. A dedicated, secured footpath to the site office is established at the gate for registration and obtaining PPE prior to entering the site. A log will be maintained by security to control access to the site. Visitors will be required to attend a site-specific induction to allow access to the compound and/or construction site unless being accompanied by an inducted member of the site team.

Visitors will then be taken by an inducted member of the construction team to the required area of the site.

5.6 Site Working Hours

The standard wording of DCC conditions in this regard is: The site and building works required to implement the development shall only be carried out between the hours of: Mondays to Fridays - 7.00a.m. to 6.00p.m. Saturday - 8.00a.m. to 2.00p.m. Sundays and Public Holidays - No activity on site.

5.7 Employment and Management Workforce

It is not possible at this time to confirm the precise number of workers likely to be present on site during the works, however it is envisaged that the site workforce will fluctuate considerably over the duration of the project. It is anticipated that the key project managers and main contractor representatives will maintain a presence on site for the whole duration of the project and the labour workforce will be determined by the specialist contractors required on site.

All employees working on the site will be required to have a SafePass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery, as required. The details of training required, records maintained, and induction procedures will be outlined in the Main Contractor’s Health and Safety Plan(s).

6.0 CONSTRUCTION TRAFFIC AND SITE ACCESS

Construction traffic operation will only be limited 0700 to 1900 from Monday to Friday and 0800 to 1300 on Saturday for the off-road construction Any variation will be discussed and agreed in advance with DCC and Dublin Port Company.

Approved traffic management plans will be submitted with this CEMP, prior to the commencement of works.

6.1 Traffic Queueing

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

6.2 Site Hoarding and Security Fencing

Erection of security fencing and hoarding will take place at the start of the project alongside the site establishment and security works. It is estimated that erection of hoardings and fencing will require 1 week to complete. The security fence will be established in conjunction around the entire development.

Site access will be restricted by dedicated security personnel who will check all incoming and outgoing vehicles and workers.

7.0 SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTIN WORKS

The appointed main contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- Construction Health & Safety training requirements;
- Induction procedures;
- Emergency protocols; and
- Details of welfare facilities.

7.1 Air Quality

This section describes the site policy with regard to dust management and the specific mitigation measures which will be put in place during construction works. 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 measures have been formulated by drawing on best practice guidance from Ireland, the UK and the US, such as:

- Department of Environment, Heritage and Local Government (DOEHLG), *Quarries and Ancillary Activities, Guidelines for Planning Authorities* (2004) [1];
- US Environment Protection Agency (USEPA), *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition* (periodically updated) (1986) [2];
- The Scottish Office – Development Department, *Planning Advice Note PAN50 Controlling the Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings* (1996) [3]; and
- Institute of Air Quality Management (IAQM), *Guidance on the Assessment of Dust from Demolition and Construction* (2014) [4].

7.1.1 Site Management

The site activities will be undertaken with due consideration of the surrounding environment and the close proximity of sensitive receptors such as residents and pedestrians. Dust management during the construction phase will be the most important aspect in terms of minimising the impacts of the project on the surrounding air quality. The following measures will also be implemented to ensure impacts are minimised:

- Complaint registers will be kept detailing all telephone calls and letters of complaint received in connection with construction activities, together with details of any remedial actions carried out;
- Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive; and
- Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.

7.1.2 Dust Control Measures

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and the limiting of stockpiling will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs.

- During working hours, technical staff will be available to monitor dust levels as appropriate; and
- At all times, the dust management procedures put in place will be strictly monitored and assessed.

The dust minimisation measures should be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust generation. In the event of dust nuisance occurring outside the site boundary, site activities should be reviewed, and procedures implemented to rectify the problem. Specific dust control measures to be employed are presented below.

Demolition/Excavation

Demolition and excavation work 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.

The movement of truck containing materials with a potential for dust generation to an off-site location will be enclosed or covered.

Stockpiling

The location and moisture content of rubble stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible, and;
- Regular watering will take place during dry/windy periods to ensure the moisture content is high enough to increase the stability of the soil and suppress dust.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads will 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 vehicle cleaning facility shall be installed if feasible. All trucks leaving the site should be cleaned, and;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.

General

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 management of dust by the construction contractor.

7.2 Ecology and Water

The key strategies to be undertaken to minimise impact on the local flora and fauna and water quality during site clearing and construction are as follows.

7.2.1 Site Environmental Training and Awareness Procedure

An initial site environmental induction and ongoing training will be provided to communicate the main provisions of this environmental plan to all site personnel.

Two-way communication will be encouraged to promote a culture of environmental protection.

The following outlines the information which must be communicated to site staff:

- Environmental procedures of the CEMP.
- Environmental buffers and exclusion zones.
- Housekeeping of materials and waste storage areas.
- Environmental emergency response plan.

Prior to any works, all personnel involved will receive an on-site induction relating to operations adjacent to water courses/bodies and the environmentally sensitive nature of Dublin Bay and re-emphasise the precautions that are required as well as the construction management measures to be implemented.

The project proponent will ensure that the engineer setting out the works is fully aware of the ecological constraints and construction management requirements.

7.2.2 Environmental Emergency Response Plan

In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure (to be finalised by contractor). The following outlines the information on the types of emergency which must be communicated to site staff:

- Release of hazardous substance – fuel or oil spill.
- Concrete spill or release of concrete.
- Flood event – extreme rainfall or rising river level event.
- Environmental buffers and exclusion zones breach.
- Housekeeping of materials and waste storage areas breach.
- Stop work orders due to environmental issue or concern (e.g. threat to ecological feature).

7.2.3 Concrete Control Procedure

Concrete will be used for wall foundations, wall forming structures and grouting of precast concrete. Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to water courses/bodies. The following measures will be implemented to prevent concrete entering watercourses:

- A hardstand area of the site will be prepared as a temporary storage compound and construction preparation area.
- Batch loads of concrete will be delivered, on an as needed basis, to the pre-prepared hardstand areas or designated site compound.
- Small batch concrete loads will be delivered to specific construction locations by mini dumper or other enclose contained system of transfer.
- Trucks that deliver concrete to site will be washed out at the supplier's facilities and not on site.
- A designated trained operator experienced in working with concrete will be employed during concrete pouring.
- Disposal of raw or uncured waste concrete will be controlled to ensure that Dublin Bay will not be impacted.
- Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times will be implemented.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline, therefore, washing will not be permitted on site.

7.2.4 Fuel and Oil Management Plan

The appointed contractor will implement a fuel management plan which will incorporate the following elements:

- Chemicals used will be stored in sealed containers.
- Chemicals shall be applied in such a way as to avoid any spillage or leakage.
- All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and water courses/bodies and away from drains and water courses as far as reasonably practicable. Vehicles will not be left unattended during refuelling.
- Storage areas, machinery depots and site offices will be located within the site boundary.
- Spill kits will be made available and all staff will be properly trained on correct use.
- All fuels, lubricants and hydraulic fluids required to be stored on site will be kept in secure bunded areas at a minimum of 10m from the sea shore. The bunded area will accommodate 110% of the total capacity of the containers within it.
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.
- All plant shall be well maintained with any fuel or oil drips attended to on an ongoing basis.
- Any minor spillage during this process will be cleaned up immediately.
- Should any incident occur, the situation will be dealt with and coordinated by the nearest supervisor who will be responsible for instructions by the Local Authority.

7.2.5 Protection of Water Resources

(A) Silt

- Site boundary markings to safeguard features of interest/value, e.g. drainage connectivity with Dublin Bay will be established.
- Excavations: Water will be prevented from entering local excavations by way of cut-off drains. Personnel and/or plant will not disturb water in a local excavation. The means of dewatering excavations in the event there is ingress will include settlement tanks or a silt buster stream if required to ensure that any de-watering do not increase background suspended solids levels in the environment.
- Spoil heaps: Small (<100m3) topsoil/subsoil heaps will be located, protected and stabilised in the temporary compound in a way that will avoid the risk of contamination of drainage systems and local water bodies.
- Site roads will be kept free from dust and mud deposits.

(B) Deliveries

- Special care will be taken during deliveries, especially when fuels and hazardous materials are being handled.
- All liquid deliveries will be supervised by a responsible person to ensure that (1) storage tank levels are checked before delivery to prevent overfilling and (2) the product is delivered to the correct tank.
- Contingency plans will be agreed and suitable materials available to deal with any incident.
- All employees will be briefed on the actions required in the event of a spillage.
- Spillages will be recorded and advised to the project manager who will inform local authorities if they deem it significant.

(C) Refuelling

- Mobile plant will be refuelled in the construction compound, on an impermeable surface away from any drains or water courses/bodies. A spill kit will be available at this location.
- Hoses and valves will be checked regularly for signs of wear and turned off and securely locked when not in use.
- Generators, diesel pumps and similar equipment will be placed on drip trays to collect minor spillages. These will be checked regularly, and any accumulated oil removed for disposal.

(D) Storage

- Leaking or empty oil drums will be removed from the site immediately and disposed of via a licensed waste disposal contractor.
- The contents of any tank will be clearly marked on the tank, and a notice displayed requiring that valves and hoses be locked when not in use.
- Any tanks or drums will be stored in a secure container or compound, which is to be kept locked when not in use.

7.2.6 Management of Excavation and Spoil

For the management of excavation and spoil, the contractor will:

- Erect all protective fencing.
- Implement a surface water management plan (including the installation of drainage infrastructure) prior to excavation and include areas dedicated to spoil storage with the drainage infrastructure.
- Ensure all spoil and excavated materials will be stored in the construction compound.
- Ensure stockpiles and adjacent features of drainage infrastructure will be monitored and maintained appropriately.
- A Waste Management Plan will identify any material such as dust, sand, rubble, concrete that may be generated during demolition works and address

its storage and appropriate removal from the site to avoid pathways identified as having connectivity with Dublin Bay.

7.2.7 Monitoring

Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or other items, and that all storage is located at least 10m from surface water receptors. A regular log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.

7.3 Noise and Vibration

Noise impacts arising from construction activities have the potential to cause annoyance or nuisance to local residents in the area.

The earthworks will generate typical construction activity related noise and vibration sources from use of a variety of plant and machinery.

The noise limits to be applied for the duration of the infrastructure works are those specified in the B Category of BS 5228. These limits are summarised below and will be applied at the nearest sensitive receptors to the works.

- Night (23:00-07:00) = 55dB
- Evening (19:00-23:00) = 65dB
- Day (07:00-19:00) = 70dB

The total noise (LAeq) which should not be exceeded during daytime is therefore 70dB.

Vibration limits to be applied for the infrastructure works are those specified in the TII document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, Revision 1, 2004). These limits are outlined below:

Allowable Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of;

- Less than 11Hz - 3mm/s
- 11 to 50 Hz - 3 to 8mm/s
- 50 to 110 Hz (and above) - 8 to 11mm/s

Any noise complaints related to activities at the site will be logged and investigated and, where required, measures taken to ameliorate the source of the noise complaint.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. excavation close to a property, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities. In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

More specifically the Contractor shall ensure that:

- In accordance with "Best Practicable Means", plant and activities to be employed on site are reviewed to ensure that they are the quietest available for the required purpose.
- Where required, improved sound reduction methods are used e.g. enclosures.
- Site equipment is located away from noise sensitive areas, as much as physically possible.
- Regular and effective maintenance by trained personnel is carried out to reduce noise and / or vibration from plant and machinery.
- Hours are limited during which site activities likely to create high levels of noise and vibration are carried out.
- A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site.

7.4 Waste Management

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment. A site-specific Construction and Demolition Waste Management Plan (C&D WMP) has been prepared by AWN Consulting and will be employed to ensure sustainable and effective waste management throughout the construction and demolition phases of the project.

Adherence to the C&D WMP prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the *Waste Management Acts 1996 – 2011* as amended [7], associated Regulations [7], the *Litter Pollution Act of 1997*-2009 as amended [8] and the *Eastern-Midlands Region Waste Management Plan 2015 – 2021* [9], and achieve optimum levels of waste reduction, re-use and recycling.

Typical waste materials that will be generated from the demolition and construction works will include:

- Soil and stones;
- Concrete, bricks, tiles and ceramics;
- Wood, glass and plastics;
- Metals;
- Gypsum-based construction material;
- Paper and cardboard;
- Mixed C&D waste;
- Chemicals (solvents, paints, adhesives, detergents etc.), and;
- Asbestos Containing Materials.

The management of all hazardous waste arisings, if they occur, shall be coordinated in liaison with Health and Safety Management.

7.4.1 Waste Minimisation

Waste minimisation measures proposed are summarised as follows (and are described in more detail in the C&D WMP):

- Materials will be ordered on an ‘as needed’ basis to prevent over supply;
- Materials will be correctly stored and handled to minimise the generation of damaged materials;
- Materials will be ordered in appropriate sequence to minimise materials stored on site;
- A waste tracking log will be established;
- Sub-contractors will be responsible for similarly managing their wastes; and
- All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

7.4.2 Waste Storage

The main waste storage area will be located in the site compound A dedicated and secure area containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities, will be established within the development (see Figure 5.1).

Waste materials generated will be segregated on at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled. There are numerous waste contractors in the Dublin Region that provide this service.

The site construction manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

7.4.3 Responsibility

It will be the responsibility of the demolition and construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or his/her delegate that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licenced or permitted waste facility in compliance with the relevant Regulations as outlined in the C&DWMP.

The contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the demolition, excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste stream will be provided to DCC, along with waste collection permit numbers.

8.0 SUMMARY

This CEMP sets out the overall management strategy for demolition, excavation and construction works for the proposed development. The CEMP aims to ensure the management of demolition, excavation and construction activity is carried out in a planned, structured and considerate manner which minimises the impacts of the works on the local environment, residents and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed so as to minimise potential impacts.

9.0 REFERENCES

1. Department of Environment, Heritage and Local Government (DOEHLG), *Quarries and Ancillary Activities, Guidelines for Planning Authorities* (2004).
2. US Environment Protection Agency (USEPA), *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition (periodically updated)* (1986).
3. The Scottish Office – Development Department, *Planning Advice Note PAN50 Controlling the Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings* (1996).
4. Institute of Air Quality Management (IAQM), *Guidance on the Assessment of Dust from Demolition and Construction* (2014).
5. UK Office of Deputy Prime Minister, *Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance* (2002).
6. USEPA, *Fugitive Dust Technical Information Document for the Best Available Control Measures* (1997).
7. *Waste Management Acts 1996 – 2011* Litter Pollution Act 1997 (No. 12 of 1997) as amended
8. *Eastern-Midlands Region Waste Management Plan 2015 – 2021* (2015)
9. Construction Industry Research and Information Association (CIRIA) *Control of Water Pollution from construction Sites, Guidance for consultants and contractors (C532).*
10. CIRIA, *Environmental Good Practice on Site* (3rd edition) (C692)

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 INTRODUCTION

As described in Chapter 1 (Introduction), as a consequence of Brexit, additional infrastructure is required for customs, SPS and health checks and controls at Dublin Port to ensure that Ireland can effectively manage the new requirements for checks and controls on trade with the UK at the end of the transition period. The Applicant is submitting an EIAR and NIS (in accordance with the requirements of S.I. 418 which amends Section 181(2)(a) of the Planning and Development Act 2000) to An Bord Pleanála (ABP) for Brexit Infrastructure at Bond Drive Extension Road and Yards 3 & 4 on Bond Drive Extension and Promenade Road respectively, Dublin Port, Dublin 3.

The following chapter presents a description of the Proposed Development as required by the relevant planning legislation, Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended by the 2014 EIA Directive (2014/52/EU) (herein referred to as the EIA Directive), European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, the current Draft EPA "Guidelines on the Information to be Contained in Environmental Impact Assessment Reports" (2017) (herein referred to the as the EPA Draft EIA Report Guidelines 2017) and the EPA Draft "Advice Notes for Preparing Environmental Impact Statements" (2015) (herein referred to as the EPA Draft Advice Notes for EIS 2015). Guidance outlined in the 'Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report'' published by the European Commission in 2017 was also considered in the preparation of this EIA Report.

2.2 CHARACTERISTICS OF THE APPLICATION

2.2.1 Description of Existing Site

The subject sites are c. 5.4 hectares in extent and are located at Bond Drive Extension and Yards 3 & 4 on Bond Drive Extension and Promenade Road respectively, Dublin Port, North Dock, Dublin 3. (See Figure 2.1).

The proposed development would be developed at existing commercial sites which currently comprise warehouse buildings, existing hardstanding areas, and truck and car parking areas. The proposed development will primarily be built on existing hardstand/gravel surfaces, but some upgrade works will be undertaken for site entrance roadways etc. The site has an existing connection to the public sewer network and the Dublin Port Surface Water drainage system.

Bond Drive Extension Site

The Bond Drive Extension site is along the northern edge of Dublin Port, between Bond Drive Extension and Dublin Harbour (Tolka Estuary). The site area currently comprises eight individual logistics, transport and storage compounds, with a combined area of c. 3.75 hectares. The perimeters of the individual compounds are secured by 2.6m high palisade fences, and the compounds are accessed from Bond Drive Extension via individual gateways within the southern perimeter fencing. All the compounds are hard surfaced with tarmac, concrete, or compacted gravel, and some include small porta cabin or container type offices. There are continuous tree and shrub planted landscape berms outside the northern and eastern sides of the overall area that form a buffer and visual screen to Dublin Harbour. It is noted that the Dublin Port Masterplan anticipates the construction of a 4km cycle and pedestrian Greenway along the northern shoreline to terminate at a two-tier linear park at the Eastern Terminal Area. This facility will run along the landscape berm along the northern and eastern site boundary referenced above.

To the immediate west of the Bond Road site, the State Warehouse occupies a high-security compound of c. 2.0 hectares, surrounded by high masonry walls with electrified security fencing on top. The compound incorporates extensive marshalling and vehicle storage areas as well as a warehouse of c. 4,500m^2 and c.15.0m in height.

The southern side of Bond Drive Ext. is similar in character to the northern side. Compounds are generally larger, and most incorporate permanent purpose-built warehouses of varying sizes.

Yards 3 & 4

Yards 3 & 4 are on the southern side of Bond Drive Extension and extend to Promenade Road further south. The combined sites extend to c. 1.65 hectares and have frontage onto three sides defined by 2.6m high palisade fencing, while the eastern boundary is shared with another compound. Yards 3 and 4 include warehouses of c. 717m^2 and 1,193m^2 respectively, and 8-9m high.

Figure 2.1a. Current site layout plan

The sites are bound by Dublin Bay to the north and developed industrial Dublin Port lands. The nearest residential noise sensitive locations are located some 500m across the Tolka Estuary to the north of the sites.

The nearest European sites are South Dublin Bay and River Tolka Estuary SPA (Site Code 004024), which is located along the coast approximately 300 m to the north of the proposed Project, and North Bull Island SPA (Site Code 004006), which is located approximately 1.28 km east north east of the proposed Project. Also, within relatively proximity to the proposed site are North Dublin Bay SAC (Site Code 000206) and South Dublin Bay SAC (Site Code 000210).

Other Nearby Brexit Related Developments
Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017).

2.2.2 Proposed Development Description

Dublin Port is the main seaport and point of entry for ferry and container traffic into the Republic of Ireland. It is located east of the city centre. It is equipped with a ferry terminal, container terminals and storage facilities, as well as supporting infrastructure, including public roads. The proposed site for the proposed development is on an area of previously developed land within the boundary of Dublin Port.

The proposed development will include the following:

Bond Drive Extension Site
Establishment of a single compound measuring c. 368m x 100m, to provide parking facilities for 175 HGVs, together with associated internal access roads and a staff parking facility. Additional accommodation on site will include five single storey porta cabin structures, of 75m^2 each, for use as a Facilities Management office, two Import Offices, and two Driver Welfare facilities. The existing site boundary palisade fences will be renewed with continuous 3.0m high paladin fencing, and new access and egress gateways. Site lighting will include 6 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways.

Yards 3 & 4
The smaller of the two existing warehouses on site will be demolished, and the larger warehouse along the southern boundary will be refurbished and extended to provide c. 2,953 m^2 for use as an EHS & Revenue Building. Yards 3 & 4 will incorporate loading bays and dock levellers along the northern side of the EHS & Revenue Building, together with 30 HGV parking spaces and associated internal access roads. Two single storey porta cabins, 75m^2 each, will be installed at the northern side boundary for use as Export Offices. Site lighting will include 2 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways. Landscaping will include ground cover planting in the end bays of the HGV parking aisles and at the south western corner of the side along Promenade Road.

New Permanent Structures:

EHS & Revenue Building: Existing warehouse building (approx. 1193 sq. m) to be refurbished and additional floor area of approx.1760 sq. m to be constructed comprising of (approx. 796 sq. m) ground floor extension to the north of the existing warehouse and an additional first floor area (approx. 964 sq. m) to the existing warehouse. Total proposed overall area approx. 2953 sq. m).

Building to incorporate loading bays with dock levellers, bays to inspect curtain siders with dock levellers, driver accessible WC's, open plan unloading areas, male changing room, female changing room, accessible changing rooms, disinfect area, inspection rooms (c. 2 no. to be temperature controlled), ancillary unloading areas, chilled storage rooms,. Comms. rooms, M&E plant room, secure store, interview rooms, tool room, drying room, cleaners store, no. open plan offices, staff canteen, male toilets, female toilets, accessible WC, welfare room, breakout space, meeting room, conference room, cellular offices, store rooms, external south facing first floor terrace.

The proposed development will include provision for 205 no. HGV parking spaces. The Bond Drive Extension Site will accommodate 175 no. HGV parking spaces, Yard 3 & 4 Sites will accommodate 30 no. HGV parking spaces for the Export Office, staff car parking, and associated ancillary development.

A site layout plan of the proposed development is provided in Figure 2.1b below.

Visually the appearance of the proposed development is intended to complement the commercial and industrial developments in the environs (Further details on the visual treatment of the proposed development are provided in Chapter 11 Landscape and Visual Impact).

Figure 2.1b. Site layout plan of the proposed development (Source: OPW February 2020)

2.2.3 Proposed Site Infrastructure and Secondary Facilities

Surface Water Drainage

The proposed surface water drainage system has been designed for a 2-year storm return period, and with no surface flooding at any part of the site for storms up to and including the 1:100 year return period plus 20% for climate change. Run-off from currently developed/hardstanding/roofs sites enters the off site drainage system, therefore there should be a significant future reduction in discharge volumes as a result of increase in attenuation within the proposed development. Oil petrol interceptors will be provided on all discharges from newly developed sites which will improve the quality of run off entering the sewer. All restricted discharges will have a sump unit which will also reduce the amount of silt entering the receiving system. Overall, the drainage will discharge through the Dublin Port Drainage outfall which includes additional measures for spill mitigation.

Further detail on the storm water drainage system is included in the Engineering report and addressed in Chapter 6 Hydrology and Chapter 14 Material Assets.

Foul Drainage

Domestic effluent arising from occupation of the proposed development will be collected in the existing foul drainage network within the site and discharged to the existing foul sewer infrastructure within Dublin Port. The wastewater discharged from the site will ultimately discharge to the municipal Wastewater Treatment Plant (WWTP) at Ringsend.

Further detail in relation to wastewater emissions is presented in Chapter 14 Material Assets.

Electricity

The site is currently serviced with electricity from the existing electrical transmission infrastructure located in Dublin Port. There is sufficient capacity in the electrical grid for the proposed development.

Generators and Diesel Storage

In the event of a loss of power supply i.e. temporary grid blackout, diesel powered back-up generators will be provided to maintain power supply. These generators are designed to automatically activate and provide power to the proposed development pending restoration of mains power. The proposed generators will be 259kVA with a 340L belly tank which is fully contained a will be located on hardstand area.

Security and Lighting

Other than during construction, the majority of traffic accessing the facilities will approach and access the northern site through the primary south-eastern access gate on the Bond Drive Ext Road, and the southern site through a northern access gate on the Bond Drive Ext Road. A maximum speed limit of 20km/hour will be in place on the access road. A pair of access gates will be manned and maintained by security personnel at this entrance 24/7. (The access gates have been designed to act as a truck lock as and when required).

Access to the Bond Drive Extension sites is via a new access gate to the south east of the site and egress is via a gate to the south west of the site. There is a secondary access/egress gate to the Bond Drive Extension sites at the southwest corner for staff car parking. During the construction phase, in the Bond Drive Extension Site, entrance to the site will be at the south centre and egress will be at the southeast of the site. Access to the Yard 3 & 4 sites is via a new access gate to the northeast of the site and egress is via an existing gate to the southeast of the site. During the construction phase in the Yard 3 & 4 site, entrance will be at the southeast of the site and egress will be at the northeast of the site. Security will ensure that the procedure for accessing the facility is followed at all times.

As outlined above security fence will be constructed around the perimeter of proposed development.

CCTV cameras will be installed at strategic locations around the facilities to ensure all boundaries and approaches to the facilities are adequately monitored. Security lighting will also be provided.

Site Roads and Parking

As above, the main access to the Bond Drive Extension Site will be via a new access gate to the south east of the site and the main access to the Yard 3 & 4 sites will be via a new access gate to the northeast of the site. Access arrangements and potential traffic safety impacts are considered in Chapter 13 Traffic and Transportation.

Car parking (75 no. spaces) and bicycle parking (76 no. spaces) will be provided in designated areas to allow for parking for full time staff as well as external staff, maintenance contractors and visitors attending the site.

The number of proposed car parking spaces and bicycle parking spaces have been checked against *Table 16.1 – Maximum Car Parking Standards for Various Land-Uses, Table 16.2 – Cycle Parking Standards for Various Land-Uses* in Chapter 16 (Development Standards), Map J (Strategic Transport and Parking Areas) of the *Dublin City Development Plan 2016-2022*. It is considered that the provision of permanent Brexit related infrastructure at Dublin Port does not match any of the Land uses cited in Tables 16.1 and 16.2. The nearest related Land Use is: ‘Enterprise and Employment/Offices/General Industry (inc warehousing).

An exercise was undertaken to compare the proposed number of car parking spaces and bicycle parking spaces against the maximum development plan standards. It was found that the maximum standards have been exceed in both instances.. It is considered that this deviation from the development plan’s maximum standards is acceptable given that the parking caters for staff working shifts on a 24 hour basis ie. staff having to travel out of hours when there is no public transport available.

HGV parking (205 no. spaces) will be provided to facilitate the parking of HGVs for customs and documentation checks as per the requirements of the site.

2.3 EXISTENCE OF THE PROJECT

Under the current Draft EPA Guidelines on the information to be contained in EIA Reports, the description of the existence of the project is required to define all aspects of the proposed lifecycle of the proposed development under the following headings:

- Construction;
- Commissioning;

- Operation;
- Decommissioning; and
- Description of Other Developments.

The following sections present a description of each of these aspects.

2.3.1 Description of Construction

The construction of the BCP will comprise four main stages, namely.

- Site preparation works;
- Building Structure Construction;
- Building Envelope Construction; and
- Internal Fit Out Including M&E and commissioning.

Working Hours

The standard wording of DCC conditions in this regard is: The site and building works required to implement the development shall only be carried out between the hours of: Mondays to Fridays - 7.00a.m. to 6.00p.m. Saturday - 8.00a.m. to 2.00p.m. Sundays and Public Holidays - No activity on site.

Staffing

The total peak construction population on site is estimated to be of the order of c. 180 staff (average 90 - 110). Site staff will include management, engineers, construction crews, supervisors, and indirect staff.

Construction Schedules

Subject to granting of the Ministerial Order construction will be undertaken on a phased basis.

A summary of the proposed target dates (earliest possible dates) for the construction of each phase of the proposed development are set out in Table 2..1 and 2.2 below.

Table 2.1 Phasing of the Proposed Development (Demolition)

Phase	**Building Name**	**Demolition Start**	**Duration (months)**	**Demolition End**
1	Yard 3 & 4 Site	Q2 2020 (Subject to Statutory Approvals)	1	Q2 2020 (Subject to Statutory Approvals)
2	Bond Drive Site	Q2 2020 (Subject to Statutory Approvals)	1	Q2 2020 (Subject to Statutory Approvals)

Table 2.2 Phasing of the Proposed Development (Construction)

Phase	Building Name	Construction Start	Duration (months)	Construction End
1	Yard 3 & 4 Site	Q2 2020 (Subject to Statutory Approvals)	9-12	Q2 2021 (Subject to Statutory Approvals)
2	Bond Drive Site	Q2 2020 (Subject to Statutory Approvals)	9	Q1 2021 (Subject to Statutory Approvals)

Note: that the timelines above are subject to Statutory Approvals.

Site Preparation

It is proposed that the fencing, access and haul roads for vehicles and a construction compound will be established first. The contractor will erect a suitably robust fencing line around the perimeter boundaries of both the Yard 3 and Yard 4 sites with controlled access/egress points. The plan alignment of the fencing will remain largely consistent for the duration of the works but may be realigned locally to facilitate tie-ins to external road and drainage networks. In some cases, appropriate localised protection measures may be adopted for some of these works external to the site boundary.

Dedicated construction compounds will be set up in each of the Yard 3 and Yard 4 sites to support the concurrent but separate construction works ongoing in both. The construction compound will facilitate office, portable sanitary facilities, equipment storage, waste storage, parking etc. for contractors. Access to this compound and to the site works area will be controlled and managed to ensure no public access. The location of the construction compounds on each of the sites will move in line with the phasing of the construction of the proposed development, with a designated area set aside for the construction compound throughout each phase of the construction of the proposed development.

The primary activities that will be required during the site preparation phase for the proposed development will be site clearance, compound set up, surveying and setting out for structures.”

Building Construction Works

Following the completion of any required site clearance and levelling, the project engineers have advised that 32,208m^3 soil will be excavated for piling, foundation and drainage works etc. This soil will be reused where feasible to minimise requirement for importation of fill. Where any contaminated soil is encountered it will be removed from site for licenced disposal.

Contractors will be required to submit and adhere to a method statement (including the necessary risk assessments) and indicating the extent of the areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

Any temporary storage of spoil required will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

The construction of the walls and roofs of the buildings will closely follow the completion of structures. The outer finishing of the building envelopes is intended to be of a similar quality and appearance to the existing and permitted developments across Dublin Port.

Material Sourcing, Transportation and Storage

Materials

Key materials will include steel, concrete, composite cladding, piping, electrical cabling, process equipment and architectural finishes. A 'Just in Time' delivery system will operate to minimise storage of materials on site.

Sourcing

Where possible it is proposed to source general construction materials from the Dublin area to minimize transportation distances.

Storage

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles within a secure area in the construction compound to prevent contamination. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications – BS EN 1992-3:2006) to prevent spillage.

Transportation

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

Waste Management

Chapter 15 contains a detailed description of waste management relating to construction of the proposed development. A site-specific Construction and Demolition Waste Management Plan is included as Appendix 15.1 of this EIA Report. This C&D Waste Management Plan will be refined and updated in advance of the works to ensure best practice is followed in the management of waste from the proposed development.

Noise, Vibration and Dust Nuisance Prevention

With regard to construction activities, reference will be made to BS 5228, Noise Control on Construction and Open Sites (i.e. BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014) for noise and vibration control on construction and open sites, which offers detailed guidance on the control of noise and vibration from construction activities. Various mitigation measures will be considered and implemented during the construction of the proposed development, such as:

- Limiting the hours during which site activities are likely to create high levels of noise are permitted, e.g. pile foundation boring;
- Establishing channels of communication between the contractor, local authority, Dublin Port Company, businesses and residents;
- Appointing a site representative responsible for matters relating to noise and vibration, and;
- Monitoring typical levels of noise during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise;
- Erection of barriers as necessary around items such as generators or high duty compressors, and
- Siting of noisy plant as far away from sensitive receptors as permitted by site constraints.

Noise and vibration control measures are discussed in detail in Chapter 10 Noise & Vibration.

The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of dust produced will be deposited close to the generated source.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented including:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic only;
- If required, any area/road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. Indeed, on any un-surfaced site road, this will be 20km/hour, and on hard surfaced roads as site management dictates;
- In dry conditions vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- Wheel washing facilities will be provided for vehicles exiting the site to ensure that mud and other wastes are not tracked onto public roads;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary; and
- At all times, these procedures will be strictly monitored and assessed. In the event of dust emissions 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.

Dust nuisance control measures are discussed in further detail in Chapter 9 (Air Quality and Climate).

Water Discharges

Welfare facilities will be provided for the contractors on site during the construction works. Portable sanitary facilities will be provided.

Any surface water run-off will be adequately contained and treated prior to being discharged into the existing Dublin Port drainage network. See Chapter 7 Hydrology for a full description of mitigation measures proposed.

Construction Impacts

Each of the following EIA Report chapters (Chapters 4-15) includes an assessment of the potential impact of construction works on their individual environmental aspect and set out the relevant mitigation measures relating to that aspect.

It is proposed that a Construction Environmental Management Plan (CEMP) will be put in place by contractors to minimise the impact of all aspects of the construction works on the local environment. The CEMP will include emergency response procedures in the event of a spill, leak, fire, or other environmental incident related to construction.

The primary potential effects from construction are all short-term and are anticipated to include.

- Effects in terms of nuisances relating to the air quality of the environs due to dust and other particulate matter generated from excavation works and effects on the noise environment due to plant and equipment involved in construction;
- Effects on the land, soils, geology & hydrogeology of the site during construction i.e. some loss of protection of the underlying aquifer to contaminants during site clearance, levelling and excavations etc.; and
- Effects on the local road network and its environs due to construction workers and other staff attending site during preparation, construction and commissioning phases.

Mitigation measures to address each of these potential short-term effects are presented in each individual EIA Report chapter.

2.3.2 Description of Commissioning

Once the first building is constructed, specialist contractors will be mobilised to complete the commissioning of any electrical and mechanical equipment and services and related plant. Commissioning will be carried out on a phased basis as each building is completed, over a period of approximately 4 weeks.

Any hard landscaping and final soft landscaping will be completed.

2.3.3 Operation of the Project

Staffing

Once operational, up to c. 128 full time employees will be present on site during the day, including external staff, maintenance contractors and visitors, as required. Staff will be present on a shift basis, so numbers will vary throughout the day.

Traffic relating to staff movements have been assessed as part of the traffic and transportation chapter of this EIA Report (Chapter 13).

2.3.4 Decommissioning of the Project

The proposed development is is designed to have a long lifespan. Approx. Building Lifespan:
M&E lifespan: 10-15 years approx.
Building structures lifespan: 50 years approx.
Components and fitting lifespan: 10 – 30 years approx.

It is likely that regular maintenance and periodic upgrading of the facility over time will enable it to continue to meet future demands.

Upon closure all buildings, plant, equipment, drainage networks etc. at the site will be fully decontaminated and decommissioned in accordance with prevailing best practice. The buildings once rendered environmentally safe will more than likely be retained and sold on for future use following closure.

2.3.5 Description of Other Developments

A list of the other developments in the vicinity of the proposed development is provided in Chapter 3 (Planning and Development Context) of this EIA Report.

2.4 HEALTH & SAFETY

2.4.1 Design and Construction Health and Safety

The proposed development has been designed in accordance with the Safety, Health and Welfare at Work Act 2005 (S.I. 10 of 2005) as amended and the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. 299 of 2007) as amended and associated regulations.

The proposed development has been designed by skilled personnel in accordance with internationally recognised standards, design codes, legislation, good practice and experience based on a number of similar existing facilities operated by the Government Agencies and their facilities management consultants. Bond Drive Extension and Yard 3 & 4 will be managed by the Revenue Commissioners, The Health Service Executive and the Department of Agriculture, Food and the Marine who will appoint an experienced facilities management consultant.

2.4.2 General Operational Health and Safety

The Operator implements an Environmental Safety and Health Management System at each of its facilities. Prior to start up a comprehensive set of operational procedures will be established (based on those used at other similar facilities) to ensure a smooth roll out of operations at each facility.

2.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

The proposed development is to be located on suitably zoned lands adjacent to extensive industrial/commercial development. The development, when operational, will generate limited additional traffic, air, noise, and water emissions, wastes generation from activities etc.

During construction, there is the potential for short-term nuisance impacts from traffic, dust, noise, and construction waste, if not carefully managed. The Operator will require contractors to implement a CEMP to ensure each of these potential impacts are minimised.

Each chapter of this EIA Report assesses the potential impact of the construction and operation of the proposed development on the receiving environment. Please refer to each specialist chapter, respectively.

2.6 MAJOR ACCIDENTS/DISASTERS

The 2014 EIA Directive and associated Draft EPA EIA Guidelines requires that the vulnerability of the project to major accidents, and/or natural disasters (such as earthquakes, landslides, flooding, sea level rise etc.), as well as man-made disasters (such as industrial accidents etc.) are considered in the EIA Report. The site has been assessed in relation to the following external natural disasters; landslides, seismic activity and volcanic activity and sea level rise/flooding as outlined below. The potential for major accidents to occur at the data storage facility has also been considered with reference to Seveso/COMAH.

Landslides, Seismic Activity and Volcanic Activity

There is a negligible risk of landslides occurring at the site and in the immediate vicinity due to the topography and soil profile of the site and surrounding areas. There is no history of seismic activity in the vicinity of the site. There are no active volcanoes in Ireland so there is no risk of volcanic activity. Further detail is provided in Chapter 6 Land, Soils, Geology & Hydrogeology.

Flooding/Sea Level Rise

The potential risk of flooding on the site was also assessed. A Flood Risk Assessment was carried out and it was concluded that the development is not at risk of flooding. Furthermore, it is not expected that the proposed development would adversely impact on flood risk for other neighbouring properties. Further detail is provided in Chapter 7 Hydrology and the Flood Risk Assessment included in the engineering report.

Seveso/COMAH

The proposed development will not be a Seveso/COMAH facility. The only substance stored on site controlled under Seveso/COMAH will be diesel for generators and the amounts proposed do not exceed the relevant thresholds of the Seveso directive.

The Chemical Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. 209 of 2015) define the “consultation distance” as a distance or area relating to an establishment, within which there are potentially significant consequences for human health or the environment from a major accident at the establishment, including potentially significant consequences for developments such as residential areas, buildings and areas of public use, recreational areas and major transport routes.

Establishments are either lower tier establishments or upper-tier COMAH sites with above threshold quantities of dangerous substances present, and to which the provisions of the 2015 COMAH regulations apply.

The Seveso III Directive (2012/18/EU) requires Member States to apply land-use or other relevant policies to ensure that appropriate distances are maintained between residential areas, areas of substantial public use and the environment, including areas of particular natural interest and sensitivity and hazardous establishments.

The HSA is the Competent Authority in Ireland as defined by 2015 COMAH Regulations which implement the Seveso III Directive. The HSA is responsible for ensuring that the impacts of facilities which fall within the remit of this legislation are taken into account with respect to land use planning. This is achieved through the provision of technical advice to planning authorities.

A risk-based approach to land use planning near hazardous installations has been adopted by the HSA and is set out in the guidance document *Policy and Approach to COMAH Risk-based Land-use Planning* (HSA, 2010). This approach involves delineating three zones for land use planning guidance purposes, based on the potential risk of fatality from major accident scenarios resulting in damaging levels of thermal radiation (e.g. from pool fires), overpressure (e.g. from vapour cloud explosions) and toxic gas concentrations (e.g. from an uncontrolled toxic gas release).

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

10^{-5}/year	Risk of fatality for Inner Zone (Zone 1) boundary
10^{-6}/year	Risk of fatality for Middle Zone (Zone 2) boundary
10^{-7}/year	Risk of fatality for Outer Zone (Zone 3) boundary

The 2010 HSA Risk-Based LUP Policy/Approach document provides guidance on the type of development appropriate to the inner, middle and outer LUP zones. The advice for each zone is based on the UK Health and Safety Executive (HSE) PADHI (Planning Advice for Developments near Hazardous Installations) methodology. The PADHI methodology sets four levels of sensitivity, with sensitivity increasing from 1 to 4, to describe the development types in the vicinity of a COMAH establishment. The sensitivity levels are:

Level 1	Based on normal working population;
Level 2	Based on the general public – at home and involved in normal activities;
Level 3	Based on vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger); and
Level 4	Large examples of Level 3 and large outdoor examples of Level 2 and Institutional Accommodation.

Table 2.3 details the matrix that is used by the HSA to advise on suitable development for technical LUP purposes:

Table 2.3 LUP Matrix

Level of Sensitivity	**Inner Zone (Zone 1)**	**Middle Zone (Zone 2)**	**Outer Zone (Zone 3)**
Level 1	✓	✓	✓
Level 2	✗	✓	✓
Level 3	✗	✗	✓
Level 4	✗	✗	✗

Land Use Contours

The COMAH Land Use Planning risk contours for the Dublin Port area were determined by Byrne Ó Cléirigh as part of the 2019 Dublin Port Company's MP2 project. The risk contours incorporate the risk of fatality arising from all COMAH establishments within the Port area on the northern side of the River Liffey. Figure ***2*** below illustrates the location of the proposed developments in relation to the Byrne Ó Cléirigh LUP contours.

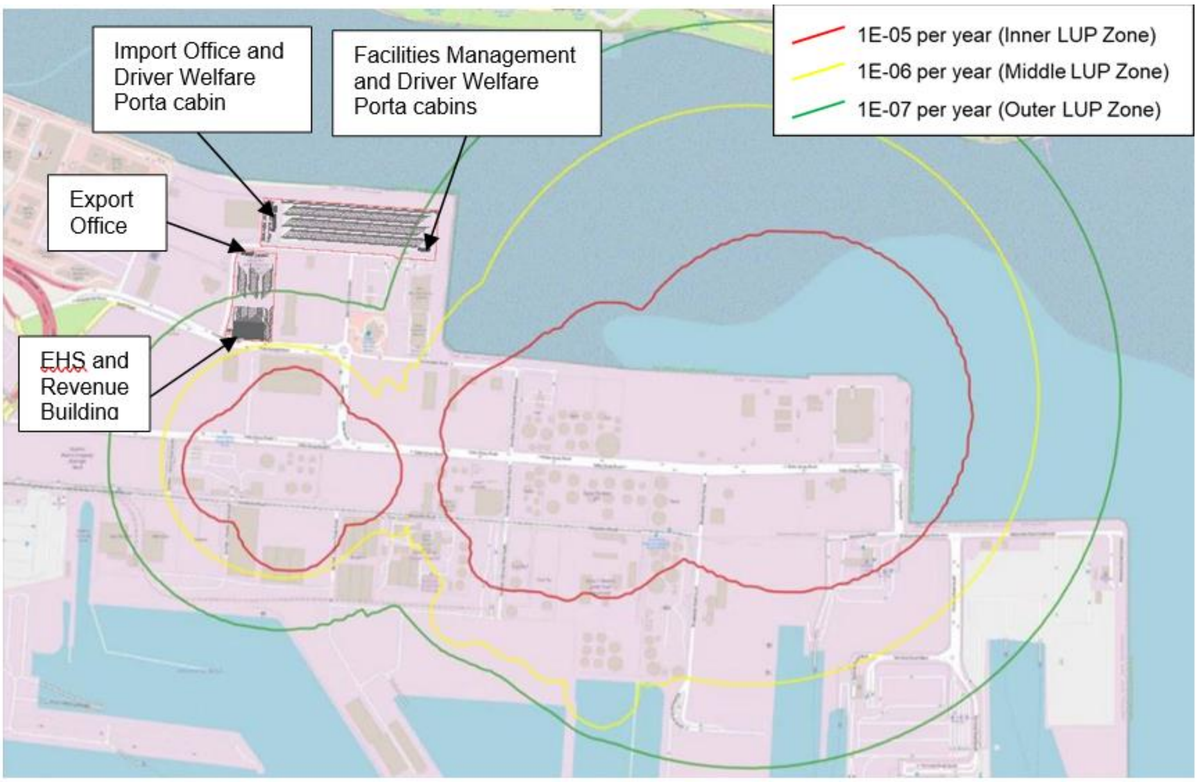

Figure 2.2 Individual Risk of Fatality Contours for Dublin Port Area

The proposed developments at Bond Drive Extension and Yards 3 & 4 comprise office space (and associated staff parking) and HGV parking (and associated facilities) and are therefore classified as **Level 1** type development and are therefore permitted within all three LUP Zones.

A summary of the development types and location within the LUP contours is provided in Table 2.4 below.

Table 2.4 Development types and location within the LUP contours

Development Type	**Development Type Sensitivity Level**	**Location within LUP contours**	**Permitted (Y/N)**
Bond Drive			
Facilities Management (FM) Porta Cabin	Level 1	Outer Zone	Y
Driver Welfare (DW) (East) Porta Cabin	Level 1	Outer Zone	Y
Driver Welfare (DW) (West) Porta Cabin	Level 1	Outside Outer Zone	Y
Import Office (2 no. Porta Cabins)	Level 1	Outside Outer Zone	Y
HGV Parking	Level 1	Predominately Outside Outer Zone	Y
Yard 3 & 4			
Export Office (2 no Porta Cabins)	Level 1	Outside Outer Zone	Y
EHS & Revenue Building	Level 1	Outer Zone	Y
HGV Parking	Level 1	Predominately Outside Outer Zone	Y

Minor Accidents/Leaks

There is a potential impact on the receiving environment as a result of minor accidents/leaks of fuel/oils during the construction and operational phases. However, the implementation of standard mitigation measures will ensure the risk of a minor accident/leak is low and that the residual effect on the environment is imperceptible.

2.7 RELATED DEVELOPMENT AND CUMULATIVE IMPACTS

The proposed development is Brexit Infrastructure at Dublin Port. The site is currently developed, and located in an active existing industrial area.

The cumulative impact of the proposed development with other developments that are currently permitted or under construction within the vicinity of the site, neighbouring industrial parks and surrounding areas have been assessed in each chapter of this EIA Report to the extent possible, having regard to information available on other developments in the vicinity.

3.0 PLANNING AND DEVELOPMENT CONTEXT

3.1 INTRODUCTION

This chapter will examine the proposed development within the context of the Dublin City Council (DCC) planning policy.

The site for the proposed development is situated within the administrative area of Dublin City Council, and therefore the Planning and Development Framework with which the development complies is defined by the Dublin City Development Plan 2016 – 2022.

The following sections describe how the proposed development is in compliance with the stated and statutory requirements of DCC with respect to planning and sustainable development.

3.2 NATIONAL, REGIONAL AND LOCAL PLANNING CONTEXT

Trans-European Transport Network (TEN-T)

The TEN-T policy is based on Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU. Its purpose is to address the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate goal is to "*close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU.*".

To this effect, the TEN-T comprises two networks layers:

- The Core Network, which comprises the most important connections and links the most important nodes, and is targeted for completion by 2030; and,

- The Comprehensive Network, which covers all European regions and is targeted for completion by 2050.

The Core Network is defined by nine Core Network Corridors, which were identified to simplify and facilitate coordinated development of the Core Network. The Core Network Corridor which concerns Irish infrastructure, including Dublin Port, is the North Sea-Mediterranean (NSMED), which extends from Edinburgh, Scotland, to the French ports of Marseille and Fos-sur-Mer in the south, passing through Ireland, England, the Low Countries (Belgium, Luxembourg and the Netherlands) and France.

The European Coordinator for the TEN-T NSMED Corridor is Mr Péter Balázs.

North Sea – Mediterranean Third Work Plan of the European Coordinator Péter Balázs

The Third Work Plan was published in 2018 with the intention of providing an analysis and update on the NSMED Corridor. Most notably, this document refers to the progress of the Alexandra Basin Redevelopment at Dublin Port (An Bord Pleanála (ABP) Ref. 304888). The development consists of deepening the harbour basin and channel to accommodate larger sea going vessels, constructing 3km of quay walls and conservation of the port's Victorian industrial harbour. The intent of this, as described in the Third Work Plan, is to "*…allow it* [Dublin Port] *to be served by larger vessels and be more competitive Deepening of the harbour basin would also allow easier access for cruise vessels, which at present have to reverse into the port*". This development was granted permission by ABP on 7th July 2015. Works commenced in November 2016, with an estimated construction period of 36 – 47 months.

National Ports Policy 2013

The National Ports Policy (NPP) was published in 2013 by the Department of Transport, Tourism, and Sport. The NPP states that the core objective of the NPP is "*to facilitate a competitive and effective market for maritime transport services*".

In 1992, a review group recommended that the 12 main Irish seaports be reconstituted as commercial state ports, which was underpinned by the 1996 Harbours Act. The NPP acknowledges that since this time, the approach to port development has been "*laissez-faire*". The NPP provides a clear categorisation of the ports sector into Tier 1 (Ports of National Significance), Tier 2 (Ports of National Significance) and Tier 3 (Ports of Regional Significance).

Tier 1 ports are defined in the NPP as ports that:

- Are responsible for 15% to 20% of overall tonnage through Irish ports, and
- Have clear potential to lead the development of future port capacity in the medium and long term, when and as required.

There are three Tier 1 ports in Ireland, with the first of these being Dublin Port. The remaining two ports are the Port of Cork and the Shannon Foynes Port.

The NPP states that "*the continued commercial development of these three Ports of National Significance (Tier 1) is a key objective of National Ports Policy*".

National Planning Framework – Ireland 2040

The National Planning Framework (herein referred to as the NPF) was published in February 2018 and contains policies which are supportive of the development of marine infrastructure, with particular reference made to ports. National Strategic Outcome 6 of the NPF relates to the creation of *"High-Quality International Connectivity"*. This strategic outcome is underpinned by a range of objectives relating to addressing the opportunities and challenges from Brexit with relation to ports.

The NPF also states under National Strategic Outcome 6:
"As an island, the effectiveness of our airport and port connections to our nearest neighbours in the UK, the EU and the wider global context is vital to our survival, our competitiveness and our future prospects."

Specifically, National Policy Objective 40 of the NPF states the aim to:

“Ensure that the strategic development requirements of Tier 1 and Tier 2 Ports, ports of regional significance and smaller harbours are addressed as part of Regional Spatial and Economic Strategies, metropolitan area and city/county development plans, to ensure the effective growth and sustainable development of the city regions and regional and rural areas.”

As per the National Ports Policy, Dublin Port is designated as a Tier 1 port.

Dublin Port Masterplan 2012 - 2040 (Reviewed 2018)

The Dublin Port Masterplan 2012 - 2040 (DPM) is the core document which guides the development in Dublin Port up to 2040. The DPM was first published in February 2012, by the Dublin Port Company (DPC), with the first review of the DPM completed in 2018. It is envisaged that the second review of the DPM will take place no earlier than 2023, and no later than 2028. The DPM is a non-statutory plan but has been compiled in within the context of prevailing EU, national, regional and local development plan policies. The DPM was developed by DPC with the intention to:

- Plan for future sustainable growth and changes in facilitating seaborne trade in goods and passenger movements to and from Ireland and the Dublin region in particular;
- Provide an overall context for future investment decisions;
- Reflect and provide for current national and regional policies, local guidelines and initiatives; and,
- Ensure there is harmony and synergy between the plans for the Port and those for the Dublin Docklands Area, Dublin City and neighbouring counties within the Dublin Region. Give some certainty to customers about how the Port will develop in the future to meet their requirements.

The DPM suggests options to facilitate Dublin Port handling up to 77 million gross tonnes by 2040.

The DPM outlines a number of strategic objectives to facilitate the effective operation of Dublin Port in the period to 2040. The most relevant of these to the proposed development are outlined below under their respective headings as defined in the DPM.

Port Functions

- Ensure the safe operation and sustainable development of the Port and its approach waters and provide appropriate infrastructure, facilities, services and accommodation for ships, goods, and passengers to meet future demand.
- Optimise the use of Port lands by rationalising the distribution and location of specific areas of activity (including Ro-Ro, Lo-Lo, passenger ferry services, Cruise Ships, Bulk Liquid, Bulk Solid and Break Bulk goods) with necessary reconfigurations of service facilities as required.
- Recover lands that are not being used for core port activities.
- Use new and developing technology to increase throughput to its environmentally sustainable maximum.
- Identify configurations for extending berthage and storage that mitigate impact on adjacent environmentally sensitive / designated areas.

Investment and Growth

- Utilise the Masterplan as a framework for investment and growth based on the Port's projected demand forecasts.

Movement and Access

- Develop a transport plan for the Port estate in conjunction with the NTA and DCC.

Environment and Heritage

- Integrate new development with the built and natural landscapes of the surrounding area.

The DPM shows the proposed project site zoned as "lands currently used for Non-Core Activity for Future Redevelopment" and "Multi Purpose Transit Storage" (Figure 3.1). This zoning aligns the proposed development site with the strategic objectives outlined above.

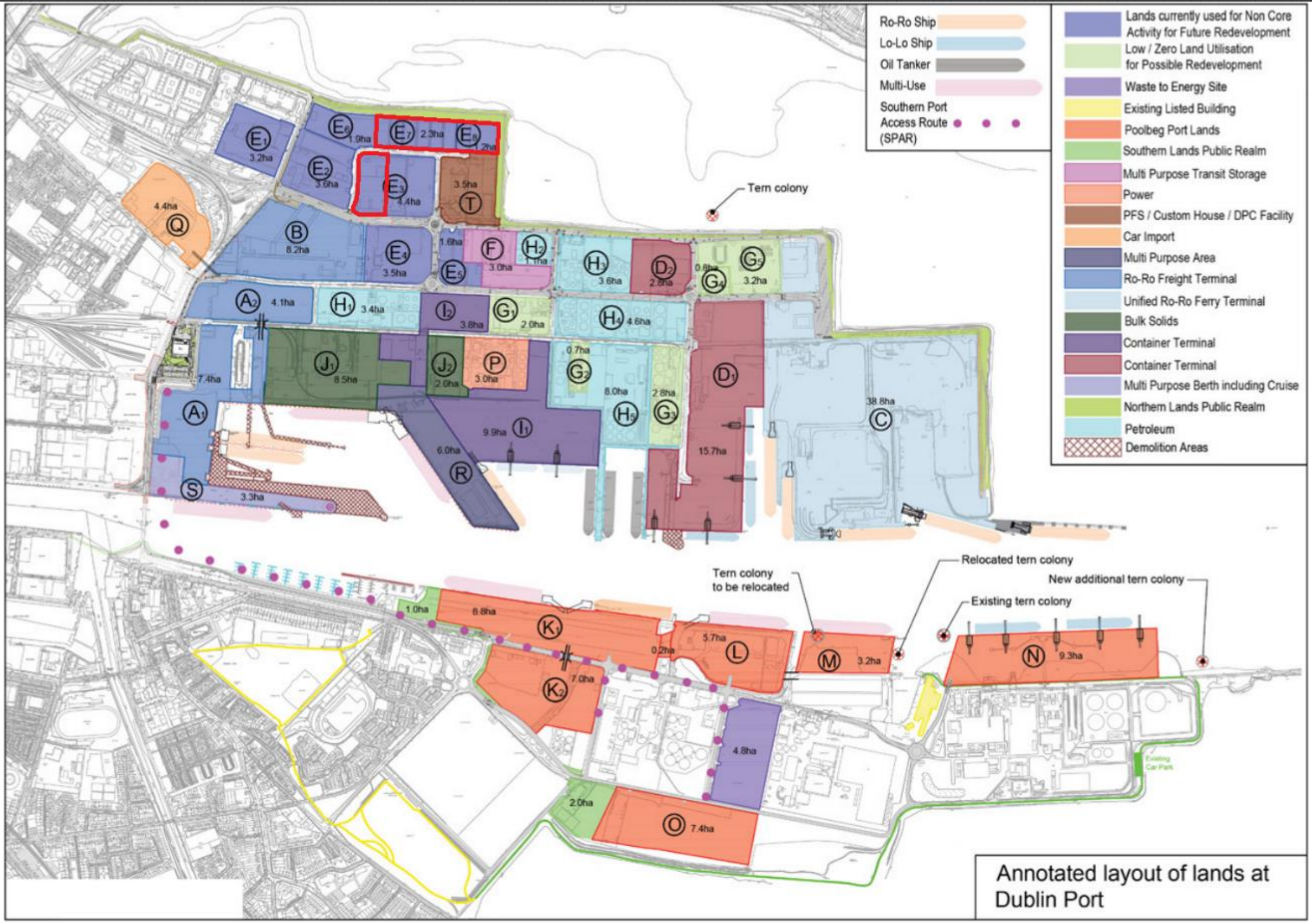

Figure 3.1. Zoning map from the Dublin Port Masterplan 2040 (Reviewed 2018) showing the proposed site (outlined in red) being zoned as lands currently used for Non-Core Activity for Future Redevelopment and Multi Purpose Transit Storage

Regional Spatial and Economic Strategy for the Eastern & Midland Regional Assembly

The Regional Spatial and Economic Strategy (RSES) for the Eastern & Midland Regional Assembly outlines several Regional Policy Objectives (RPO) which relate specifically to port development. The most notable of these is:

RPO 8.21
"*EMRA will support the role of Dublin Port as a Port of National Significance (Tier 1 Port) and its continued commercial development, including limited expansion and improved road access, including the Southern Port Access Route.*"

Dublin City Development Plan 2016 – 2022

The Dublin City Development Plan 2016 – 2022 was adopted by DCC at a Special Council meeting on 23rd September 2016 and came into effect on 21st October 2016. The plan outlines DCC's policies and objectives for the Proposed Development and improvement in a sustainable manner of the economic, environmental, cultural and social assets of the City over the period 2016 to 2022.

Zoning

A review of the Dublin City Development Plan 2016 – 2022, Map F shows the proposed Project lands as "Z7 – Employment (Heavy)" (Figure 3.2).

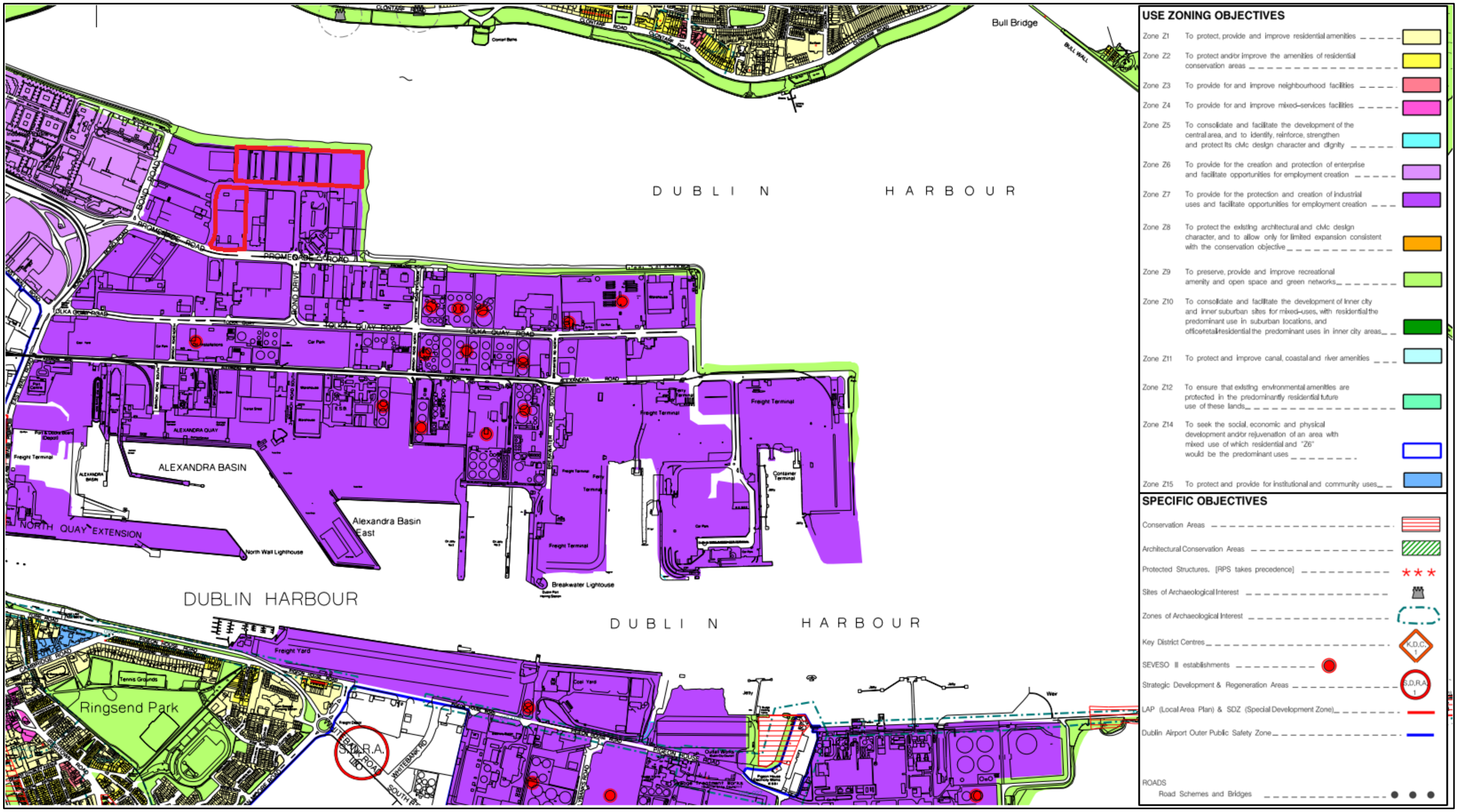

Figure 3.2. Zoning map from the Dublin City Development Plan 2016 – 2022, showing the proposed site (outlined in red) as being zoned for Employment (Heavy).

Employment, Economy and Enterprise

It is the policy of the local authority to facilitate economic development and the growth of employment in the county through support for objectives which promote economic, social, and cultural development and in assisting the provision of employment opportunities for all.

Several policies have been outlined for Dublin Port for the development of employment, economy and enterprise:

Policy SC9: To support and recognise the important national and regional role of Dublin Port in the economic life of the city and region and to facilitate port activities and development, having regard to the Dublin Port Masterplan 2012 – 2040.

Policy CEE23 (iii): To recognise that Dublin Port is a key economic resource, including for cruise tourism, and to have regard to the policies and objectives of the Dublin Port Masterplan.

3.3 SUSTAINABLE DEVELOPMENT

Irelands Framework for Sustainable Development *'Our Sustainable Future'* (launched 2012 with subsequent progress report in 2015), by the Department of the Environment, Community and Local Government. It provides a framework to ensure that development is undertaken in a sustainable manner.

'Our Sustainable Future' aims to ensure that development is carried out sustainably and in an environmentally sound manner which includes optimisation of natural resources, minimisation of waste, safe and sparing use of chemicals and the application of clean technology.

All of these aspects will be integral considerations in the operation of the proposed development on a day to day basis and are addressed within this EIA Report where appropriate.

3.4 PLANNING PERMISSIONS

As part of the assessment of the impact of the proposed development, account has been taken of developments that are currently permitted, or under construction and substantial projects for which planning has been submitted within the Dublin Port area.

The proposed development site is located in an area zoned as Z7 - Employment (Heavy) in the Dublin City Development Plan 2016-2022, and Non-Core Activity for Future Redevelopment and Multi-Purpose Transit Storage in the DPM. The proposed development site is located within Dublin Port, an existing operation port.

The DCC Planning Department website was consulted in order to generate a list of granted planning permissions from the surrounding areas of the proposed development within the previous five years (since October 2014). The area under consideration for this search included the Dublin Port, East Wall and Ringsend areas. The outcome of this search is presented in Table 3.1 of Appendix 3.1. Some notable applications granted planning permission, which will be undergoing construction at the same time as the proposed development, are described below.

3.4.1 Dublin Port MP2 Project

The Dublin Port MP2 Project is a notable proposed development in Dublin Port, currently under consideration by An Bord Pleanála (ABP Reg. Ref. PL29N.304888), with a decision due. The development, applied for by the Dublin Port Company, consists of 15-year permission for development at Oil Berth 3 and Oil Berth 4, Eastern Oil Jetty and at Berths 50A, 50N, 50S, 51, 51A, 49, 52, 53 and associated terminal yards to provide for various elements including new Ro-Ro jetty and consolidation of passenger terminal buildings. Pending grant of planning permission, construction of this development, which will consist of both land and marine works across a number of phases, will commence in Q2 2022, and finish in Q1 2032.

3.4.2 Dublin Port Alexandra Basin Redevelopment

The Alexandra Basin Redevelopment consists of:

- The redevelopment of Alexandra Basin West including demolition of part of North Wall Quay Extension and its reconfiguration, new quay walls, dredging as well as excavation of contaminated materials, infilling of Graving Dock No2, provision for new berths and conservation measures including the excavation of Graving Dock No.1 and the construction of an interpretive centre on North Wall Quay Extension;
- The infilling of Berths Nos. 52 and 53 at the eastern end of the Port and the provision of new landside and berthing facilities, and;
- Dredging of the approach channel and provision of a marina protection structure to the north of the Poolbeg Yacht, Boat Club and Marina.

Permission for these works was granted by An Bord Pleanála on 8th July 2015 (ABP Reg. Ref PL29N.PA0034). Works began in November 2016 and will continue within the 10-year planning permission timeframe.

3.4.3 Dublin Port Greenway

Comprising works to the Port's private internal road network and includes works on public roads at East Wall Road, Bond Road and Alfie Byrne Road, the Dublin Port Greenway development was granted permission by Dublin City Council in July 2016 (DCC Reg. Ref. 3084/16). The scheme is due to commence construction in early 2020, with the complete programme of works anticipated to be 24 – 42 months. The duration of works on the external road network is expected to be 6 – 12 months.

3.5 PLANNING ORDERS

Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017).

3.6 CONSULTATION WITH AN BORD PLEANÁLA AND DUBLIN PORT COMPANY

AWN and the Commissioners of Public Works in Ireland (on behalf of the Applicant) have liaised with the relevant departments of An Bord Pleanála (ABP) and Dublin Port Company in advance of lodgement of this application. A pre-planning meeting was held with ABP on 5 November 2019.

AWN and the other respective EIA contributors/authors have incorporated advice and comments received from ABP and consultees into the relevant chapters of this EIA Report.

3.7 PLANNING CONCLUSIONS

The proposed development will be in keeping with all of the aspects of the relevant policy documents as described in Section 3.2 and 3.3 above. The proposed development will be situated on suitably zoned lands in the Dublin Port area.

The policies and objectives outlined in Section 3.2 above regarding the conservation, protection and enhancement of environmental resources and assets of the region will not be contravened by this proposed development, as will be described in the relevant chapters in this EIA Report.

In conclusion, it can be stated that the proposed development complies fully with the stated requirements and will deliver a key piece of national infrastructure that will ensure that Ireland can effectively manage the new requirements for checks and controls on trade with the United Kingdom as a consequence of Brexit.

APPENDIX 3.1

Planning Search Results

Prepared by AWN Consulting

Table 3.1. Recent planning applications to DCC in the locality of the proposed development site. DCC planning website search conducted in October 2019.

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	**Summary Description of Development**	**Location of Development**	**Outcome & Final Grant Date**
4483/19 Dublin Port Company	The proposed development will consist of the demolition of 10 no. redundant buildings (c. 6830sqm) and removal of temporary structures including portacabins and general site clearance (an existing substation and pump house will remain in situ) to optimise the use of the site as a multi-functional storage yard (primarily for heavy goods vehicles) and facilitate wider infrastructural upgrades to provide additional capacity within the Port. The proposed development will also include: construction of vehicular check-in booths (c. 30sqm); an open-air blockwork electrical enclosure; amendments to boundary treatments including provision of 4m high security fencing (including 1.5m high retaining walls) on the northern, eastern and southern boundaries; 4m high security fencing fixed to the existing masonry wall along the western boundary with Bond Road; 3 no. new 12m wide automatic vehicular sliding gates and re-building of 1 no. existing 9m wide automatic vehicular sliding gate; provision of 14 no. high mast lighting columns (30m high) and 54 no. perimeter lighting columns (12m high); installation of 9 no. CCTV columns (18m high); installation of new pavement, underground drainage, attenuation, interceptors, water services and electrical infrastructure; installation of new wash bay and fuel spill areas; installation of pedestrian barriers; and all associated site and development works on a site of c. 9.52ha.	Terminal 4 North Lands, Dublin Port, Dublin 1, bounded by Bond Road, Tolka Quay Road & Promenade Road	GRANT PERMISSION 21st January 2020
4115/19 Lagan Materials Ltd.	The development will consist of the removal of a redundant fire water storage tank of 7.6m in diameter and 7.5m in height with a volume of approximately 340m3 and the installation of a new bitumen storage tank of 3.37m in diameter and 17.3m in height with a volume of approximately 100m3.	Lagan Materials Ltd., Alexandra Road, Dublin Port, Dublin 1	GRANT PERMISSION 7th January 2020
3859/19 Dublin Port Company	The development will consist of: demolition of redundant warehouse building known as 'Stack R Warehouse')c. 6,600sqm); demolition of redundant ESB pumphouse and adjacent switchroom (c. 285sqm) at Berth 31/32 (Ocean Pier); installation of 25 no. new reefer access gantries (5.0m high) at Stack R and McCairn's yard; installation of a new substation (c. 92sqm) adjacent to Stack R; extension of the existing Alexandra Quay East (AQE) Rubber Tyre	Ocean Pier and Alexandra Quay East, Alexandra Road and No. 3 Branch Road South, Dublin Port, Dublin 1	GRANT PERMISSION 27th November 2019

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	Gantry (RTG) stack area by 17,500sqm to the west (3 no. bays, 18.2m high); installation of 3 no. new reefer access gantries (7 no. rows, 14.65m high) in the proposed AQE RTG stack extensions; demolition of Dublin Stevedores substation (c. 30 sqm) and installation of new substation (c. 98sqm); re-routing of existing, and installation of new, electrical infrastructure; construction of 1.5m high retaining wall and 4m high security fencing along part of western boundary; provision of 3 no. 30m high mast lighting towers including integrated CCTV cameras; provision of 1 no. 10m high lighting column on the western boundary of McCairn's Yard; provision of ancillary associated lighting and lighting upgrades; installation of new pavement and associated drainage and services; general site clearance; and all associated works on site of c. 75,750sqm (c.7,575ha).		
Dublin Port Company 3711/18	Permission is sought for development that will consist of: construction of a bridge to span the existing cooling water outfall channel, adjacent to Pigeon House Road; construction of a new junction opposite the entrance to the Ecocem Ireland Plant; hard surfacing; site drainage and outfall; the use of lands for the storage of port-related maintenance and service equipment, construction project materials, contractor's site compound and project cargo; amendments to boundaries; and all associated services and site development works.	Lands at Berth 47A, adjacent to Pigeon House Road, Dublin 4, north of the Ringsend Wastewater Treatment Works.	GRANT PERMISSION 12/08/2019
Tony Riordan 2771/19	The development will consist of: Demolition of an existing single storey building and construction of a new two storey building with a footprint of 14.9m by 5.6m. The building will consist of concrete foundations, blockwork walls, an external cladding and plaster finish, a trapezoidal roof, an internal concrete stairs and an external steel stairs. The building will be subdivided into a production area and store at ground floor level and an office and store rooms at first floor level. The building will be connected to the site's existing storm drainage and electrical services.	Irish Tar & Bitumen Suppliers Alexandra Road Dublin 1.	GRANT PERMISSION 18/07/2019

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Dublin Port Company 3176/19	The development will consist of: a c.189m long, c.10m wide approachway and ramp; 1 no. office and staff facilities building (c.193 sq.m and 7.7m in height); 1 no. control kiosk (c.6 sq.m and 2.3m in height); 1 no. control cabin (c.20 sq.m and 2.3m in height); new lighting (including 18 no. lighting columns 10m high); demolition of 5 no. existing staff facilities buildings with a combined area of c.329 sq.m; building 1 has an area of c.198 sq.m, building 2 has an area of c.10.7 sq.m, building 3 has an area of c.35.5 sq.m, building 4 has an area of c.42.4 sq.m, building 5 has an area of c.42.4 sq.m; and associated site works to include 15 no. tug parking spaces, drainage, utility services, fencing 2.4m in height and pedestrian gate 2.4m in height on a site of approx. 1.3 hectares. A Natura Impact Statement (NIS) will be submitted to the Planning Authority with the planning application.	Adjacent to Berth 49 Ferryport Terminal 1 Dublin Port Dublin 1	GRANT PERMISSION 06/06/2019
Dublin Port Company 4250/18	The development will consist of; the demolition of existing ESB Substation (approx. 25sq.m and 3.2m heigh), general site clearance, and construction of new ESB Substation building (approx. 40sq.m and 3.1m heigh) to include access ramps, handrails, replacement fencing, and pedestrian access gate adjacent to proposed substation; and development also includes dropped kerb access off Tolka Quay Road. All development to take place on a site approximately 0.66 hecdtares. The application is for a 10 year planning Permission.	Tolka Quay Road Dublin Port Dublin 1	GRANT PERMISSION 10/05/2019
Dublin Port Company 4521/18	The development will consist of: a 150m long, 13m wide two lane vehicular bridge with access ramps over Alexandra Road connecting the CDL yard and Terminal 4, associated lighting columns of up to 8m in height and all associated site development works.	Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 25/04/2019
Irish Water PL29S.301798	The proposed development consists of: 10-year permission for development comprising revisions and alterations to the existing and permitted development at the Ringsend Wastewater Treatment Plant and for a new Regional Biosolids Storage Facility, being two components of an integrated wastewater treatment facility. The proposed development comprises revisions and alterations to the 2012 Approval (case reference number 29N.YA0010). The proposed revisions and alterations will continue to facilitate the	Ringsend, Dublin 4, and Newtown, Dublin 11	GRANT PERMISSION 24/04/2019

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	expansion of the existing wastewater treatment plant (Ringsend Wastewater Treatment Plant) to its permitted capacity of 2.4 million population equivalent within the confines of its current site. However, this will now be achieved primarily through the introduction of aerobic granular sludge (AGS) technology at the Ringsend Wastewater Treatment Plant. The introduction of this technology will facilitate the omission of the nine-kilometre Long Sea Outfall Tunnel and the continued use of the existing outfall.		
Dublin Port Company 4507/18	The development will consist of temporary permission for 5 years for facilities to cater for cruise ship operators to include: a marquee (c.2,250sq.m) 8m in height, 300 car parking spaces, bus and car drop off area, fencing 2m in height, mini-roundabout, 6m access off Tolka Quay Road and all associated site development works at Tolka Quay Road; and; a marquee (c.1750sq.m) c.8m in height at Ocean Pier.	Tolka Quay Road and Ocean Pier Dublin Port Dublin 1	GRANT PERMISSION 07/03/2019
Marine Terminals Ltd 3878/18	The development consists of the erection of a proposed 4m high acoustic screen fence, consisting of a steel frame, timber infill with concrete ballast base supports. The proposed fence will be erected adjacent to the existing 1.8m metal palisade fence at existing site boundary.	Dublin Port Pigeon House Road Ringsend Dublin 4	GRANT PERMISSION 15/01/2019
Dublin Port Company 3638/18	The development will consist of a unified State services facility including: 2 no. Inspection Sheds (each 207sq.m and 7.5m in height), 2 no. single storey State Service office blocks (each 266sq.m and 3.5m in height), 5 no. Immigration Control Booths with a total floor area of 66sq.m and including canopy (293sq.m and 7.7m in height) and 4 no. gateways, control point comprising canopy (216sq.m and 7.7m in height) and 4 no. gateways, 24 no. staff car parking spaces, 20 no. car parking spaces, 18 no. HGV parking spaces, new 20m vehicular access onto Tolka Quay Road, 4 no. CCTV poles (18m high), new lighting (including 3 no. lighting columns 30m high and 8 no. lighting columns 12m high), 2.4m palisade fencing along sections of the northern and eastern site boundary and Alexandra Road, demolition of existing boundary wall along Tolka Quay Road and boundary fencing along Alexandra Road and, all associated site works. The development also includes modifications to check-in facilities	Former Calor Yard and Ferry Terminals 1 and 2 Dublin Port Dublin 1	GRANT PERMISSION 14/11/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	and internal roads and circulation which will consist of: Demolition of existing freight office (612sq.m and 9.8m in height) and 3 no. check in booths with a total floor area of 32sq.m and associated site works and resurfacing to tie in with adjacent stacking areas, removal of Terminal Road West including associated fencing and resurfacing to tie in with adjacent stacking areas, realignment and lane alteration of Terminal Road South at junction with Terminal Road West; provision of signage gantry on Terminal Road South, extension of HGV check-in area including 6 no. booths with a total area of 60sq.m, 6 no. weighbridges and canopy (416sq.m and 7.8m in height). Associated site works including drainage, utility services, fencing, gates and bollards. All development to take place on a site of approx. 7.8 hectares.		
Dublin Port Company 3488/18	Permission for development at the former Asahi Site, Breakwater Road North, Dublin Port, Dublin 1. The development will consist of: the demolition of redundant storage tank including associated pipework; general site clearance; construction of new hard surface including underground drainage and electricity infrastructure; 2 no. CCTV poles (18m high); new lighting (including 2 no. lighting columns 30m high and 9 no. lighting columns 12m high); new 4m high security fence on all boundaries. The development also includes the closure of the existing site access and provision of a 12m wide sliding gate access on Breakwater Road North. All development to take place on a site of approx. 0.3 hectares.	Asahi Site Breakwater Road North Dublin Port Dublin 1	GRANT PERMISSION 06/11/2018
Dublin Port Company 3269/18	The development will consist of: the removal of plinths, fences and vegetation etc; new pavement construction including underground drainage and electricity infrastructure; 2 no. CCTV poles (18m high); new lighting (including 2 no. lighting columns 30m high and 10 no. lighting columns 12m high); new 4m high security fence on western and southern boundaries; new 7.2m high fire wall on the eastern boundary and; a 5m sliding gate as fire access on the south eastern corner of the site. The development will also include the closure of the existing site accesses and modifications to the proposed access permitted under Reg. ref. 3084/16, to provide a 12m wide sliding gate on Breakwater Road North. All development to take	Former Calor Site, Breakwater Road North, Dublin Port, Dublin 1	GRANT PERMISSION 06/11/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	place on a site approx. 0.3 hectares. The application is for a 10 year planning permission. The site of the proposed development is a SEVESO site.		
Dublin Port Company 3657/18	Demolition of three buildings a single storey shed (775sqm and 8m in height); an office building (135sqm and 3m in height); welfare facilities (2.75sqm and 2.6m in height); and general site clearance. The development also comprises; Construction of new hard surface on part of the site (approx. 1,173sqm). All development to take place on a site of approx. 0.6 hectares.	Bord Na Mona Yard Bond Drive Extension Dublin Port Dublin 1	GRANT PERMISSION 06/11/2018
Colin McKean 3586/18	RETENTION: Demolition of a 4sq.m existing 2-storey rear annex; construction of a 2-storey rear extension of 24 sq.m including a kitchen and bedroom; internal layout modifications to the existing plans with two rear roof lights and all associated site works.	28 East Wall Road East Wall Dublin 3	GRANT RETENTION PERMISSION 24/10/2018
Dublin Port Company 3269/18	The development will consist of: the removal of plinths, fences and vegetation etc; new pavement construction including underground drainage and electricity infrastructure; 2 no. CCTV poles (18m high); new lighting (including 2 no. lighting columns 30m high and 10 no. lighting columns 12m high); new 4m high security fence on western and southern boundaries; new 7.2m high fire wall on the eastern boundary and; a 5m sliding gate as fire access on the south eastern corner of the site. The development will also include the closure of the existing site accesses and modifications to the proposed access permitted under Reg. ref. 3084/16, to provide a 12m wide sliding gate on Breakwater Road North. All development to take place on a site approx. 0.3 hectares. The application is for a 10 year planning permission. The site of the proposed development is a SEVESO site.	Former Calor Site Breakwater Road North Dublin Port Dublin 1	GRANT PERMISSION 18/10/2018
Paul McCann & Steve Tennant (Grant Thornton) DSDZ3754/18	Paul McCann and Steve Tennant, Joint Statutory Receivers, acting for the Specified Assets of Henry A. Crosbie c/o Grant Thornton, 24-26 City Quay, Dublin 2 intend to apply for permission for development at a site of 2,382sq.m at the junction of North Wall Quay and East Wall Road, Dublin 1. The site is	The Exo Building Point Village North Wall Quay & East Wall Road Dublin 1	GRANT PERMISSION 15/10/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	bounded by North Wall Quay to the South, East Wall Road to the East, the 3Arena to the West and the Point Village District Centre to the North. The overall site is located within City Block 10, as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of alterations to the permitted development of the Exo Building under Reg. Ref: DSDZ3632/15, DSDZ3686/16 and DSDZ3776/17. The development proposed comprises the following design modifications: 1. Minor alteration to core locations, reconfiguration of the permitted elliptical cores layout including development of mezzanine level in Core 3 and external plant door locations. 2. Reconfiguration of the internal layout of the Glass Box. 3. Minor alterations to Level 8 roof terrace layout, including decrease in external plant of Core 2. 4. Increase of permitted balustrade at Level 8 by 0.5m in height and 1.5m extension in length towards the southern elevation and alterations to the permitted glass canopies at Level 8 and Level 1. 5. Reconfigurations of basement -1, -2 and -3 level including relocation of cycle facilities and some cycle parking with an increase in cycle parking spaces from 300 to 352. 6. Minor increase of lift overrun at level 17. 7. Internal signage located inside glass lobby of Core 1 and 3 and in the Glass Box onto Point Square. 8. These alterations result in a minor increase in overall floor space of 730.2 sq.m. This application relates to a proposed development within the North Lotts & Grand Canal Dock SDZ Planning Scheme Area.		
Dublin Port Company 3540/18	Demolition of a single storey office building (785sq.m); demolition of a maintenance shed building (840sq.m);demolition of reinforced concrete bund and steel tank (42sqm); demolition of boiler room building (25sqm); demolition of sections of northern boundary wall, and all associated general site clearance. The development also includes: Construction of new hard surface including underground drainage infrastructure; new 2.4m palisade security fence on sections of northern and western boundary, and the upgrade of the existing access to provide a 12 m wide sliding gate access on Tolka Quay Road. An existing substation on site will remain in situ. All development to take place on a site of approx. 0.4 hectares.	Calor Office Site Tolka Quay Road Dublin Port Dublin 1	GRANT PERMISSION 18/09/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Dublin Port Company 3314/18	The development will comprise of works to the existing Breakwater Road North and Breakwater Road South to upgrade access to the Dublin Port Operations Centre and the Dublin Ferryport Terminals (DFT), to consist of: re-alignment of traffic lanes and modification of Alexandra Road and Tolka Quay Road junctions to include pedestrian crossings, signage, traffic signals, flexible bollards, barriers, relocation of gate and removal of existing traffic island; provision of Optical Character Recognition system to include traffic lights, camera, barriers and gantry; 2.4m high palisade security fence along the western boundary of the DFT entrance; DFT check points with associated barriers, kiosks and traffic signals and; associated site works including underground drainage and electricity infrastructure. The proposed development will modify lane alignment on Breakwater Road North and Breakwater South, layout of the Breakwater Road North / Tolka Quay Road and the Breakwater Road South / Alexandra Road junctions, remove a bus stop from Breakwater Road North and, relocate a gantry to the north on Breakwater Road North. (As permitted under Reg. Ref. 3084/16) All development shall take place on a total area of c.1.1ha.	Dublin Port lands at Breakwater Road South Dublin Port Dublin 1	GRANT PERMISSION 31/08/2018
Dublin Port Company 3143/18	The construction of a vehicle service/maintenance facility and office accommodation contained in one building (approx. 946sq.m and 7.2m high to eaves/9.8m high) incorporating vehicle service/maintence bays, a store with associated mezzanine, a boiler room, compressor room, nitrogen generator room, switch room, a two storey office area of 260sq.m with offices, meeting/training room, canteen and changing area, toilets, building signage;, solar photovoltaic (PV) system on the south facing elevation, micro louvres on part of east elevation, associated site works; 8 lighting columns (approx. 7m); removal of existing fencing and replace with a 2m high boundary fence along the south, east and west boundaries and a 5.2m high fire wall on the northern boundary and part of eastern and western boundaries of the site and; car parking areas for 55 cars. The development also includes reconfiguration and widening of existing entrances/exits and connection to existing services on Tolka Quay Road. All development to take place on a site of approx.	Calor Tolka Quay Road Dublin Port Dublin 1	GRANT PERMISSION 14/08/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	0.38 hectares. The site of the proposed development is a SEVESO site.		
Paul McCann & Steve Tennant (Grant Thornton) DSDZ3029/18	Paul McCann and Steve Tennant, Joint Statutory Receivers, acting for the Specified Assets of Henry A. Crosbie c/o Grant Thornton, 24-26 City Quay Dublin 2 intend to apply for permission for development at Unit 11 & 12, First Floor, Point Village District Centre, East Wall Road and Sheriff St, Dublin 1. The site is located within the City Block 5 as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of the amalgamation, change of use and extension of Units 11 & 12 as follows; 1. The amalgamation of Unit 11 and Unit 12, located at first floor level , into a single unit of 1197 sq.m (including a new mezzanine floor of 607 sq.m); 2. Change of use of the new unit from previously permitted restaurant to office. The proposed development includes all associated and ancillary works, including site development works.	Unit 11 & 12 First Floor Point Village District Centre East Wall Road and Sheriff St Dublin 1	GRANT PERMISSION 10/07/2018
The Hammond Lane Metal Company 2130/18	Demolition of existing two-storey administration building (534 sq.m); construction of a new two-storey building (563 sq.m) containing an administration area, staff facilities and a non-ferrous metals recovery area; 2 no. 18 m long weighbridges; 1 no. dry wheelwash; car parking; all associated site development works all on a site of 1.79 Ha. This application relates to a development which comprises an activity for which an Industrial Emissions License under Part IV of the EPA 1992 (as amended) is required.	The Hammond Lane Metal Company Ltd., Pigeon House Road, Ringsend, Dublin 4	GRANT PERMISSION 30/04/2018
Dublin Port Company 2994/18	The development will consist of the removal of 16 no. rooflights and the modification and expansion of the existing solar photovoltaic (PV) system on the east-west facing roof of the existing Maintenance and Services Building (M&S Building). The expansion of the array will comprise c. 990 sq.m. of PV modules (c. 605 no panels), inverters, cables and all associated development works within a zone measuring c. 2,140 sq.m. The combined total array will comprise c. 1,152 sq.m. of PV modules (c. 704 no. panels).	Maintenance and Services Building Bond Drive Extension Dublin Port Dublin 1	GRANT PERMISSION 16/02/2018

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Dublin Port Company 4216/17	The development will consist of removal of internal structural and infrastructural elements including vegetation, plinths, fences and bollards; new access roadway including footpath and utility ducting with high strength surface treatment as required; floating dock sections (pontoons) with an area of c.321sq.m clamped to vertical guides which rise and fall with the tide; An access walkway connecting the dock sections and quay walls which shall rise and fall with the tide; 7 no. lighting towers (approx. 15m); 1 no. CCTV pole (c.8m); 2.7m high security fence to the western and northern boundary; 8m wide rolling gate access to the northern boundary; 10 no. ancillary car parking spaces; and all associated site works. All development shall take place on a total area of c. 3,535sq.m.	Located at Northern End of Berth 50 Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 08/01/2018
P McGann and S Tennant Joint Receivers DSDZ3776/17	Permission for development at a site of 2,382sqm.The overall site is located within City Block 10, as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of revisions to permitted development of the Exo Building under Reg. Ref: DSDZ3632/15 and DSDZ3686/16 comprising minor amendments. The development proposed comprises the following design modifications: (i) A 136mm extension to the building on all sides which results in an overall floor space increase of 294.53 sqm; (ii) Reconfiguration of permitted southern core (Core 3) at roof level resulting in a height increase of 0.7m	Site at junction of North Wall Quay and East Wall Road The site is bounded by North Wall Quay to the South East Wall Road to the east 3Arena to the west and the Point Village District Centre to the North Overall site in City Block 10 Dublin 1	GRANT PERMISSION 27/10/2017
JCDecaux Ireland Limited 3310/17	Planning permission for the replacement of the existing 1 no. 96 sheet illuminated static advertising display with 1 no. 96 sheet (12.5m wide x 3.35m high) Premiere internally illuminated advertising display and to permanently decommission and remove 1 no. 48 sheet advertising display at no. 10 Ushers Island, Dublin 8 and 1 no. 48 sheet advertising display at 87 Manor Street, Dublin 7	East Wall Road (South West side opposite Conway House) Dublin 1	GRANT PERMISSION 06/10/2017
Dublin Port Company 3649/17	Development will consist of works which, for the purposes of this application, are designated as being within three Zones: A, B and C. Development within Zone A will consist of	Dublin Port lands at Alexandra Road and	GRANT PERMISSION 11/09/2017

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	removal of all internal structural and infrastructural elements, vegetation, plinths, fences, etc.; new high strength surface treatment including underground drainage, attenuation, water services and electricity infrastructure; new lighting to include 8 no. lighting towers (c. 12 m) and 1 no. lighting tower (c.30 m); 4 m high security fence to the eastern and southern boundary; 8 m wide rolling gate access to the southern boundary and 12 m wide rolling gate access to the eastern boundary; and all associated site works. Development within Zone B will consist of change of use from existing ancillary staff car park to a concrete paved multipurpose yard designed to facilitate established core port activities; removal of all internal structural and infrastructural elements, vegetation, plinths, fences etc.; new high strength surface treatment including underground drainage, attenuation, water services and electricity infrastructure; new lighting to include 1 no. lighting tower c. 30 m; high security fence attached to existing masonry wall along northern boundary to a height of c. 4 m; and all associated site works. Development within Zone C will consist of 12 m wide gate, fence and pedestrian gate all 3 m in height across Alexandra Road and all associated site works. All development shall take place on a total area of c. 11,013 sq.m.	Tolka Quay Road Dublin 1	
Dublin Port Company 2429/17	The development will consist of: The demolition of 3 no. existing buildings comprising Building A (c. 283sq.m), Building B (c. 303sq.m) and Building C (c. 112sq.m) and removal of all structural and infrastructural elements, vegetation, plinths, fences etc; new concrete surface treatment across entire site including underground drainage and electricity infrastructure; 4 no. CCTV (approx. 18m); new lighting (including 6 no. lighting towers (approx. 30m)); new approx. 4m high security fence to northern, eastern and southern (Tolka Quay Road) boundaries; and new substation. An existing substation on site will be retained. The development also includes the closure of the existing (eastern) vehicular entrance and widening of the existing western entrance to provide a 12m sliding gate on Tolka Quay Road. All development to take place on site of approx. 2.8 hectares.	Dublin Port Lands at Tolka Quay Road Dublin 1	GRANT PERMISSION 18/08/2017

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Tedcastles Oil Products 2199/17	Construction of a two-storey operations building of 432 sq.m, an ESB substation of 21.8 sq.m with ancillary transformer and generator and site clearance works. The ground floor of the proposed operations building of 216 sq.m will accommodate welfare facilities, supervisors control room, conference room, electric switch room and stores. The first floor of 216 sq.m will contain the company offices. These and any associated development and works to be undertaken at Yard 1, Promenade Road, Parish of Saint Thomas, Dublin Port, Dublin 1, which is a SEVESO site.	Yard 1 Promenade Road Parish of Saint Thomas Dublin Port Dublin 3	GRANT PERMISSION 18/08/2017
Dublin Port Company 2840/17	A new single storey substation building (approximately 65 sq.m) and all associated site development works. The proposed building comprises a Client LV Switch-room, a client MV Switch-room and an ESB MV Switch-room/ Meter-room.	Ocean Pier Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 18/07/2017
Dublin Port Company 2684/17	The development comprises amendments to the already permitted Dublin Port Road Network Improvement Project (Planning Ref. 3084/16) at no. 2 Branch Road North Extension. The development will consist of: a) Modifications to approved scheme Planning Ref. 3084/16 for Dublin Port Road Network Improvement Project at No. 2 Branch Road North Extension; b) Realignment and narrowing of c. 280 m of Promenade Road to omit 2 no. Right Slip Lanes; c) Reconfiguration of no. 2 Branch Road North Extension from one-way southbound to two-way with primary access from the south and emergency access only from the north; d) Minor modifications to junction of no. 2 Branch Road North Extension with Tolka Quay Road; e) Modifications to TOP Yard 1 boundary and access arrangements to complement proposed TOP Change of Use from office use to Product Storage Tank - Planning Ref. 3820/08/x1; f) Reduction in proposed car parking provision on No. 2 Branch Road North Extension from 50 spaces to 15 spaces, reflecting proposed TOP Change of Use - Planning Ref. 3820/08/x1; g) Associated amendments to services and culvert. The application is for a 10 year planning permission.	Dublin Port Alexandra Road Dublin 1 D01 H4C6	GRANT PERMISSION 20/06/2017

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Topaz Energy Ltd. 4000/16	Change of use from permitted retail use to retail use including the sale of alcohol for consumption off the premises (i.e. off licence use) within the overall retail unit, where the floor area for the off licence use is 9.6 sq.m, and is ancillary to the primary retail use.	Topaz Service Station Bond Drive Extension Promenade Road Parish of St. Thomas Dublin Port Dublin 3	GRANT PERMISSION 03/02/2017
Dublin Port Company 2495/17	Planning permission for the continuance of use of a 110m long 6.5m wide single lane bridge with access ramps over the M50 and a storage area for imported cars and vans and all associated site development and service works as permitted under planning register reference 3788/11.	Site located at Tolka Quay Road Dublin Port Dublin 1	GRANT PERMISSION 03/02/2017
Topaz Energy Ltd. 4000/16	Change of use from permitted retail use to retail use including the sale of alcohol for consumption off the premises (i.e. off licence use) within the overall retail unit, where the floor area for the off licence use is 9.6 sq.m, and is ancillary to the primary retail use.	Topaz Service Station Bond Drive Extension Promenade Road Parish of St. Thomas Dublin Port Dublin 3	GRANT PERMISSION AND RETENTION PERMISSION 31/01/2017
Dublin Port Company 3620/16	The development will consist of: the demolition of 7 no. existing buildings comprising Building 1A- Stack C Warehouse (c. 1,880 sq.m), Building 2A - Temporary Locker Room Portacabin (c. 11 sq.m), Building 2B - Temporary Canteen Portacabin (c. 35 sq.m), Building 2C - Workshop (c. 394 sq.m), Building 2D - Toilet Block (c. 34 sq.m), Building 3A - Store (c. 22 sq.m), and Building 4A - Warehouse (c.1,610 sq.m); and the removal of all structural and infrastructural elements, reinstatement works and all associated site development works on a site area of 1.7 hectares. The development will not include works to the existing road network within Dublin Port.	Part of Dublin Port lands bounded by East Wall Road Promenade Road Tolka Quay Road Alexandra Road and existing Dublin Port lands Dublin 1	GRANT PERMISSION 06/12/2016
Dublin Port Company 3934/16	PERMISSION & RETENTION: Retention permission and permission for development at this site c 1.9 ha at Alexandra Road and No. 3 Branch Road South, Dublin Port, Dublin 1. The development consists of alterations to previously granted planning permission P.A. Reg. Ref. 2310/15. It consists of the retention of: (a) Two sets of gates along the Alexandra Road frontage, (b) The remaining open of No. 3 Branch Road South (a private Road), (c)	Site c 1.9 ha at Alexandra Road and No. 3 Branch Road South Dublin Port Dublin 1	GRANT PERMISSION 06/12/2016

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	Retention of two steelwork reefer access platforms and refrigerated gantries, 3 cctv bases, attenuation tank, 4 lighting masts and luminaires 30 metres high and (d) All associated site works. Permission is also sought for 3 cctv poles up to 18 m high.		
Dublin Port Company 3620/16	The development will consist of: the demolition of 7 no. existing buildings comprising Building 1A- Stack C Warehouse (c. 1,880 sq.m), Building 2A - Temporary Locker Room Portacabin (c. 11 sq.m), Building 2B - Temporary Canteen Portacabin (c. 35 sq.m), Building 2C - Workshop (c. 394 sq.m), Building 2D - Toilet Block (c. 34 sq.m), Building 3A - Store (c. 22 sq.m), and Building 4A - Warehouse (c.1,610 sq.m); and the removal of all structural and infrastructural elements, reinstatement works and all associated site development works on a site area of 1.7 hectares. The development will not include works to the existing road network within Dublin Port.	Part of Dublin Port lands bounded by East Wall Road Promenade Road Tolka Quay Road Alexandra Road and existing Dublin Port lands Dublin 1	GRANT PERMISSION 18/11/2016
Paul McCann&Steve Tennant(Receivers) DSDZ3686/16	Paul McCann and Steve Tennant, Joint Statutory Receivers, acting for the Specified Assets of Henry A. Crosbie c/o Grant Thornton, 24-26 City Quay, Dublin 2 intend to apply for permission for development at this site of 1.1507 ha. The site is bounded by North Wall Quay to the South, East Wall Road to the East, the 3 Arena to the West and the Point Village District Centre to the North. The overall site is located within City Block 5 and 10, as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of revisions to permitted development of the Exo Building under Reg. Ref. DSDZ3632/15 comprising minor amendments. The proposed development comprises the following design modifications: - Relocation of the permitted cycle access ramp from the central core to a dedicated cycle access stair with integral channel to the east of the permitted glass box onto East Wall Road. - Reduction of the permitted -1 basement under the Exo Building from 1588 sq.m to 430 sq.m and relocation of proposed plant, cycle parking and facilities to the existing basement level -1 and -2 beneath the Point Village Square. This will result in a reduction of permitted car-parking spaces from 48 to 42. - Modification to the internal layout of the permitted restaurant/ bar glass box including the incorporation of a controlled lift opening onto the Point Village	Junction of North Wall Quay and East Wall Road Dublin 1	GRANT PERMISSION 03/11/2016

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	Square from the car-parking and bicycle parking at basement -1. - Modification to permitted undercroft of the Exo Building to incorporate new openwork industrial panels at soffit level. - The proposed revisions also include internal layout amendments to permitted cores of the Exo Building which include relocation of escape doors and removal of the mezzanine level in the northern core.		
Dublin Port Company 3551/16	The development will consist of: The erection of a solar photovoltaic ("PV") system on the east-west facing roof of the existing Dublin Port Maintenance and Services (M&S) building. The array will comprise approximately 180sqm of PV modules and associate development including inverters, cables and all associated site development works within a zone measuring approximately 66m x approximately 6.3m (approximately 416 sqm).	Bond Drive Extension Dublin Port Dublin 1	GRANT PERMISSION 21/10/2016
P & O Ferries (Irish Sea) Limited 2784/16	Erection of a detached metal cladded 192 sq.m 7.65m high warehouse structure with 17.4 sq.m link building, all to the north of the existing warehouse/ vehicle maintenance unit adjacent to East Wall Road on lands at P & O Terminal, East Wall Road, Dublin 1.	P & O Terminal East Wall Road Dublin 1	GRANT PERMISSION 19/10/2016
Dublin Port Company 3387/16	The development will consist of: the demolition of 5 no. existing buildings comprising Building A - Bord na Mona Shed (c. 3,236sq.m.), Building B - Rubb Shed (c. 3,042sq.m.), Building C - Doyle Shipping Group Offices (c. 380sq.m.), Building D - Toilet Block (c. 33sq.m.); and Building E - Substation (c. 148sq.m); and; the removal of structural and infrastructural elements, reinstatement works and all associated site development works on a site area of 4.54 hectares.	Ocean Pier Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 14/09/2016
ESB 3052/16	The development will consist of: The provision of a temporary surface car park for a period up to a maximum of five years comprising part of the ESB landholding to provide parking for staff temporally located at the Gateway Building, East Wall Road. The works include provision of 250 temporary car parking spaces; the temporary relocation of the vehicular and pedestrian entrance onto East Wall Road; works to the footpath at the entrance and new road markings	ESB Compound East Wall Road Dublin 1	GRANT PERMISSION 06/09/2016

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	on the East Wall Road; removal of a section of boundary wall and adjoining lean-to sheds; erection of security gates; security hut; lighting and all ancillary site and development works.		
Port Side Investments Ltd 3022/16	Construction of new single storey extension (75 sqmts) to front and side of existing motor showroom along with new glazed curtain walling and wall cladding to front section of existing motor showroom at their existing premises.	Tom Canavan Motors East Wall Road Dublin 3	GRANT PERMISSION 02/09/2016
McDonald's Restaurants of Ireland Ltd 2644/16	Permission for development at the Former Cahill Printworks Site, East Wall Road/Church Road, Dublin 3. The proposed development affects Condition No. 12 of DCC Reg. Ref. 2555/13 (ABP Ref. PL 29N.242804) and will consist of an extension to the operating hours of the permitted drive-thru restaurant on Saturdays, Sundays and Bank Holidays from 08.00 to 22.00 to 07.00 to 23.00 hours.	Former Cahill Printworks Site East Wall Road/Church Road Dublin 3	REFUSE PERMISSION 22/08/2016
McDonald's Restaurants of Ireland Ltd 2645/16	The proposed development relates to the permitted drive-thru restaurant (as granted under DCC Reg. Ref. 2555/13, ABP Ref: PL29N.242804) and will consist of: the provision of signage (elevational, freestanding)and freestanding structures for the drive-thru restaurant including a height restrictor and customer order point with canopy; road markings in the car-park; and roof plant provided behind a louvred screen.	Former Cahill Printworks Site East Wall Road/Church Road Dublin 3	GRANT PERMISSION 06/07/2016
Dublin Port Company 3084/16	The development comprises of works to the Port's private internal road network, and includes works on public roads at East Wall Road, Bond Road and Alfie Byrne Road. The development will consist of: a) Construction of new roads and enhancements to existing roads within the Dublin Port estate north of River Liffey; b) Construction of enhanced landscaping and amenity route along the northern boundary; c) Construction of new pedestrian and cycle overbridge at Promenade Road; d) Construction of access ramps to pedestrian and cycle overbridge at Promenade Road; e) Construction of new pedestrian and cycle underpass at Promenade Road; f) Construction of 11 no. new signage gantries; g) Ancillary construction works, including site clearance, demolitions, earthworks, pavement construction,	Dublin Port Alexandra Road Dublin 1	GRANT PERMISSION AND RETENTION PERMISSION 04/07/2016

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	construction of verges, modifications to accesses, construction of new and amended drainage services, diversion and installation of utility services, installation of road markings and signs and accommodation works; h) Works to existing boundaries and construction of new boundaries; i) Construction of minor works to the junctions of East Wall Road with Tolka Quay Road and East Wall Road with Alexandra Road. The application is for a 10 year planning permission.		
CIE 2160/16	Permission is sought to replace 3 No. existing advertising signs on a site to the western side of the East Wall Rd. adjacent to the junction with Sheriff Street Upper. Sign 1, Replace an existing 13 metre wide x 3.3 metre illuminated tri-vision rotating advertising sign with new a 12.621 metre wide x 3.47 metre internally illuminated advertising display. Sign 2 & 3, Replace 2 No 6.5 metre wide x 3.3 metre illuminated tri-vision advertising signs with 2 No 6.52 metre wide x 3.470 internally illuminated advertising displays erected in a V formation.	Site to the Western side East Wall Road adjacent to the junction with Sheriff Street upper Dublin Port Dublin 3	GRANT PERMISSION 16/06/2016
Dublin Port Company 2567/16	RETENTION: Dublin Port Company intend to apply for retention permission and permission for development at this site c. 4.1 ha. The development consists of alterations to previously granted planning permissions P.A. Reg.Ref. 2310/15 and P.A. Reg.Ref. 3021/15. It consists of the retention of: (a) 4 m high fencing erected in place of demolished defective walls and fences fronting Alexandra Road. (b) Relocation and widening of gates fronting Alexandra Road providing three accesses, one pair of gates totalling 16 m and two gates 9 m wide, all of which are 4 m high. (c) One new 12 m wide gate on Tolka Quay Road and retention of one replacement gate on Tolka Quay Road with a 9 m wide gate, both gates 4 m high. (d) Two no. project notice structures. (e) 6 no. bases for CCTV pole. (f) All associated site works. Permission is sought for 6 no. CCTV poles of up to 18 m high,	Site c.4.1 ha bounded by Alexandra Road Tolka Quay Road East Wall and No. 1 Branch Road North Dublin Port Dublin 1	GRANT PERMISSION 16/06/2016
Gas Networks Ireland 2410/16	Planning permission for 1no. single storey CNG (compressed natural gas) compressor installation with a floor area of 18m2 and 1no. covered shelter with a floor area of 41m2 with associated ground works.	77/78 Bond Drive Extension Promenade Road Dublin 1	GRANT PERMISSION 26/05/2016

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Dublin Port Company 2318/16	The proposed development consists of: a) Demolition of the boundary wall on the south side and of the fence on the east side and replacement with a 4m high fence; b) Added fencing to the existing boundary wall to bring it to an overall height of 4m on the north and west sides; c) Replacement of four existing entrances onto Alexandra Road with two 12 m roller access gates on Alexandra Road; d) Resurfacing; e) 6 no. 30 m high lighting masts and luminaries and 4 no. 18 m CCTV poles; f) An ESB sub-station and associated switchroom to the south west corner; g) An attenuation tank to the north west corner; h) Three 3-4 storey steelwork reefer access platforms and refrigerated gantries; and i) All associated site works.	Texaco Yard Alexandra Road and Tolka Quay Road Dublin 1	GRANT PERMISSION 26/05/2016
Darland Enterprises T/A JP Ryan Trans 2377/16	RETENTION: Retention planning permission for a modification to a previously approved grant of planning permission (DCC Planning Ref:- 3069/13) at their new offices at Bond Drive Extension, Dublin Port, Dublin 3. Darland Enterprises, T/A JP Ryan Transport Ltd wish to apply to retain modifications to the external cladding of the building. The modified external cladding materials comprise metal insulated panels with sections of alternating horizontal panels, tinted windows and other minor alterations.	J.P. Ryan Transport Ltd. Bond Drive Extension Dublin Port Dublin 1	GRANT PERMISSION 11/05/2016
Pat Brennan (Doyle Shipping Group) 2193/16	Refurbishment of an existing 5-storey office building including new external facade insulation and cladding system, elevation alterations, roof plant and roof plant screening, building mounted signage, demolition of an existing one storey side extension and sundry associated works.	Lagan Bitumen site Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 26/04/2016
Lidl Ireland GmbH 2085/16	The proposed development comprises the erection of 1 no. dual-pole mounted, internally illuminated, car park information sign placed at the corner of East Wall Road and Church Road.	Former Cahill Printworks Church Road East Wall Road Dublin 3	GRANT PERMISSION 25/04/2016
Veronica Kennedy 2113/16	Permission sought to demolish existing single storey non compliant extension to rear, and to build new two storey extension to rear, together with new roof to existing front porch.	150 East Wall Road East Wall Dublin 3	GRANT PERMISSION 25/04/2016

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Fingleton White 2552/15	PROTECTED STRUCTURE: Permission for development of an aviation fuel pipeline from Dublin Port, Dublin 1 to Dublin Airport, Co Dublin. The route of the pipeline is from proposed inlet station at Team CV Ltd, Bond Drive, Dublin Port, Dublin 1 and via Bond Drive, Tolka Quay Road, East Wall Road, under the Tolka River, Alfie Byrne Road, Clontarf Road, Howth Road, Copeland Avenue, Malahide Road (R107) and R139 (formerly N32). (It then enters Fingal Co. Council administrative area at Clonshaugh Rd. and routes via AUL/FAI sports ground, under the M1 motorway via the DAA Long Term Red Carpark, adjacent to Eastlands Car Hire Compound, ALSAA complex, under the Swords Road R132 and via Corballis Road to a reception station at Dublin Airport, Co Dublin. A separate application is being lodged concurrently with Fingal County Council in respect of the development proposed in its administrative area). The development will consist of (a) single storey Control Building, pumps and ancillary pipework in a fenced compound at Bond Drive, Dublin Port, Dublin 1 (b) a 200mm diameter continuously welded steel pipeline, laid generally in the public road at a depth of circa 1.2m below surface level except where it will pass under the Tolka and Santry Rivers and culverted streams. The length of the pipeline in Dublin City Council administrative area will be circa 11.4 km (total length will be circa 14.4 km.) (c) 2no. above-ground control boxes associated with emergency shut-down valves on the pipeline, at the junction of the Malahide Road R107 and Donnycarney Road and on the R139 (formerly N32) east of the junction with Clonshaugh Road South. The pipeline will be laid in the roadway under the Clontarf Bridge which is a protected structure. An Environmental Impact Statement and Natura Impact Statement have been prepared in respect of the application and will be submitted with the planning application.	Inlet Station: Team CV Bond Drive Dublin Port Dublin 1 to Dublin Airport Co. Dublin	GRANT RETENTION PERMISSION 13/04/2016
Dublin Port Company 2034/16	RETENTION: The development involves alterations to previously granted permissions under P.A. Reg. Ref. 2310/15 and P.A. Reg. Ref. 3022/15and consists of: (a) On the Promenade Road frontage: a 4 metre-high fence and a 9m wide roller access gate. (b) On the eastern side: added fencing to the existing boundary wall to bring it to an overall height of 4 metres. (c) On the No.2 Branch z\oad frontage:	2 Branch Road North Tolka Quay Road and Promenade Road Dublin Port Dublin 1	GRANT RETENTION PERMISSION 13/04/2016

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	a 9m wide roller access gate and 4 metre-high fence. (e) On the western side: a 4 metre-high fence.		
Topaz Energy Ltd 4337/15	The proposed development will consist of alterations to existing entrance as follows: (1) removal of part of existing dwarf wall and (2) installation of new entrance kerbs and (3) all associated development works.	Sites 77&78 Bond Drive Extension/Promenade Road Parish Of St. Thomas Dublin 1	GRANT PERMISSION 08/04/2016
Paul McCann & Steve Tennant (Grant Thornton) DSDZ3632/15	Paul McCann and Steve Tennant, Joint Statutory Receivers, acting for the Specified Assets of Henry A. Crosbie c/o Grant Thornton, 24-26 City Quay, Dublin 2 intend to apply for permission for a development at a site of 1.1507 ha at the junction of North Wall Quay and East Wall Road, Dublin 1. The site is bounded by North Wall Quay to the South, East Wall Road to the East, the 3Arena to the West and The Point Village District Centre to the North. The overall site is located within City Block 5 and 10, as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of the following: Construction of a commercial office building ranging in height from 8 storeys to 17 storeys (including one level of plant) at the northern end. The total gross floor area above ground of this building will be circa 19263 sq.m. The building is raised at ground level to 8m and supported by three elliptical cores. Access via dedicated northern and southern glass entrance foyers. As part of the development there will be an external roof terrace and plant at eighth floor level. Construction of one level of basement beneath the proposed commercial building connecting to the existing constructed basement beneath the Point Village Square (as constructed under Section 25 DD478) accommodating 300 bicycle parking spaces, plant, staff facilities, storage areas and other associated facilities. Cycle access to the basement will be via a dedicated, access controlled cycle ramp in the central core. Reconfiguration of the existing basement level -1 beneath the Point Village Square to facilitate 48 No. car parking spaces at -1 level, plant, storage areas and other associated facilities. This will also involve associated structural reconfiguration of existing basement levels -2	The Exo Building Point Village District Centre North Wall Quay & East Wall Road Dublin 1	GRANT PERMISSION 24/03/2016

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	and -3. Vehicular access to the basement will be via the existing ramped access on Sheriff St servicing the Point Village District Centre. The reconfiguration of the basement will involve the removal of the existing external stairs from the Point Village Square to existing underground bar located at -1 level. Construction of 14.5m high restaurant/bar glass box with mezzanine level located within the Point Village Square. The total above ground gross floor will be circa. 519.4 sq.m. Permission is also sought for revisions to the Point Village Square Public Realm including proposed hard and soft landscaping works. This includes a new bus shelter, taxi shelter, 5 number glass screens and the relocation of existing Point Village Signage on East Wall Rd. The proposed development includes all associated and ancillary works, including site development works.		
Paul McCann and Steve Tennant DSDZ2141/16	Paul McCann and Steve Tennant, Joint Statutory Receivers, acting for the Specified Assets of Henry A. Crosbie c/o Grant Thornton 24-26 City Quay, Dublin 2 intend to apply for permission for development at Unit 27, Point Village District Centre, East Wall Road and Sheriff Street, Dublin 1. The site is located within City Block 5 as identified in the North Lotts & Grand Canal Dock SDZ Planning Scheme. The development consists of the sub-division, change of use and external amendment to Unit 27 as follows: 1. The subdivision of existing Unit 27 into 1 no. retail unit of 85 sq.m and 1 no. unit of 4 sq.m; 2. Change of use of the new unit of 4 sq.m to a LUAS welfare facility; and 3. Alterations to the facade of Unit 27 by removal of double doors and replacement with single access door and glazed panel to new LUAS welfare facility. The proposed development includes all associated and ancillary works, including site development works.	Unit 27 Point Village District Centre East Wall Road and Sherrif Street Dublin 1	GRANT PERMISSION 21/03/2016
Montgomery Transport Ltd 2809/15	Application for permission under planning legislation to remove/demolish a number of small structures from site and demolish a rear section to the main building for the purpose of constructing a new single storey extension to an existing steel frame distribution warehouse facility and reclad the exterior of the existing warehouse unit to match the proposed extension. The extension is to the rear of the existing site adjacent to Bond Road and the existing vehicular entrance is maintained. All	Montgomery Transport Ltd 3 Bond Road Dublin Port Dublin 3	GRANT PERMISSION 06/01/2016

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	existing hardstanding and external car parking to the front of the existing building are to be retained.		
Euro Car Parks (Ireland) Ltd 3653/15	Permission sought for a Parking Guidance Information Sign for The Point Village underground car park, Upper Sheriff Street, by Euro Car Parks (Ireland) Ltd. It shall be internally illuminated, single sided, 1800mm wide X 750mm high mounted on a post, overall height 3350mm.	In the pavement at East Wall Road Adjacent to the Dublin Port Compnay Building Dublin 1	GRANT PERMISSION 06/01/2016
James Kelleher, Estates & Facilities (Dublin Port Company Ltd) 3452/15	Permission for development at Port Centre, on a 1.7ha site bounded by Alexandra Road & East Wall Road, Dublin 1. The development will consist of Landscape and associated civil engineering works to the Port Centre Precinct to contribute to the public realm and to accommodate the relocation of the existing carpark from the Alexandra Road site boundary to an area south of the Port Centre Building bounded by the East Wall Road including demolition of the existing redundant single storey building, Port Centre vehicular entrance wing walls and the two storey office block all on Alexandra Road, existing internal site concrete block carpark boundary walls, part demolition of the existing East Wall Road stone wall (approx. 35m length) & existing East Wall boundary wall currently concealed behind hoarding (approx. 32.5m length) and construction of - 1) Proposed 24.5m length of 4m high stone wall and 25m length 4m high metal clad boundary walls with vehicular and pedestrian gates to Alexandra Road including inter alia the sensitive relocation and refurbishment of the existing Marian statue on the Alexandra Road. 2) Proposed 4m high pedestrian "Turn-stile" access gates to north of Port Centre Plaza on the East Wall Road with integrated artwork. 3) Proposed 3.75 - 5.6m high metal clad boundary sculptural wall with integrated signage south of Port Centre Building to East Wall Road to enclose the relocation of an existing crane structure (Crane no. 292,Stothert & Pitt ten tonne crane, approximately 34m tall) behind East Wall Road boundary south of Port Centre building as a new landmark and an example of Dublin Port's Industrial Heritage which will be illuminated and	Port Centre a 1.7ha site bounded by Alexandra Road & East Wall Road Dublin 1	GRANT PERMISSION 13/11/2015

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	protected with anti climb features. 4) Proposed 4m high east & south internal site metal railings creating new site boundaries that will redefine the extent of the Port Centre Precinct and carpark. 5) Proposed carpark area to accommodate the relocation of the 118no. existing car spaces south of the Port Centre building with associated internal road link from the existing Alexandra Road vehicular entrance with a total of 6no. accessible carspaces available within Port Precinct. 6) Proposed external pedestrian and wheelchair accessible sculptural ramp structure adjacent to the southern elevation of the Port Centre Building, serving the Podium level of the Port Centre from the relocated carpark on the southern boundary spanning over the landscaped garden, approximately 38m long. 7) New bicycle & motorcycle shelter structure to the west of the Port Centre Building & 8no. bike lockers with a 3m high metal screen north of the Port Centre Building. 8) Installation of new art work to the Port Centre Podium & 2no. Wind sculptures to the Plaza north of Port Centre Building. 9) Proposed 1.1m high guarding with handrail to be fixed to the existing Podium perimeter upstand to all sides of the Port Centre Building. 10) New external lighting scheme throughout and relocation of the existing external generator from the east facade of the Port Centre Building to the lower ground level of the external moat to the south of Port Centre.		
Dublin Port Company 3532/15	The development will consist of removal of existing vehicular gate and fencing fronting Alexandra Road, creating an open vehicular access, erection of new palisade fences measuring 2.7 m high and erection of new tri folding gates at southern end of site.	R & H Hall No. 1 Branch Road Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 05/11/2015
LIDL (Ireland) GmbH 3153/15	ESB substation attached to previously approved development (Reg. Ref. 2555/13) on site of 0.9h	Site of 0.9h at the Former Cahill Printworks Church Road East Wall Road Dublin 3	GRANT PERMISSION 30/09/2015
Dublin Port Company 3021/15	The development will consist of; (a) the demolition of two warehouses having a total area of 1335 sq.m. (b) the erection of new 4 metre high boundary fence fronting Tolka Quay Road and new fencing fixed to the existing boundary wall fronting East Wall Road to bring	Site at the corner of Tolka Quay Road and East Wall Road Dublin 1.	GRANT PERMISSION 21/09/2015

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	the overall height of the boundary to 4 metres, (c) the incorporation of the site into the adjacent site located to the east and south, (d) the construction of new reinforced concrete surfacing and new replacement drainage and water system and associated ancillary works.		
Dublin Port Company 2651/15	The development will consist of the erection of two sets of gates 12 metres wide and side fences (each set incorporating a pedestrian gate) 4 metres high above pavement level across Alexandra Road.	Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 04/09/2015
James Kelleher (Dublin Port Company) 2982/15	Planning permission for a) a change of use from a canteen to a new port related seafarers reception centre facility, and b) modifications to the existing building. The modifications to the existing single storey building consist of the demolition of the existing 6.4m2 single storey lobby extension, minor modifications to the parapet and windows to the east and north elevations, new 11m2 glazed single storey entrance lobby, new canopy, new roof mounted PV panels, 2 no new self-illuminated signs to the north elevation, a new pedestrian and vehicular gate, new boundary wall with railings, and associated site works.	Former Odlums factory site Alexandra Road Dublin Port Dublin 1	GRANT PERMISSION 04/09/2015
Dublin Port Company 3022/15	The development will consist of: (a) the removal of a vehicular gate fronting Promenade Road , Dublin Port, Dublin 3 and replacement with new 4 metre high fence. (b) the erection of new 4 metre high fences in place of defective or inadequate fencing on three sides of the site. (c) the incorporation of the site into the adjacent site located to the east and (d) the construction of new re-enforced concrete surfacing and new replacement drainage and water system and associated ancillary works.	Site of c. 0.256 ha at Promenade Road Dublin Port Dublin 3	GRANT PERMISSION 04/09/2015
Irish Ferries Ltd. 2596/15	The development will consist of the relocation of the existing vehicular and pedestrian entrances off Breakwater Road South to a new location off Breakwater Road South, alterations to the existing layout of the road and pavements and all ancillary site works.	DFT Lo-Lo Terminal, Breakwater Road South, Dublin 1	GRANT PERMISSION 10/07/2015

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Dublin Port Company 2310/15	The development will consist of the erection of new fencing fixed to the existing boundary walls to bring the overall height of the boundaries to 4 metres, the erection of new 4 metre high fences in place of existing defective or inadequate fencing and walls, the erection of new replacement gates to a height of 4 metres, the erection of 16 no. 30 metre high lighting masts and luminaries, the incorporation of 3 Branch Road South (a private road) into the adjoining quayside goods handling area, the construction of new re-enforced concrete surfacing and new replacement drainage and water supply system and associated ancillary works.	Site of c. 11.1 hectares at East Wall Road Alexandra Road 1 Branch Road North Tolka Quay Road 3 Branch Road South 2 Branch Road North and Promenade Road Dublin Port Dublin 1 & Dublin 3	GRANT PERMISSION 08/07/2015
Dublin Port Company PL29N.PA0034	The development includes the following: • Redevelopment of Alexandra Basin West including demolition of part of North Wall Quay Extension and its reconfiguration, new quay walls, dredging as well as remediation of contaminated materials, infilling of Graving Dock No.2, provision of new berths and conservation measures including the excavation of Graving Dock No.1 and the construction of an interpretive centre on North Wall Quay Extension. • The infilling of Berths 52 and 53 at the eastern end of the Port and the provision of new landside and berthing facilities. Dredging of the approach channel and provision of a marina protection structure to the north of the Poolbeg Yacht, Boat Club and Marina.	Dublin Port, Alexandra Road, Dublin1.	GRANT PERMISSION 08/07/2015
Yahoo! EMEA DSDZ3620/14	The development will consist of a proposed, internally lit, external sign to top of existing office entrance canopy at ground floor and proposed strip lighting to exterior of two existing stair cores on east facade. This application relates to a proposed development within the North Lotts & Grand Canal Dock SDZ Planning Scheme area.	Office Accommodation at Ground 5th 6th and 7th Floors Point Village East Wall Road Dublin 1	GRANT PERMISSION 16/12/2014
Topaz Energy Limited 3221/14	Permission for development at New Topaz Terminal, Promenade Road, Dublin Port, Dublin 3, bounded to the south by Tolka Quay Road, to the west by TOP Yard 2, and to the east by an access lane. The development will consist of modifications to previously approved planning	New Terminal - Topaz Energy Limited Promenade Road Dublin Port Dublin 3	GRANT PERMISSION 22/10/2014

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	permission, Reference 3171/12. The modifications will consist of the following: 1. Re-designation of Tank 6 (T406) to store Jet A 1/Kerosene instead of Ethanol; 2. Re-designation of Tanks 7 and 8 (T407 and T408) to store ethanol instead of unleaded gasoline (ULG); 3. Tanks 1, 2, 3, 4, 5 and 6 to be located in one Bund instead of two bunds; 4. Tanks 7, 8 and 9 to be double-skin tanks with a single bund wall instead of single-skin tanks with two bund walls; 5. Deletion of the 3m high secondary containment (inner) concrete wall around Tanks 7, 8 and 9; 6. Reduction of the height of the tertiary containment concrete walls of the bunds and of the perimeter walls from 3 metres to 2 metres. There will also be palisade fencing on the boundary. These changes will reduce the storage capacity for Class I liquids by approximately 30 %. The total storage capacity of all hydrocarbons will be unchanged. The development will be an Upper Tier Seveso site and comes within the meaning of Part 11 of the planning regulations. An Environmental Impact Statement and a Natura Impact Statement will be submitted to the planning authority with the planning application and the EIS and NIS will be available for inspection or purchase, at a fee not exceeding the reasonable cost of making a copy, during office hours, at the offices of Dublin City Council.		
Dublin Port Company Ltd 2753/14	To erect 60m of replacement boundary wall to its property at East Wall Road Dublin 1. It is proposed to demolish 40m of existing wall deemed to be structurally unstable and a portion of abutting wall. The proposed replacement wall will comprise an outer skin of galvanised mild steel mesh of cavity of 700mm min and an inner wall constructed of stone filled gabions and integrated plant propagation elements and dry stone limestone facing to East Wall Road.	Dublin Port East Wall Road Dublin 1	GRANT PERMISSION 08/09/2014
Burke Shipping Group 3140/14	The development will comprise the provision of a ship to shore (STS) gantry crane and all ancillary works.	Berths 38-40 Alexandra Quay East Dublin Port Dublin 1	GRANT PERMISSION 08/09/2014

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
Dublin Port Company 2860/14	Demolish 3 No. warehouses, an office and out-buildings having a total area of 4227 sq. metres as well as internal site fencing.	Former Chetham Timber Co. Ltd and Heiton Buckley Sites Promenade Road Dublin 3	GRANT PERMISSION 08/09/2014
Dublin Port Company Ltd 2753/14	To erect 60m of replacement boundary wall to its property at East Wall Road Dublin 1. It is proposed to demolish 40m of existing wall deemed to be structurally unstable and a portion of abutting wall. The proposed replacement wall will comprise an outer skin of galvanised mild steel mesh of cavity of 700mm min and an inner wall constructed of stone filled gabions and integrated plant propagation elements and dry stone limestone facing to East Wall Road.	Dublin Port East Wall Road Dublin 1	GRANT PERMISSION 21/07/2014
Dublin Port Company 3746/13	To demolish 3 no. derelict structures having a total area of 691 sq.m and erect 6 no. floodlight masts 25 metre high with floodlights, single-storey offices, control booth and toilets having a total area of 68sq.m and new 4 meter high fencing at its storage site.	Dublin Port Company Storage Site (Formally ESB Storage Site) East Wall Road Dublin 3	GRANT PERMISSION 21/07/2014
Anne Flood and Paul Flood 2467/14	RETENTION: Retention of change of use of 33 Blythe Avenue, East Wall, Dublin 3 from ancillary family accommodation to 55 Arbour Mews Church Road, East Wall, Dublin 3 (permitted under previous permission Reg. Ref 4441/04) to a separate single dwelling unit. Permission is also sought for the provision of 24 square metres of open space for each house and ancillary site works.	33 Blythe Avenue and 55 Arbour Mews Church Road East Wall Road Dublin 3.	GRANT PERMISSION AND RETENTION PERMISSION 08/07/2014
Mr Marten Knol 2243/14	Demolish existing non-compliant single storey extension to rear of existing dwelling and to build new two storey extension to rear and to convert existing attic space to bedroom with dormer window to front and dormer extension to rear together with internal alterations.	166 East Wall Road East Wall Dublin 3	GRANT PERMISSION 20/05/2014
Darland Enterprises 3069/13	To construct a new 2 storey office block with attic storage. The proposed new detached office to comprise an open plan design, total floor area 488sq.m over Ground and First floors, with 242 sq.m attic storage. Included also reception area for Customers and Drivers, additional car parking (15 no. plus 2 no. disabled), smoking shed, parameter footpaths and associated facilities, signage and features. In addition	J.P Ryan Transport Ltd Bond Road Extension Dublin Port Dublin 1	GRANT PERMISSION 12/05/2014

Applicant & Dublin City Council Planning Application Reference No. (ABP Reference No. where applicable)	Summary Description of Development	Location of Development	Outcome & Final Grant Date
	Planning Permission is sought to demolish the existing offices, located at the same site area.		
Lidl Ireland Gmbh 2555/13	For a mixed use development to be constructed over 2 no. blocks (A & B) and totalling 6,258sqm gross floor space on a site of 0.9 hectares. The proposed development comprises Blocks A & B fronting East Wall Road and Church Road and arranged around surafce car parking to the rear (118 spaces) with a proposed new vehicular access off Church Road; Block A is upto 4 storeys in height with a ground floor area of 1,980 sqm incorporating a Licensed Discount Foodstore (with a net retail sales area of 1,280sqm) first floor gym/leisure facility of 1,887sqm and second and third floor office space of 974 & 241 sqm respectively ; Block B is 2 storey in height and comprises a drive-thru restaurant over two floors of 655sq.m a ground floor retail unit of 151 sqm. first floor office of 149 sqm and associated access, servicing, plant circulation and waste storage areas totalling 221 sq.m. The development will also comprise the demolition of remaining boundary structures and external walls of former print works in connection with a previous permission for demolition and redevelopment (under Dublin City Council Planning Ref: 6608/06), closure of 2no. former vehicular access points off Church Road, the provision of 32no. cycle parking spaces, the erection of associated advertisement signage, the provision of new pedestrian access and circulation areas, boundary treatments, hard and soft landscaping, lighting, connections to drainage and water services and all other ancillary and associated works.	Former Cahill Printworks Church Road East Wall Road Dublin 3	GRANT PERMISSION 06/05/2014
Aldi Stores (Ireland) Limited 3752/13	RETENTION: For an internally illuminated external sign of 5.12sq.m on the rear elevation and permission for an internally illuminated external sign of 5.12sq.m on the side (east) elevation, and two internal non-illuminated signs (64.33sq.m and 58.44 sq.m) on the front elevation.	Aldi Store East Wall Road Dublin 3	GRANT PERMISSION AND RETENTION PERMISSION 04/04/2014

4.0 ALTERNATIVES

4.1 INTRODUCTION

EIA legislation and the prevailing guidelines and best practice require that EIA Reports describe reasonable 'alternatives' for projects with regard to their environmental effects addressing:

- Do Nothing Alternative;
- Alternative project locations;
- Alternative layouts/designs;
- Alternative processes/technologies; and
- Alternative mitigation.

This chapter describes the alternatives that were considered for the proposed development, where applicable, under each of these headings and the reasons for the selection of the chosen option including consideration of environmental effects.

4.2 DO NOTHING ALTERNATIVE

The United Kingdom has withdrawn from the European Union and will withdraw from the EU single market and customs union once the transition period expires (currently 31st December 2020). As a non-EU country, goods entering the State from the United Kingdom will require checks and controls in line with EU legislation. Certain goods and trade consignments being exported to, or through, the United Kingdom will also need interventions that must be carried out at the port. The proposed development will provide the infrastructure for the relevant State agencies to carry out these checks and controls.

The relevant EU legislation states that the necessary checks and controls must be carried out at a designated point of entry for those goods. Dublin Port is currently a designated point of entry for non-EU goods and there are facilities in place within the port to carry out the checks and controls on those goods. However, the volume and type of goods which currently enter the State from the UK mean that the current facilities for non-EU trade would not be sufficient to cope with the increased volumes.

In this scenario, the "do nothing alternative" cannot be considered a viable alternative. The State has an obligation to protect the integrity of the European Single Market. In order to do so, the State must ensure that there is sufficient infrastructure in place so that the necessary checks and controls can be effectively managed. Furthermore, any shortfall in facilities would lead to a backlog of consignments needing clearance before exiting the Port. This could lead to widespread disruption of traffic within the Port, within the wider road network and on the seas.

4.3 ALTERNATIVE PROJECT LOCATIONS

As discussed above and in Chapters 1 and 3, the proposed development is required to facilitate checks and controls on goods entering and exiting Ireland to and from the United Kingdom and other third countries via Dublin Port. Under the relevant EU legislation, the Border Control Post must be situated at the designated point of entry which, in this case, means it must be located within the confines of Dublin Port.

As part of the planning application for the proposed development, the Commissioners of Public Works in Ireland, on behalf of the Applicant, undertook an assessment of a number of potential alternative project locations in order to determine the most appropriate location for the proposed development. This assessment was limited to sites within Dublin Port, as per the EU regulations.

The location of the proposed development within Dublin Port was selected due to the area of available land at the chosen development site to facilitate 205 no. HGV parking spaces, as well as warehouse facilities, public offices, administrative buildings and other facilities required. At 5.4 hectares, the proposed development site provides sufficient space to provide for these aspects of the proposed development. Furthermore, it should be highlighted that there were no other sites available in Dublin Port within the strict timeline with this quantum of land available for development, and that there is little prospect of additional landholdings becoming available due to active leaseholds being held on the sites. The selected site is therefore the only viable location on which to develop the required infrastructure.

4.4 ALTERNATIVE LAYOUTS/DESIGN

The chosen layout was selected due to its efficient use of the available land on site. It was deemed that there was no significant environmental effect associated with any arrangement of the facilities on site, and as such the chosen layout was selected in terms of providing efficiency in terms of turnaround of vehicles entering for checks and controls.

4.5 ALTERNATIVE PROCESSES/TECHNOLOGIES

Processes at the proposed development will consist of the necessary checks and controls on trade to ensure Ireland can meet its obligations following the end of the transition period. These checks and controls will be carried out in accordance with relevant EU Regulations and national legislation. Technological solutions, such as the use of Automated Number Plate Recognition systems, will run in tandem with the infrastructure developments to ensure maximum efficiency and flexibility.

Where a relevant technological feature has been identified as a requirement by the client, it has been incorporated into the design. The proposed development will take advantage of the most up-to-date technologies such as high-efficiency lighting (e.g. LEDs), motion detection sensors to activate lighting in areas as required. As this infrastructure reaches the end of its service life, it will be replaced with the most technologically advanced infrastructure available at that time, insofar as reasonably practicable.

4.6 ALTERNATIVE MITIGATION

For each aspect of the environment, each specialist has considered the existing environment, likely impacts of the proposed development and reviewed feasible mitigation measures to identify the most suitable measure appropriate to the environmental setting of the project design. In making a decision on the most suitable mitigation measure the specialist has considered relevant guidance and legislation. In each case, the specialist has reviewed the possible mitigation measures available and considered the use of the mitigation in terms of the likely residual impact on the environment. The four established strategies for mitigation of effects have been considered: avoidance, prevention, reduction and offsetting (not required in this development). Mitigation measures have also been considered based on the effect on quality, duration of impact, probability and significance of effects.

The selected mitigation measures are set out in each of the EIA Report Chapters 5-16 and are summarised in the outline Construction Environmental Management Plan (CEMP) included in Chapter 1.

4.7 CONCLUSIONS

As a result of the decision by the United Kingdom to leave the European Union’s single market and customs union, additional infrastructure is required in Dublin port to enable the relevant State agencies to carry out additional customs, SPS and health checks and controls.

Under the relevant EU legislation, checks and controls on non EU goods are a requirement. The additional capacity delivered by the proposed development is essential to ensure they can be carried out in an efficient manner, minimising disruption of trade through the Port while meeting Ireland’s obligations as a member of the Single Market and protecting public, animal and plant health. Furthermore, the development must be situated within the confines of the Port. The selected site fulfils that requirement.

The selected site is also an ideal location for the proposed development from both an environmental perspective and a planning perspective.

The site is currently zoned for Employment (Heavy) use and is therefore in keeping with the policies and objectives of the Dublin City Council Development Plan (see Chapter 3). The site is zoned as “lands currently used for Non-Core Activity for Future Redevelopment” and “Multi-Purpose Transit Storage” in the Dublin Port Masterplan 2018 – 2040 and as such is highly in keeping with the proposed development.

The siting of the proposed facility within the port and near the ferry terminal as well as the overall design of the facility, have been selected based on a suitably comprehensive assessment of reasonable alternative site locations and layouts. The site has the required infrastructure readily available for the development.

In conclusion it is considered that the proposed site has significant capacity to meet the requirements of a Border Control Post.

5.0 HUMAN HEALTH AND POPULATION

5.1 INTRODUCTION

This chapter evaluates the impacts of the proposed development on population and human health.

In accordance with the Draft EPA EIA Report Guidelines (2017) and EPA Draft Advice Notes for EIS (2015), this chapter has considered the *"existence, activities and health of people"* with respect to *"topics which are manifested in the environment such as employment and housing areas, amenities, extended infrastructure or resource utilisation and associated emissions"*. Natural hazards are considered in Chapter 2 (Section 2.7) and Chapter 6. Issues examined in this chapter include:

- Demography;
- Population;
- Employment;
- Social Infrastructure;
- Landscape, Amenity and Tourism;
- Natural Resources;
- Air Quality;
- Noise & Vibration;
- Material Assets;
- Traffic; and
- Health and Safety.

Where these topics are dealt with in further detail elsewhere in this EIA Report, the relevant chapters have been cross referenced in this Chapter.

5.2 METHODOLOGY

As per Article 3 of 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:

"*1. The environmental impact assessment shall identify, describe, and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) population and human health;
(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
(c) land, soil, water, air and climate;
(d) material assets, cultural heritage and the landscape;
(e) the interaction between the factors referred to in points (a) to (d).

2. 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."

A 2017 publication by the European Commission, *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report*, considered that:

"*Human health is a very broad factor that would be highly Project dependent. The notion of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study. In addition, these would concern the commissioning, operation, and decommissioning of a Project in relation to workers on the Project and surrounding population*."

This chapter will follow these EC guidelines, and will examine the health effects relevant to the proposed development as they relate to a relevant, defined Study Area. The effects of the proposed development on the population and human health are analysed in compliance with the requirements of the EPA Draft EIA Report Guidelines 2017.

5.2.1 Assessment of Significance & Sensitivity

The assessment of significance is a professional appraisal based on the sensitivity of the receptor and the magnitude of effect.

Within any area, the sensitivity of individuals in a population will vary. As such, it would be neither representative of the population, nor a fair representation of the range of sensitivities in a population, were an overall sensitivity classification assigned to the population in question. As such, the precautionary principle has been adopted for this assessment, which assumes that the population within the Study Area is of a uniformly high sensitivity.

5.2.2 Magnitude of Impact

The magnitude of predicted impacts has been quantified in this assessment using the terms outlined in Table 5.1 below:

Table 5.1 Magnitude of Predicted Impacts

Magnitude	Description of Magnitude
High	Change in an environmental and/or socio-economic factor(s) as a result of the proposed development which would result in a **major change** to existing baseline conditions (adverse or beneficial)
Medium	Change in an environmental and/or socio-economic factor(s) as a result of the proposed development which would result in a **moderate change** to existing baseline conditions (adverse or beneficial)
Low	Change in an environmental and/or socio-economic factor(s) as a result of the proposed development which would result in a **minor change** to existing baseline conditions (adverse or beneficial)
Negligible	Change in an environmental and/or socio-economic factor(s) as a result of the proposed development which would not result in change to existing baseline conditions at a population level, but may still result in an individual impact (adverse or beneficial)
No change	No change would occur as a result of the proposed development which would alter the exiting baseline conditions (adverse or beneficial)

5.2.3 Significance of Effects

The assessment of significance of effects in this assessment is a professional appraisal and has been based on the relationship between the magnitude of effects (Section 5.2.2) and the sensitivity of the receptor. Table 5.2 below provides a matrix on the measure of the significance of effects based on these parameters.

Table 5.2 Matrix illustrating the significance of effects as determined by the relationship between the magnitude of impact and the sensitivity of receptors

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Negligible**	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible or minor	Minor	Moderate	Moderate or major
	High	Minor	Minor or moderate	Moderate or major	Major

5.3 RECEIVING ENVIRONMENT

The subject sites of the proposed development are c. 5.4 hectares in extent and are located at Bond Drive Extension and Yard 3, Bond Drive Extension and Yard 4, Promenade Road, Dublin Port, Dublin 3. (Refer to Figure 1.1).

The site is bound by Dublin Bay to the north, and developed industrial Dublin Port lands to the east, west and south. The nearest residential noise sensitive locations are located some 800m across the Tolka Estuary to the north of the site.

The nearest European sites are South Dublin Bay and River Tolka Estuary SPA (Site Code 004024), which is located along the coast approximately 300 m to the north of the proposed Project, and North Bull Island SPA (Site Code 004006), which is located approximately 1.28 km east north east of the proposed Project. Also within relatively close proximity to the proposed site are North Dublin Bay SAC (Site Code 000206) and South Dublin Bay SAC (Site Code 000210).

The surrounding area is described in further detail in Chapter 2 (Description of the Proposed Development).

5.4 STUDY AREA

The Study Area selected for the assessment of the impact on human health as a result of the proposed development was defined as the Electoral Divisions (ED) of North Dock B (ED 02077), North Dock A (ED 02076), North Dock C (ED 02078), Pembroke East A (ED 02125), Clontarf East D (ED 02040) and Clontarf East C (02039), Clontarf West C (ED 02044) and Clontarf West D (ED 02045). The Study Area is presented in Figure 5.1 below.

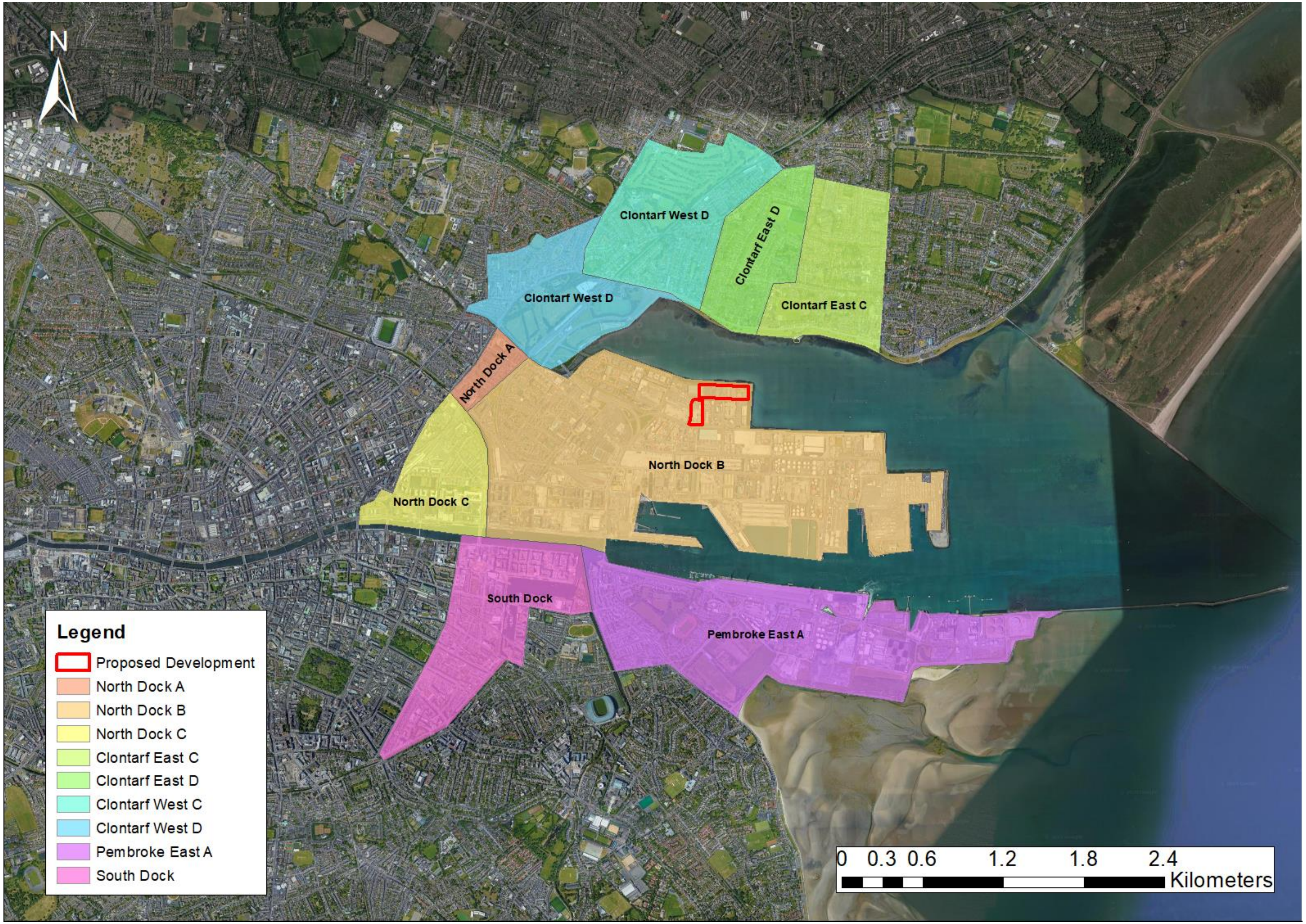

Figure 5.1 Map illustrating the selected Study Area for the Proposed Development

5.5 EXISTING BASELINE CONDITIONS

5.5.1 Population and Demographics

The most recent census of population was carried out by the CSO on the 24th of April 2016. The previous census was completed on the 10th of April 2011 and before that on 23rd April 2006. The census compiles data for the whole state as well as smaller individual areas including counties, cities, towns and electoral divisions. Taking into consideration the location of the proposed development, the census information on population, age profile, employment and social class, has been analysed in relation to the Dublin City Council Region.

The latest census data shows that the population in the Dublin City Council (DCC) area grew by 5.1% between the years 2011 and 2016 compared with 3.8% nationally. The average rate of population growth across the Study Area was 5.2%, the electoral division for the site, saw a higher rate of growth with an increase of 10.4% (Table 5.3). Projections for the national and the county populations are predicted to continue this trend of moderate to high population growth into the short-term future.

Table 5.3 Population change at National, primary and secondary hinterland level from 2011 – 2016 (*Source:* www.cso.ie)

Area	2011	2016	% Change 2011-2016
State	4,588,252	4,761,865	+ 3.8%
Dublin City	527,612	554,554	+ 5.1%
North Dock B	6,895	7,695	+ 10.4%
North Dock A	1,303	1,365	+ 4.5%
North Dock C	4,345	4,214	- 3.1%
Pembroke East A	4,929	5,078	+ 2.9%
South Dock	7,129	7,004	- 1.8%
Clontarf East C	3,113	3,183	+ 2.2%
Clontarf East D	2,673	2,766	+ 3.4%
Clontarf West C	3,366	3,659	+ 8.7%
Clontarf West D	2,066	2,297	+ 10.1%
Study Area (Mean)	3,980	4,140	+ 5.2%

Age Profile

The age profile of the population in the area is an important parameter as it provides a good insight into the potential labour force, the demand for schools, amenities, other facilities and the future housing demand.

Table 5.4 shows the age profiles Nationally and in Dublin City for 2016.

Table 5.4 Age profile at National and County level 2016 (*Source:* www.cso.ie)

Area	**0-14**	**15-24**	**25-44**	**45-64**	**65+**	**Total Persons**
State	21%	12%	30%	24%	13%	4,761,865
Dublin City	15%	13%	37%	21%	13%	554,554
North Dock B	11%	13%	54%	15%	6%	7,695
North Dock B	11%	13%	54%	15%	6%	7,695
North Dock A	12%	11%	45%	20%	12%	1,365
North Dock C	9%	17%	48%	19%	7%	4,214
Pembroke East A	15%	11%	42%	22%	10%	5,078
Clontarf East C	17%	12%	23%	27%	21%	3,183
Clontarf East D	17%	12%	23%	29%	19%	2,766
Clontarf West C	14%	10%	40%	23%	13%	3,659
Clontarf West D	15%	10%	43%	21%	12%	2,297
Study Area (Mean)	13%	12%	41%	21%	12%	4,217

This table shows that both Nationally, the DCC area, and the Study Area, the dominant age grouping is 25-44 at 30%, 37% and 41% of the total population, respectively. The figures for both Dublin City and the Study Area indicate a young working age population in the area which is above the national level. This is in keeping with census data from 2011 and 2006.

5.5.2 Socioeconomics

Employment

Table 5.5 presents the employment statistics in 2016 compared with 2011. The data shows that unemployment decreased significantly in the County, as well as nationally, reflecting the economic recovery in recent years.

Table 5.5 Employment statistics Nationally and at County level in 2011 and 2016 (*Source:* www.cso.ie)

	At Work	**Looking for first regular job**	**Unemployed having lost or given up previous job**	**Total in labour force**	**% Unemployment**
2011 Labour Force					
State	1,807,360	34,166	390,677	3,608,662	11.8
Dublin City	227,429	5,086	46,613	447,583	11.6
2016 Labour Force					
State	2,006,641	31,434	265,962	3,755,313	7.9
Dublin City	265,670	4,686	34,514	471,341	8.3

The 2016 census data shows that the majority of people in employment in the DCC area are in ‘Managerial and Technical’ employment (26.6%) with the least represented social class being ‘Unskilled’ workers at (3.8%).

At a local level, the dominant social class in the North Dock B area is ‘All others gainfully occupied and unknown’ labour (25.6%) with ‘Unskilled’ being the least representative (3.2%).

Education

Census data presenting the highest level of education completed by people living in the Study Area community and Dublin City area is presented in Table 5.6. The data shows that there are higher levels of educational attainment in the Study Area than in the Dublin City area.

Table 5.6 Highest level of education completed locally and at County level in 2016 for key educational levels. (*Source:* *www.cso.ie*)

Area	**No formal education**	**Primary education**	**Upper secondary**	**Honours Bachelor's Degree, Professional qualification or both**	**Postgraduate Diploma or Degree**	**Total Persons**
Dublin City	15.3%	11.3%	14.7%	13.3%	13.9%	380,754
North Dock B	1.0%	7.4%	11.1%	15.6%	18.0%	5,506
North Dock A	1.0%	10.2%	14.4%	15.7%	14.6%	1,004
North Dock C	2.3%	13.6%	9.2%	13.0%	16.4%	1,369
Pembroke East A	1.8%	14.4%	12.6%	12.8%	15.6%	3,739
Clontarf East C	0.4%	5.7%	17.7%	19.1%	22.1%	2,217
Clontarf East D	0.7%	4.8%	17.1%	18.7%	22%	1,950
Clontarf West C	0.5%	4.5%	13.3%	21.9%	26.0%	2,670
Clontarf West D	1.2%	6.8%	15.2%	16.2%	18.5%	1,634
Study Area (Mean)	1.1%	8.4%	13.8%	16.6%	19.2%	2,511

(Note: the table presents key milestone education levels and excludes lower secondary, technical or vocational qualification, advanced certificate/completed apprenticeship, higher certificate, ordinary bachelor degree/national diploma, Ph.D./higher or where information was not stated).

Labour Force Survey

The Labour Force Survey (LFS) is a large-scale, nationwide survey of households in Ireland carried out every three months. It generates labour force estimates which include the official measure of employment and unemployment for the state.

The results Nationally for Q2 2019 showed that there were 2,300,000 people employed in the State with 130,800 registered as unemployed. This represents a 2.0% increase in employment between Q2 2018 and Q2 2019.

In Q2 2019, the majority of people were employed in the wholesale and retail trade and repair of motor vehicles and motorcycles sectors, with industry, and human health and social work activities following closely.

Income

The below data, obtained from CSO Statbank (CIA01), demonstrate that the levels of total income per person in the Dublin area are higher than that within the State. In 2015, the total income per person in the Dublin area was 24% higher than that within the State in 2015.

Table 5.7 Total Income per Person (Euro) for Dublin and the State (*Source: CSO Statbank CIA01*)

	2010	2011	2012	2013	2014	2015
Dublin	28,514	28,639	29,699	29,434	30,199	31,906
State	24,840	24,596	25,273	24,910	25,388	26,698

A similar pattern of income distribution is observed in data on disposable income per person, where in the Dublin area the disposable income per person was 27% higher than that of in the State in 2015.

Table 5.8 Total Disposable Income per Person (Euro) for Dublin and the State (*Source: CSO Statbank CIA01*)

	2010	2011	2012	2013	2014	2015
Dublin	21,416	20,850	21,632	21,200	21,919	23,298
State	19,558	18,889	19,429	18,898	19,265	20,334

Deprivation

Deprivation in small areas is mapped using the Pobal HP Deprivation Index. This Index draws on data from censuses and combines three dimensions of relative affluence and deprivation: Demographic Profile, Social Class Composition and Labour Market Situation. Figure 5.2 below shows graphical representation of how the concepts of Demographic Growth, Social Class Composition and Labour Market Situation are measured by ten key socio-economic indicators from the Census of Population. In this EIA Report, the Relative Index Score is considered as the measure for deprivation, as these Relative Index Scores are rescaled such that the mean is 0 and standard deviation is 10 at each census wave. This allows for the provision of descriptive labels with the scores, which are grouped by standard deviation as seen in Table 5.9 below.

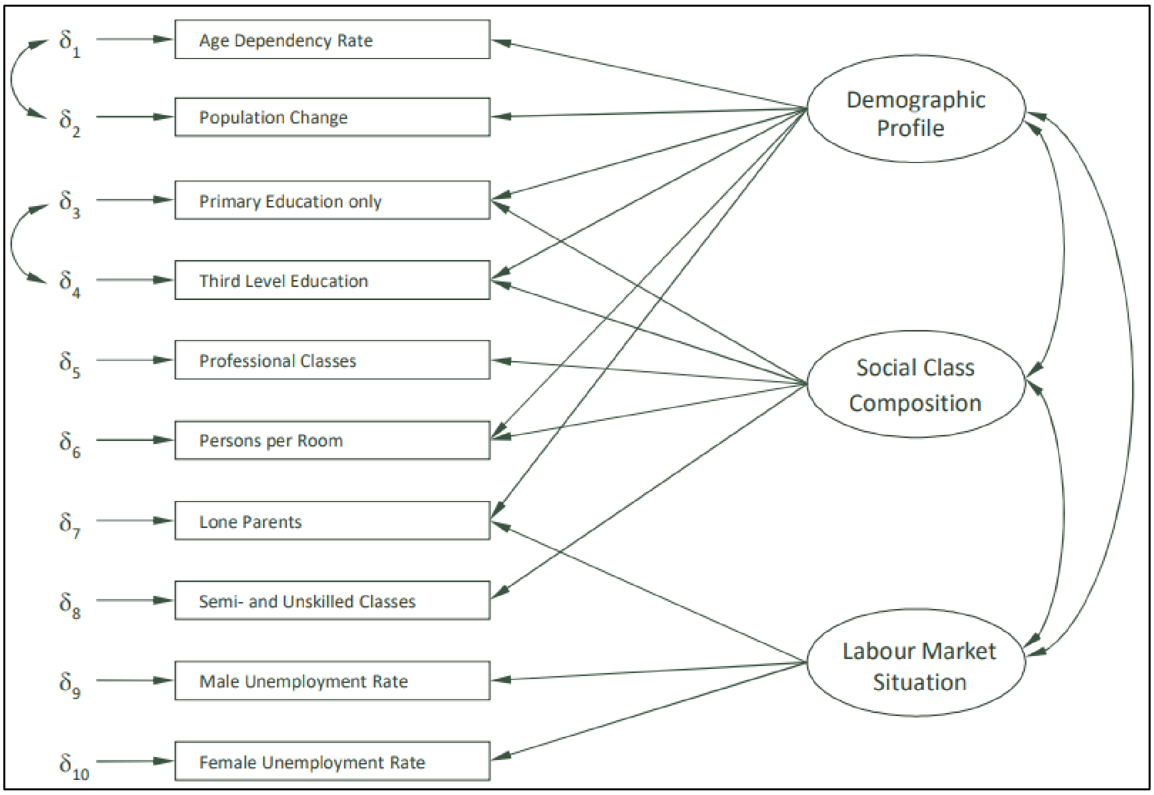

Figure 5.2 Graphical representation of how the concepts of Demographic Growth, Social Class Composition and Labour Market Situation are measured by ten key socio-economic indicators from the Census of Population.

Table 5.9 Pobal HP Index Relevant Index Score labels (*Source: Pobal HP Deprivation Index)*

Relative Index Score	Standard Deviation	Label
> 30	> 3	Extremely affluent
20 – 30	2 – 3	Very affluent
10 – 20	1 – 2	Affluent
0 – 10	0 – 1	Marginally above average
0 – -10	0 – -1	Marginally below average
-10 – -20	-1 – -2	Disadvantaged
-20 – -30	-2 – -3	Very disadvantaged
< -30	< -3	Extremely disadvantaged

The data in Table 5.10 shows that the population living within the Study Area are generally classified as 'Marginally above average', with a Relative Index Score of 8.97. Similarly, the population within the Dublin City region are generally classified as 'Marginally above average' with a Relative Index Score of 4.12. Figure 5.3 below presents the Pobal HP Index map illustrating the Study Area.

Table 5.10 Pobal HP Index Relevant Index Score Figures at a local and County level (*Source: Pobal HP Deprivation Index)*

	Relative Index Score	Pobal HP Description 2016
Dublin City	4.12	Marginally above average
North Dock B	11.10	Affluent
North Dock A	5.71	Marginally above average
North Dock C	3.49	Marginally above average
Pembroke East A	2.15	Marginally above average
Clontarf East C	10.19	Affluent
Clontarf East D	13.03	Affluent
Clontarf West C	15.85	Affluent
Clontarf West D	10.22	Affluent
Study Area (Mean)	8.97	Marginally above average

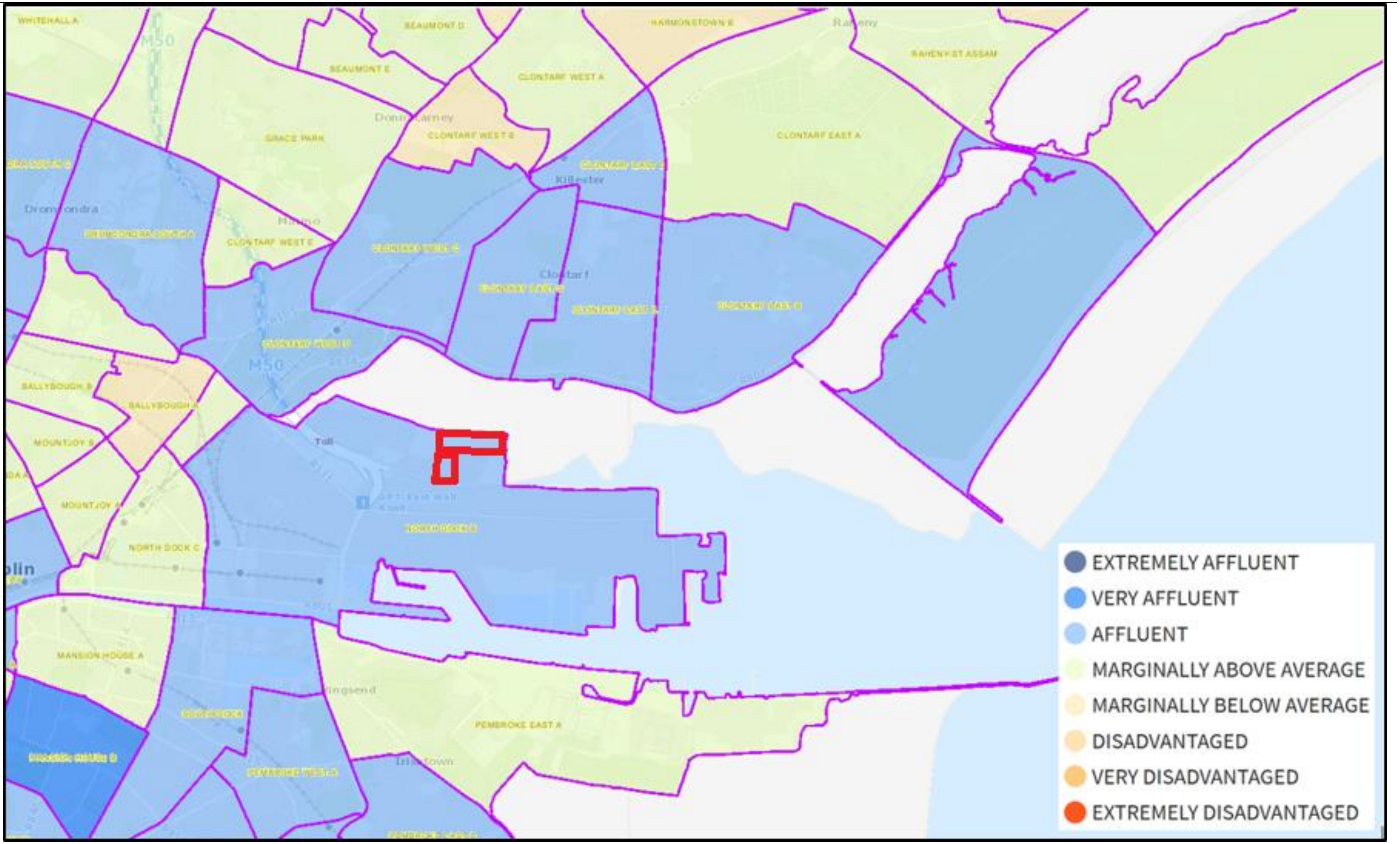

Figure 5.3 Pobal HP Index maps illustrating the Study Area (North Dock B, Clontarf East D, Clontarf East C, and Clontarf West D *(Source: Pobal HP Deprivation Index)*

5.5.3 Health

The following section provides a summary of various health aspects for the Study Area.

Physical Health

State data shows that life expectancy for both males and females has increased consistently since 1991, with female life expectancy consistently higher than male (Table 5.11)

Table 5.11 Period Life Expectancy in Ireland by sex (*Source: CSO Statbank VSA30*)

Period Life Expectancy in Ireland by sex					
	1991	**1996**	**2002**	**2006**	**2011**
Male	72.3	73	75.1	76.8	78.4
Female	77.9	78.5	80.3	81.6	82.8

A similar pattern of increasing life expectancy has been recorded in Dublin, where life expectancy has been recorded as steadily increasing since 2002, with female life expectancy consistently higher than male (Table 5.12)

Table 5.12 Period Life Expectancy in Dublin by sex (*Source: CSO Statbank VSA31*)

Period Life Expectancy in Dublin by sex			
	2002	**2006**	**2011**
Male	75.2	76.7	78.3
Female	80.2	81.2	82.7

The rate of hospital admissions for circulatory diseases is lower than that in the State (Table 5.13). On average, admissions of this nature are 11.7% lower in the Dublin City area than in the State.

Table 5.13 Circulatory Diseases Admission Rate per 100,000 Population at a National and County level (*Source: CSO Statbank DHA12*)

Circulatory Diseases Admission Rate per 100,000 Population				
	2010	**2011**	**2013**	**2014**
Dublin City	3805.56	3498.7	3950.4	4176.7
State	4308.57	4026.8	4495.6	4644.6

In terms of respiratory diseases, the rate of hospital admissions in Dublin City tends to fall broadly in line of that of the State (Table 5.14). The rates of admissions in Dublin City and the State have seen an average increase in admissions of c. 7% since 2011.

Table 5.14 Respiratory Diseases Admission Rate per 100,000 Population at a National and County level (*Source: CSO Statbank DHA12*)

Respiratory Diseases Admission Rate per 100,000 Population				
	2010	**2011**	**2013**	**2014**
Dublin City	2483.76	2349.73	2585.7	2693.7
State	2402.62	2361.02	2633.6	2691

Mental Health

The rates of death by suicide and intentional self-harm in Dublin City are consistently lower than those in the State (Table 5.15). The rate of death by suicide and intentional self-harm are generally decreasing year-on-year in line with the pattern seen in the State.

Table 5.15 Death by Suicide and Intentional Self Harm Rate per 100,000 Population *(Source: Public Health Well Community Profiles)*

Death by Suicide and Intentional Self Harm Rate per 100,000 Population				
	2010	**2011**	**2013**	**2014**
Dublin City	8.42	9.01	8.63	7.45
State	10.87	12.11	11.8	10.34

The number of admissions to hospital for anxiety or depression have followed a pattern of decreasing across both Dublin City and the State since 2009 (Table 5.16). Generally, the number of admissions to hospital for anxiety or depression are lower than those seen in the State.

Table 5.16 Number of admissions to hospital for anxiety or depression per 1,000 people *(Source: Public Health Well Community Profiles)*

Number of admissions to hospital for anxiety or depression per 1,000 people			
	2009	**2013**	**2014**
Dublin City	2.2	2	1.4
State	2.3	2	1.8

Lifestyle

In terms of lifestyle, populations in Dublin City are broadly similar to those in the State, with rates of smoking, consumption of alcohol and prevalence of eating 5 portions or more fruit or vegetables daily being similar across both comparative areas (Table 5.17).

Table 5.17 Prevalence of smoking, drinking alcohol and consumption of fruit and vegetables of persons aged 15 and over *(Source: CSO Statbank IH079)*

	Smoking daily (%)	**Smoking occasionally (%)**	**Prevalence of drinking alcohol (%)**	**Prevalence of eating 5 portions or more fruit or vegetables daily (%)**
Dublin City	14	8	86	42
State	15	7	81	42

Activity levels in Dublin City tends be slightly higher than those in the State, with the prevalence of individuals walking and cycling as a form of transport, as well as levels of participation in sports, fitness or recreational physical activities being higher in Dublin than in the State (Table 5.18).

Table 5.18 All persons aged 15 and over by Region, Year and Physical Activity Undertaken *(Source: CSO Statbank IH072)*

	Walk to get to and from places	**Cycle to get to and from places**	**Sports, fitness or recreational physical activities**	**Muscle strengthening activities**
Dublin City	90	18	54	37
State	86	14	49	34

Tourism

Dublin Port is a major Irish intermediary for imported and exported goods, having handled 38 million gross tonnes throughput in 2018. However, Dublin Port also plays a significant role in tourism. In 2018, a total of 151 cruise vessels visited Dublin Port, along with daily passenger ferries facilitating crossings to and from both the United Kingdom and mainland Europe. In total, these vessels delivered c. 1.8 million passengers and c. 510,000 tourist vehicles to the Port in 2018.

5.6 SOCIAL INFRASTRUCTURE

Residential Dwellings

The site is currently under industrial use. The site is bounded by Dublin Bay to the north, by other industrial units to the east and west, and by the Tolka Quay Road to the south. The proposed development site lies within Dublin Port's North Dock, which is largely defined by industrial port-related sites. The nearest residential noise sensitive locations are located some 800m across the Tolka Estuary to the north of the site. There are further areas of residential fabric located in the East Wall area, c. 800m west of the site.

Schools

There are a number of primary and secondary schools in the vicinity of the proposed development including:

- St. Joseph's Co-Educational National School in East Wall c. 610m west-south-west of the site;
- Howth Road Mixed National School in Clontarf c. 910 north-north-west of the site;
- St. Joseph's CBS Secondary School in Fairview c. 1.3km north west of the site;
- Saint Columba's National School in North Strand c. 1.5km west of the site;
- St. Laurence O'Toole's CBS Senior Boys' Primary School in North Dock c. 1.6km to the west-south-west of the site; and
- St. Laurence O'Toole's National School in North Wall c. 1.6km southwest of the site.

The closest third level institution in the area is the National College of Ireland located c. 1.8km southwest of the site.

Health

The nearest hospital to the site is St. Vincent's Hospital in Fairview located c. 1.9km north east of the site. The East Wall Medical Centre is also located c. 1.1 km east of the site along the Church Road.

Security

Clontarf Garda station is located on Strandville Avenue East in Clontarf c. 720m north of the site and North Strand fire station is located on North Strand Road in North Strand (c. 1.4km east of the site).

5.7 COMAH ESTABLISHMENTS

In 2012, the so-called "Seveso Directive" (Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC) was adopted. The Seveso Directive applies to in excess of 12,000 establishments in the European Union where dangerous substances are stored or used in large quantities. The Seveso Directive was transposed into Irish law by S.I. No. 209/2015 - Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (the "COMAH Regulations"). It is the purpose of the COMAH Regulations to implement the Seveso Directive in an Irish context, and through the measures it implements, prevent major accidents involving dangerous substances, and limit the consequences of any such major accidents for human health and the environment. These regulations categorise relevant establishments into upper- and lower-tier establishments. The categorisation of establishments depends on the qualifying quantity (tonnes) of dangerous substances listed in Part 1 or Part 2 of Schedule 1 of the COMAH Regulations present at the establishment.

There are several upper- and lower-tier COMAH establishments in Dublin Port which could potentially risk human health. These are presented in Table 5.19 below.

Table 5.19 List of COMAH establishments in the Dublin Port area

Establishment Name	Establishment Address	Activity	Tier	Consultation Distance
Calor Teoranta	Tolka Quay Road, Dublin Port, Dublin 1	LPG storage	Upper	600 m from perimeter
Fareplay Energy Ltd (Under the Circle K Ire Energy Ltd Group)	Fareplay Terminal Dublin, Promenade Road, Dublin Port, Dublin 3	Fuel storage (including heating, retail sale etc.)	Upper	400 m from perimeter
Indaver Ireland Ltd	Tolka Quay Road, Dublin Port, Dublin 1.	Waste storage, treatment and disposal	Upper	700 m from perimeter
Tedcastles Oil Products	Yard 2, Tolka Quay Road, Dublin Port, Dublin 1	Fuel storage (including heating, retail sale etc.)	Upper	400 m from perimeter
Tedcastles Oil Products	Yard 1, Promenade Road, Parish of St Thomas, Dublin	Fuel storage (including heating, retail sale etc.)	Upper	400 m from perimeter
Valero Energy (Ireland) Ltd.	Dublin Joint Fuels Terminal, Alexandra Road, Dublin Port, Dublin 1	Fuel storage (including heating, retail sale etc.)	Upper	280 m from perimeter
National Oil Reserves Agency Ltd.	Pigeon House Road, Ringsend, Dublin 4	Fuel storage (including heating, retail sale etc.)	Upper	1200 m from perimeter
National Oil Reserves Agency Ltd.	Shellybanks Road, Ringsend, Dublin 4	Fuel storage (including heating, retail sale etc.)	Upper	300 m from perimeter
Circle K Terminal 1	Terminal 1, Alexandra Road, Dublin Port, Dublin 1.	Fuel storage (including heating, retail sale etc.)	Lower	400 m from perimeter
Circle K Yard 3	Yard 3, Alexandra Road, Dublin Port, Dublin 1.	Fuel storage (including heating, retail sale etc.)	Lower	300 m from perimeter
Electricity Supply Board	North Wall Generating Station, Alexandra Road, Dublin 1	Power generation, supply and distribution	Lower	300 m from bund wall
Iarnrod Eireann	Alexandra Rd, North Wall, Dublin 1	Fuel storage (including heating, retail sale etc.)	Lower	300 m from bund wall
Synergen Power Ltd t/a ESB Dublin Bay Power	Pigeon House Road, Ringsend, Dublin 4	Power generation, supply and distribution	Lower	300 m from bund wall

5.8 IMPACTS OF THE PROPOSED DEVELOPMENT

The impact of construction, commissioning, operation and decommissioning of the proposed development are considered below.

5.8.1 Potential Impacts on Businesses and Residences

The main potential impacts on local businesses and residences associated with the proposed development will be in relation to air quality, noise, visual impact and traffic. The potential impacts and mitigation measures to address them are dealt with within the corresponding chapters of this EIA Report as follows:

- Chapter 9 – Air Quality and Climate
- Chapter 10 – Noise and Vibration
- Chapter 11 – Landscape and Visual Impact
- Chapter 13 – Traffic and Transportation

It is predicted that there will be a slight positive impact on local business activity during the construction phase with the increased presence of up to 180 no. construction workers using local facilities. The positive impact during the operational phase will be less with c. 128 no. full time employees anticipated on site throughout any 24 hours period. It is also anticipated that the proposed development will have indirect positive effects on employment in terms of construction material manufacture, maintenance contracts, equipment supply, landscaping etc.

5.8.2 Potential Impacts on Human Health from Air Quality

As outlined in Chapter 9 (Air Quality and Climate), 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 based on the protection of the environment as well as the protection of human health. Additional factors such as natural background levels, environmental conditions and socio-economic factors are also considered in the limit values which are set (see Chapter 9, Table 9.1). The ambient air quality standards established are designed to minimise harmful effects to health.

5.8.2.1 Construction Phase

As detailed in Chapter 9 (Air Quality & Climate), best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust 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 ***negative***, ***short-term*** and ***imperceptible*** with respect to human health.

5.8.2.2 Operational Phase

Traffic related air emissions have the potential to impact human health if they do not comply with the ambient Air Quality Standards set out in Directive 2008/50/EC. An assessment of the operational phase traffic emissions was undertaken to determine the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. There are no high sensitivity receptors (residential dwellings, schools, hospitals) in close proximity to the site. Sensitive receptors in the area are predominantly offices and places of work which are of medium sensitivity in terms of air quality. 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.

5.8.3 Potential Impacts on Human Health from Noise & Vibration

Noise and vibration impacts associated with the development have been fully considered within Chapter 10 of the EIA Report. Commentary on the impact assessment and related noise levels are summarised below with respect to potential environmental health impacts.

5.8.3.1 Construction Phase

As detailed in Chapter 10 (Noise and Vibration), there will be some impact on nearby noise sensitive properties due to noise emissions from site activity and traffic. The application of noise limits and limits on the hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. In addition, due to the distance between the site and the nearest sensitive locations, vibration impacts generated during construction are expected to be negligible. Therefore, the noise and vibration impact of the construction phase of the proposed development is likely to be ***temporary*** to ***short-term*** and ***slight negative*** with respect to human health because of the temporary to short-term construction phase.

5.8.3.2 Operational Phase

As detailed in Chapter 10, noise modelling was undertaken to assess the impact of the proposed development of the site with reference to noise limits typically applied by DCC and the EPA. As demonstrated by the modelling results, the predicted noise emissions associated with the proposed development of the site during the operational phases are compliant with the adopted noise limit values which are based with due consideration of the effect on human health. Furthermore, any change in noise levels associated with additional vehicles at road junctions in the vicinity of the proposed development is expected to be ***not significant***. In essence, the noise levels that are encountered at the nearest noise sensitive locations are predicted to be within relevant noise criteria that have been adopted here for the operation of the proposed facility and associated infrastructure. These criteria have been selected with due consideration to human health, therefore, will not result in a significant impact on human health.

The proposed development will not generate any perceptible levels of vibration during operation and therefore there will be no impact from vibrations on human health.

5.8.4 Potential Impacts on Local Amenities and Tourism

The location of the proposed development within an existing industrial port area will have a minimal impact on the local landscape amenity. There will be no impact on the local parks identified in Section 5.3.4 or the larger amenity areas of Dublin Bay and Phoenix Park.

It is not anticipated that the development will have any impact on local tourism or shopping amenities.

The proposed development will not create any wastewater discharge which could have a potential impact on local amenities or the local population.

5.8.5 Potential Impacts on Material Assets

The proposed development and its surroundings will not require any significant electrical power supply and will not generate significant quantities of wastewater or surface water. Utility providers have provided confirmation that there is sufficient capacity in the area network for the required power and drainage demands. The implementation of mitigation measures outlined in Chapter 14 will ensure there will be no impact on material assets to local residential or business users.

5.8.6 Potential Impacts from Additional Traffic

An assessment of the additional traffic movements associated with the proposed development during the construction and operational phases is presented in Chapter 13 (Traffic and Transportation).

As stated in Chapter 13, the traffic assessment shows that the additional traffic movements associated with the proposed development were found to be. ***short term, imperceptible*** and ***neutral*** for the construction phase and ***long term in duration and of slight effects*** for the operational phase.

5.8.7 Unplanned Events/Impacts on Health and Safety

The proposed development has been designed in accordance with the Safety, Health and Welfare at Work Act 2005 (S.I. 10 of 2005) as amended and the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. 299 of 2007) as amended and associated regulations. The plant has been designed by skilled personnel in accordance with internationally recognised standards, design codes, legislation, good practice and experience based on a number of similar existing facilities operated by the operator.

The proposed development has the potential for an impact on the health and safety of workers employed on the site, particularly during the construction phase. The activities of contractors during the construction phase will be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) as amended to minimise the likelihood of any impacts on worker’s health and safety.

During the operational phase of the development, the operator will implement an Environmental Safety and Health (EH&S) Management System and associated procedures at the facility. Full training in the EH&S Management System and relevant procedures will be provided to all employees.

The 2014 EIA Directive, 2018 EIA Regulations and associated EPA Draft EIA Report Guidelines 2017 require that the vulnerability of the project to major accidents and/or natural disasters (such as earthquakes, landslides, flooding, sea level rise etc.) is considered in the EIA Report.

The site has been assessed in relation to the following external natural disasters; landslides, seismic activity, volcanic activity and sea level rise/flooding as outlined below. The potential for major accidents to occur at the facility has also been considered with reference to Seveso/Control of Major Accident Hazards (COMAH) Regulations.

There is a negligible risk of landslides occurring at the site and in the immediate vicinity due to the topography and soil profile of the site and surrounding areas. There is no history of seismic activity in the vicinity of the site. There are no active volcanoes in Ireland so there is no risk of volcanic activity.

The potential risk of flooding on the site was also assessed. A Stage 1 Flood Risk Assessment was carried out by OPW and it was concluded that the development is not at risk of flooding. Refer to Brexit Infrastructure at Dublin Port Engineering Report Part 2. Furthermore, the proposed development design has adequate drainage etc. to ensure there is no potential impact on flood risk for other neighbouring properties.

The proposed development will not be a Seveso/COMAH facility. The only substance stored on site controlled under Seveso/COMAH will be small volumes of diesel for back up generators and the amounts proposed do not exceed the relevant thresholds of the Seveso Directive. A review of the sites in terms of health and safety is included in Chapter 2. The proposed developments at Bond Drive and Yards 3 & 4 comprise office space (and associated staff parking) and HGV parking (and associated facilities) and are classified as Level 1 type development which is permittable in terms of the land use planning guidelines.

There is a potential impact on the receiving environment as a result of minor accidents/leaks of fuel/oils during the construction and operational phases. However, the implementation of the mitigation measures set out in Section 8.6 of Chapter 8 (Land, Soils, Geology and Hydrogeology) and Section 6.6 of Chapter 6 (Hydrology) of the EIA Report will ensure the risk of a minor/accident is low and that the residual effect on the environment is imperceptible.

The Department of Health is leading the government response in Ireland to the national public health risk posed by Coronavirus Disease 2019 (COVID-19). Exposure to COVID-19 may present a health risk to workers and other persons at a workplace. Employers are advised to follow the latest public health advice and identify and implement suitable control measures to mitigate the risk of COVID-19 infection in the workplace. These public health measures should be communicated to all relevant employees and others at the place of work.

Employees should follow the public health official advice and guidance including ensuring good hygiene practices, such as frequent hand washing and respiratory etiquette, to protect against infections and should seek professional healthcare advice if unwell. These measures apply to both the construction phase and operational phase of the subject development.

5.9 REMEDIAL AND MITIGATION MEASURES

The impacts on the local population in terms of residents and businesses are considered to be mainly positive in the sense of creating direct employment opportunities and indirect additional business, both during the construction and operational phases.

Mitigation measures proposed to minimise the potential impacts on human health in terms of air quality and climate and noise and vibration are discussed in the relevant sections of Chapters 9 and 10, respectively.

Chapter 13 Traffic and Transportation addresses mitigation measures proposed to reduce the impact of additional traffic movements to and from the development.

5.10 RESIDUAL IMPACTS

It is expected that the proposed development will have a ***not significant, positive*** and ***long-term*** impact on the immediate hinterland through continued employment opportunities and the associated economic and social benefits.

There are no predicted adverse impacts with respect to socio-economic factors, land-use or the amenity value and tourism potential of the area, primarily due to the location of the proposed development on an existing industrial site within an established industrial port environment.

All other environmental aspects relating to the human environment which have the potential to impact on the local population such as air quality and climate, noise and vibration, material assets and traffic are addressed in Section 5.8 and in more detail in the relevant chapters of this EIA Report.

Measures outlined in Section 5.8.7 will be put in place to ensure the health and safety of all site personnel during both construction and operational phases.

5.11 CUMULATIVE IMPACTS

Permitted developments in the vicinity of the proposed development are listed in Chapter 3. There is no predicted significant cumulative impact associated with the construction or operational phase of these projects.

The proposed development has been designed to ensure there are no significant residual effects on human health when taking into account the surrounding land uses. As such it is anticipated that the proposed development will not have a significant effect on human health.

As the proposed development will have a positive impact on the immediate hinterland and the Dublin Region through economic and social benefits, it is concluded that any cumulative impacts on population and human health will be positive and long-term.

5.12 CONCLUSIONS

It is not predicted that the proposed development will have any adverse effects on human health during either the construction or operational phase.

The proposed development will have numerous direct and indirect benefits on a regional and national scale, and will have an overall positive effect on the local, regional and national population in terms of providing key infrastructure to ameliorate the effects of the exit of the United Kingdom from the European Union.

6.0 HYDROLOGY

6.1 INTRODUCTION

This chapter assesses and evaluates the potential impacts of the Proposed Development described in Chapter 2 (Description of the Proposed Development) on the surrounding water and hydrological environment. The impact on land, soils, geology and hydrogeology is addressed in Chapter 8. Chapter 14, Material Assets addresses the impacts on water supply, wastewater and storm water drainage.

6.2 METHODOLOGY

6.2.1 General

The methodology used in this assessment follows current European and Irish guidance as outlined in:

- EPA Draft EIA Report Guidelines 2017
- European Commission 'Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report' 2017
- National Roads Authority (NRA) 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes', by the National Roads Authority (2009).

6.2.2 Criteria for Rating Impacts

In assessing likely potential and predicted impacts, account is taken of both the importance of the attributes and the predicted scale and duration of the likely impacts.

The quality, significance and duration of potential impacts defined in accordance with the criteria provided in the EPA Draft EIA Report Guidelines (2017) for describing effects are summarised in Table 1.2 in Chapter 1. In addition, due significance is also given to the document entitled '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* by the National Roads Authority (2009) where appropriate. The National Roads Authority (NRA) criteria is summarised in Table 1 Appendix 6.1.

6.2.3 Sources of Information

This assessment was considered in the context of the available baseline information, potential impacts, consultations with statutory bodies and other parties, and other available relevant information. In collating this information, the following sources of information and references were consulted:

- Latest EPA Maps & Envision water quality monitoring data for watercourses in the area (these data can be accessed at https://gis.epa.ie/EPAMaps/ & catchments.ie);
- National River Basin Management Plan 2018-2021;
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW));
- Flood points & Historical Floods – Office of Public Works (OPW) floods website www.floodmaps.ie;
- Relevant Eastern Catchment Flood Risk Assessment and Management (CFRAM) Flood Reports;
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (Eastern Regional Fisheries Board (ERFB).

- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' (Inland Fisheries Ireland, 2016);
- Dublin City Council (2005) Greater Dublin Strategic Drainage Study (GDSDS): Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council;
- Greater Dublin Regional Code of Practice for Drainage Works: Version Draft 6.0 (Wicklow County Council, South Dublin County Council, Meath County Council, Kildare County Council, Fingal County Council, Dún Laoghaire- Rathdown County Council & Dublin City Council), and;
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001).

Other relevant documentation consulted as part of this assessment included the following:

- Office of Public Works (OPW, 2019) Preliminary Engineering Report, and;
- Geotechnical Investigation Report (Priority Geotechnical Ireland, 2019).

6.3 RECEIVING ENVIRONMENT

6.3.1 Existing Environment

The subject sites are 5.4 hectares in extent and are located at Bond Drive Extension Road and Promenade Road, (refer to Chapter 1 Figure 1.1).

The sites of the Proposed Development are situated in Dublin Port, Ireland's largest operational port facility. The proposed development sites are currently used for port-related activities and the sites are hardstanding throughout.

6.3.2 Hydrology (Surface Water)

The topography of the Bond Drive Extension site slopes from North-West to South-East (approximately +4.8 to +3.0 metres above ordinance datum (mAOD)). The Dublin Port surface water sewers run west to east across Bond Drive Road immediately South of the proposed development site.

There are Dublin Port surface water sewers running west to east across Bond Drive Road immediately North of the proposed development site, and running West to East through Promenade Road immediately South of the Site.

Within the proposed Bond Drive Extension site, two of the eight existing sites are well surfaced with extensive positive drainage systems taking discharge across their full area with oil interceptors. The remaining six sites which make up the proposed Bond Drive Extension site have varying amounts of positive surface water drainage on site primarily focused on the portion of sites adjacent to Bond Drive Extension.

Within the proposed Yard 3 & 4 site, there are two existing sites. These are both hardstanding with existing surface water drainage systems in place. The northern site drains to the Dublin Port Company Surface water sewer in Bond Drive Road. The Southern site drains to the Dublin Port Company Surface water sewer in Promenade Road.

The local hydrological environment is shown in Figure 6.1 below.

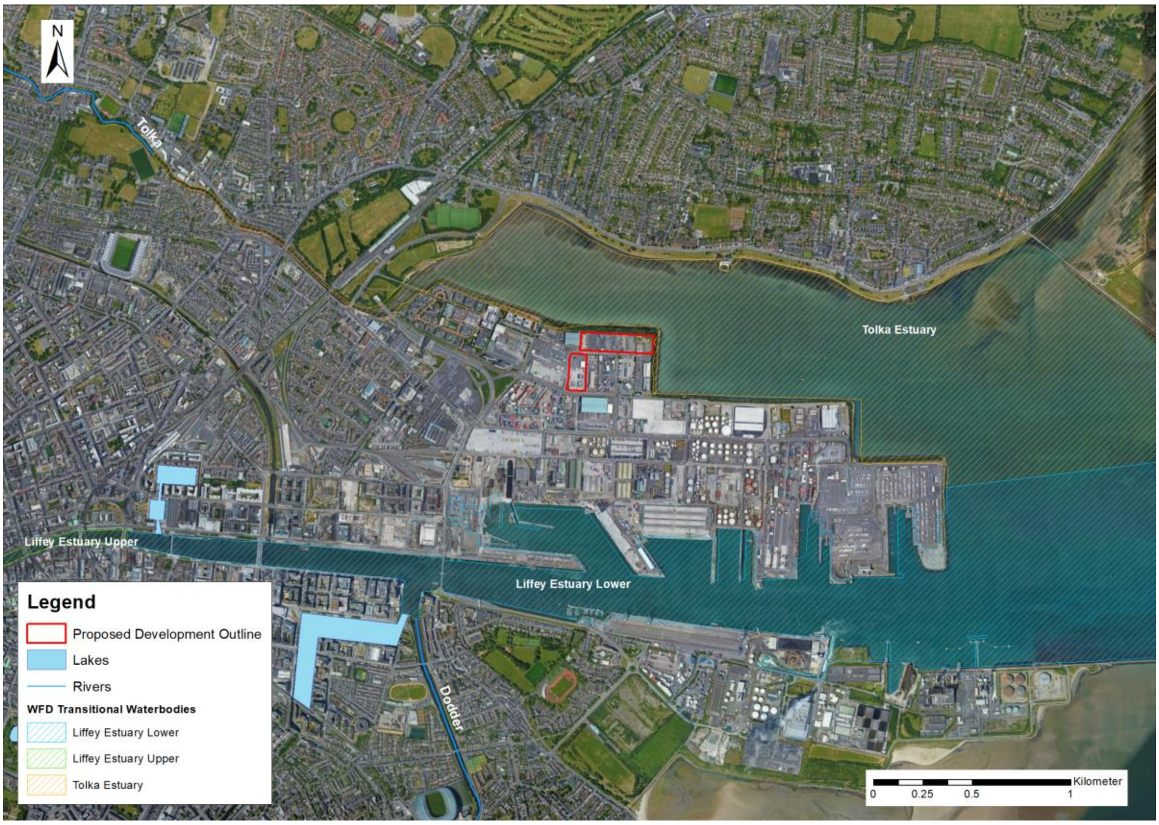

Figure 6.1 Local hydrological environment

6.3.2.1 Surface Water Quality

The Proposed Development is located within the former ERBD (now the Irish River Basin District), as defined under the European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy – this is commonly known as the Water Framework Directive (WFD). It is situated in Hydrometric Area No. 09 of the Irish River Network and is located within the Liffey and Dublin Bay Catchment.

The WFD requires *'Good Water Status'* for all European waters to be achieved through a system of river basin management planning and extensive monitoring by 2015 or, at the least, by 2027. 'Good status' means both *'Good Ecological Status'* and *'Good Chemical Status'.* In 2009 the ERBD River Basin Management Plan (RBMP) 2009-2015 was published. In the ERBD RBMP, the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015. This was the first River Basin Management planning cycle (2010-2015). The second cycle river basin management plan for Ireland is currently in place and will run between 2018-2021 with the previous management districts now merged into one Ireland River Basin District (Ireland RBD).

This second-cycle RBMP aims to build on the progress made during the first cycle. Key measures during the first cycle included the licensing of urban waste-water discharges (with an associated investment in urban waste-water treatment) and the implementation of the Nitrates Action Programme (Good Agricultural Practice Regulations). In more general terms, three key lessons have emerged from the first cycle and the public consultation processes. These lessons have been firmly integrated into the development of the second cycle RBMP. Firstly, the structure of multiple RBDs did not prove effective, either in terms of developing the plans efficiently or in terms of implementing those plans. Secondly, the governance and delivery structures in place for the first cycle were not as effective as expected. Thirdly, the targets set were too ambitious and were not grounded on a sufficiently developed evidence base. The second cycle RBMP has been developed to address these points.

The strategies and objectives of the WFD in Ireland have influenced a range of national legislation and regulations. These include the following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. 122 of 2014);
- European Communities Environmental Objectives (Surface Waters); Regulations, 2009 (S.I. No. 272 of 2009 as amended SI No. 77 of 2019)
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010 S.I. No. 366 of 2016);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010); and
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011).

Surface water quality is monitored periodically by the EPA at various regional locations along principal and other smaller watercourses. With reference to the site setting, the nearest EPA monitoring station is situated in the transitional waterbody of the Tolka Estuary to the north of the proposed development site.

The EPA assess the water quality of estuaries, rivers and streams across Ireland using a biological assessment method, which is regarded as a representative indicator of the status of such waters and reflects the overall trend in conditions of the watercourse. The closest water quality monitoring station to the proposed development site is located upstream of the Tolka Estuary, the Tolka - Drumcondra Rd Br (RS09T011200). This water monitoring station recorded a Q2-3 - Poor WFD status in 2018.

In accordance with the WFD, each river catchment within the former ERBD was assessed by the EPA and a water management plan detailing the programme of measures was put in place for each. The Tolka Estuary to the north is classified as being '*At risk of not achieving good status'.* Figure 6.2 presents the waterbody risk EPA map.

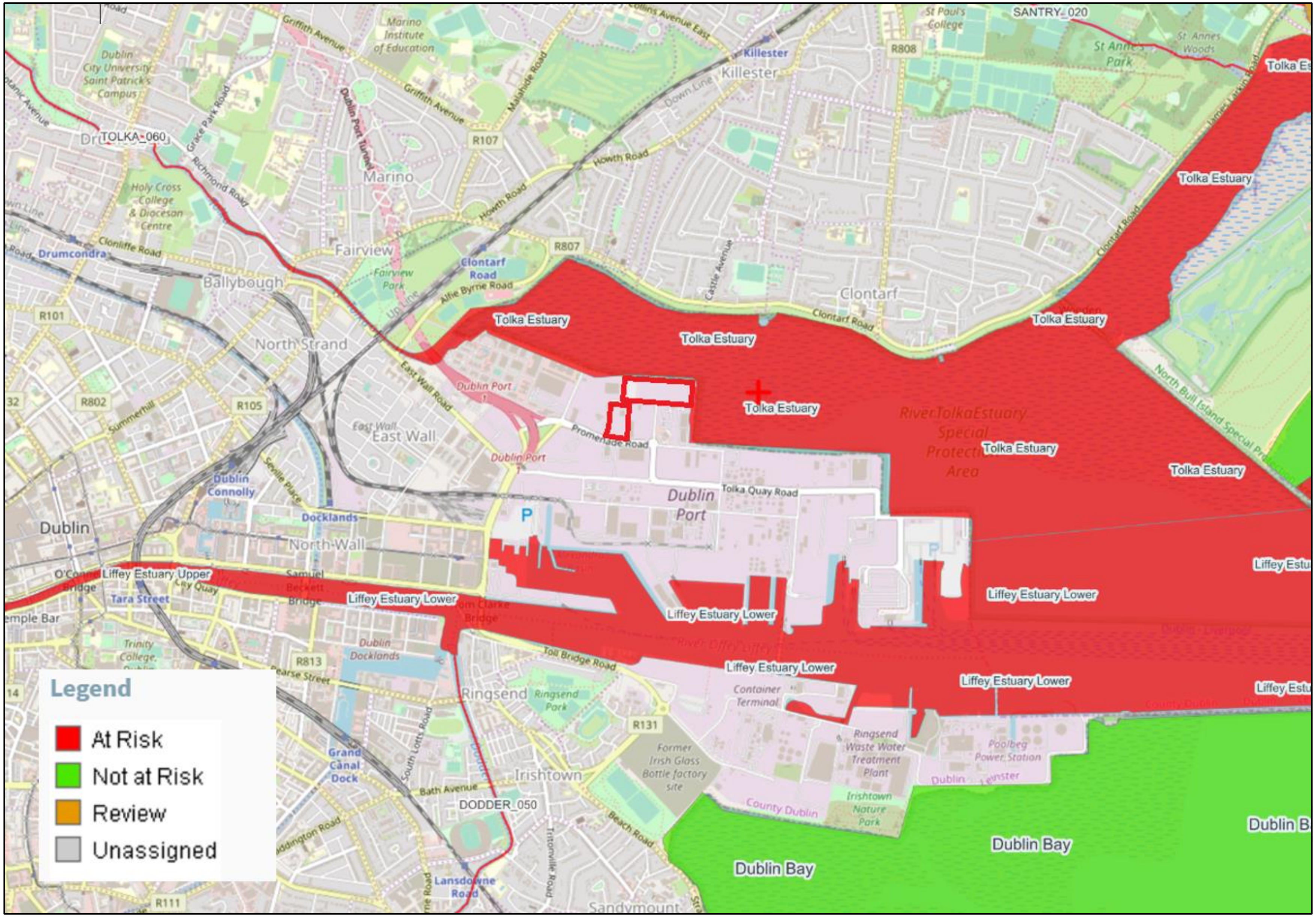

Figure 6.2 Waterbody Scores for the hydrological features in the vicinity of the proposed development

6.3.2.2 Flood Risk

The potential risk of flooding on the Bond Road and Yard 3 & 4 was assessed.

A Stage 1 Flood Risk Assessment was completed and is included within the Engineering Report prepared by OPW. The OPW guidelines identifies that docks and activities requiring a waterside location are "water compatible developments". The proposed development is therefore suitable within all flood zone designations (A B and C). As per the sequential approach within the guidelines, a justification test is not required.

The flood assessment has considered climate change scenarios following OPW guidelines and the assessment has confirmed that all the sites are suitable for this type of development.

6.3.2.3 Rating of site importance of the hydrological features

Based on the NRA methodology (refer to Appendix 6.1), for rating the importance of hydrological features, the importance of the hydrological features at this site is rated as ***medium -high importance***.

This is based on the assessment that the attribute has a medium-quality significance or value on a local scale. The Tolka Estuary is the receiving waterbody for the site, it is not a source of local potable water, and is not widely used as a local water amenity in this area due to the industrial nature of the nearby Dublin Port. However, the site is located adjacent to the South Dublin Bay and River Tolka Estuary SPA (Site code 004024) and has proximal connectivity with the North Dublin Bay SAC (Site code 000206), the South Dublin Bay SAC (Site code 000210), the North Bull Island SPA (Site code 004006).

6.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The Proposed Development comprises a new border control post (BCP) facility and associated ancillary development (see Chapter 2 for full description of the development).

The characteristics of the Proposed Development with regard to the hydrological environment, related to both construction and operation activities are described below.

6.4.1 Construction Phase

The key civil engineering works which will have potential impact on the water and hydrological environment during construction of the Proposed Development are summarised below.

(i) Excavations of topsoil and overburden are required for site preparation and levelling, building foundations, installation of underground services, access roads and car parking areas. It is proposed that the maximum cut depth will be c. 2 m below ground level (mbgl). Due to the depth of overburden recorded onsite it has been confirmed that no bedrock will be removed as part of this Proposed Development.

(ii) Connection to the existing Dublin Port surface water and foul water sewers to the South of the Proposed Bond Drive Extension Development site, and the South of the proposed Yard 3 & 4 Site and connection to the existing mains water supply via a proposed looped watermain.

(iii) From available site investigation works carried out there is very little water located within the overburden deposits and where present, it is of a discontinuous perched nature. Therefore, extensive dewatering should not be required during excavation works and groundworks. However, localised pumping of the excavations due to collection of rainfall may be required. Provisions for adequate settlement and release of this will be addressed in the detailed CEMP. (Note: An outline CEMP has been prepared by AWN Consulting for the Proposed Development and is included with the planning documentation. In advance of work starting on site, the works Contractor will prepare a detailed CEMP).

(iv) Construction activities will necessitate storage of cement and concrete materials, temporary oils, and fuels on site. Small localised accidental releases of contaminating substances including hydrocarbons have the potential to occur from construction traffic and vehicles operating on site if not mitigated adequately. Mitigation measures are set out in Section 6.6 below and will be included in the detailed CEMP.

6.4.2 Operational Phase

The key activities which will have a potential impact on the hydrological environment during operation of the Proposed Development are summarised below:

(i) Fuel will be stored in contained belly tanks which are integral with the generators. However, accidental releases may occur during transport/filling etc. if not adequately mitigated. Localised accidental discharge of hydrocarbons (likely small quantities) could also occur in car parking areas and along roads.

(ii) Wastewater will be discharged to the municipal foul sewer system (no discharges to ground/surface waters).

6.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

The potential impacts in relation to surface water during the construction and operational phases are outlined below. The assessment of effects defined is based on the description of effects as set out in the EPA Draft EIA Report Guidelines (2017) (refer to Table 1.2 Chapter 1) and the NRA criteria detailed in Appendix 6.1.

6.5.1 Construction Phase

Surface water run-off during the construction phase may contain increased silt levels or become polluted from construction activities. Run-off containing large amounts of silt can cause damage to surface water systems and receiving watercourses. Silty water can arise from excavations, exposed ground, stockpiles, and access roads.

Excavations will not extend to bedrock and is not expected that temporary dewatering will be required based on the clayey nature of the soil. Some removal of collected rainwater from the excavation may be required where excavations are left open.

During the construction phase, there is a risk of accidental pollution incidences from the following sources

- Spillage or leakage of fuels (and oils) stored on site.
- Spillage or leakage of fuels (and oils) from construction machinery or site vehicles.
- Spillage of oil or fuel from refuelling machinery on site.
- The use of concrete and cement.

Machinery activities on site during the construction phase may result in contamination of runoff/surface water. Potential impacts could arise from accidental spillage of fuels, oils, paints etc. which could impact surface water if allowed to runoff into surface water systems and/or receiving watercourses. However, implementation of the mitigation measures detailed in Section 7.6 will ensure that this does not occur.

As there is no proposed direct discharge to surface water from this site there is no likely potential impact on offsite watercourses. Discharge of water (following treatment) will be to storm or foul drains following in agreement with the relevant authority. Measures will be included within the CEMP to manage run-off water during construction.

In relation to construction phase activities the potential impact is ***short-term*** with an ***imperceptible*** and ***neutral*** effect on quality.

6.5.2 Operational Phase

Surface Water

Rainwater runoff from the impermeable areas of the site, roofs and road/car parks will be collected in storm water drainage channels and will be directed to either a storm water attenuation unit or to the Dublin Port storm sewer network. Storm flows from the site will be restricted using a flow control device.

The onsite drainage also incorporates hydrocarbon interceptors to ensure the quality of storm water discharge is treated for any hydrocarbon release prior to attenuation. The drainage design include a Class 1 full retention separator in accordance with Section 20 of the Greater Dublin Regional Code of Practice. It is proposed to provide a Class 2 bypass interceptor upstream of the surface water attenuation tank to capture the remainder of the roads and car parking areas. Roof drainage will not discharge to the bypass separator as it is conveyed by means of a separate pipe network which connects to the road drainage network downstream of the bypass interceptor. In addition to the full retention and bypass separators a hydrodynamic solid separator is provided within the drainage network to screen rubbish, debris and sediment from the surface water runoff before it enters the attenuation tank.

The attenuated storm water will be discharged at the allowable greenfield run off rate. For the Bond Drive Extension site, this is a total discharge of 18.9 l/s which will be split between four individual connections to the existing Dublin Port storm water system to the South of the site. The individual connections proposed facilitates the re-use of existing stormwater drainage infrastructure. For the Yard 3 & 4 site, this is a total discharge of 8.45 l/s to the existing Dublin Port storm water system to the South of the site.

Wastewater

It is proposed to connect to an existing foul sewer to the south of the site via a 225mm Ø connection. The proposed connections to the existing Dublin Port foul sewer have been confirmed with Dublin Port.

The potential impact from the operation phase of the development is ***long-term imperceptible*** *effect* with a ***neutral*** effect on quality.

6.5.3 Do Nothing Scenario

Should the Proposed Development not take place, the site will remain in its current state and use (i.e. port-activity related) and there will be no change to the onsite drainage characteristics.

6.6 REMEDIAL AND MITIGATION MEASURES

6.6.1 General

The design of the Proposed Development has taken account of the potential impacts of the development and the risks to the water environment specific to the areas where construction is taking place.

There are no direct discharge proposed to the Tolka Estuary, however, caution will be taken to mitigate the potential effects on the local water environment and the current indirect pathway and the proposed surface water drainage. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

6.6.2 Construction Phase

Construction Environmental Management Plan (CEMP)

An outline Construction Environmental Management Plan (CEMP) has been prepared by AWN Consulting for the Proposed Development and is included in Chapter 1 Appendix 1.1. A detailed CEMP will be prepared and maintained by the appointed contractors during the construction phase of the proposed project. The CEMP 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 CEMP. At a minimum, the CEMP will be formulated in consideration of the standard best international practice including, but not limited, to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532) Construction Industry Research and Information Association;
- CIRIA (2002) Control of water pollution from construction sites: guidance for consultants and contractors (SPI56) Construction Industry Research and Information Association;
- CIRIA (2005), Environmental Good Practice on Site (C650); Construction Industry Research and Information Association;
- BPGCS005, Oil Storage Guidelines;
- CIRIA 697 (2007), The SuDS Manual; and
- UK Pollution Prevention Guidelines, (PPG) UK Environment Agency, 2004.

Surface Water Run-off

As there are no watercourses present on the site, there will be no direct run-off to surface watercourses during the construction phase.

Run-off water containing silt will be contained on site via settlement tanks and treated to ensure adequate silt removal. Silt reduction measures on site will include a combination of silt fencing, settlement measures (silt traps, silt sacks and settlement tanks/ponds)

Should any discharge of construction water be required during the construction phase, the discharge will be treated using a sediment trap or siltbuster as required.

The temporary storage of soil will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the storm water drainage and the material will be stored away from any surface water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations. Soil from works will be stored away from existing drainage features to remove any potential impact.

Weather conditions will be considered when planning construction activities to minimise the risk of run-off from the site and the suitable distance of topsoil piles from surface water drains will be maintained.

Fuel and Chemical Handling

The following mitigation measures will be taken at the construction stage in order to prevent any spillages of fuels and prevent any resulting impacts to surface water systems;

- Designation of a bunded refuelling areas on the site;
- Provision of spill kit facilities across the site;
- Where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;

  - The pump or valve will be fitted with a lock and will be secured when not in use;
  - All bowsers will carry a spill kit and operatives must have spill response training; and
  - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted:

- Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded areas;
- Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage;
- All drums to be quality approved and manufactured to a recognised standard;
- If drums are to be moved around the site, they should be done so secured and on spill pallets; and
- Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment.

All contractors will be required to implement the CEMP.

All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline waste waters or contaminated storm water to the underlying subsoil. Wash-down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

Accidental Releases
Emergency response procedures will be outlined in the detailed CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures.

Soil Removal and Compaction
It is anticipated that the majority of excavated material will be removed from site for reuse, recovery and/or disposal. The project engineers have estimated that c. 32,208m^3(bulk) of soils will be excavated on site. Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. The material will be stored away from any surface water drains (see Surface Water Run-off section above). Movement of material will be minimised to reduce degradation of soil structure and generation of dust.

All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

6.6.3 Operational Phase

Environmental Procedures
Prior to operation of the Proposed Development, a set of operational procedures will be established (based on those used at other similar facilities) which will include site-specific mitigation measures and emergency response measures.
Specific mitigation measures related to surface water and groundwater protection for the operational phase include the following:

Fuel and Chemical Handling

The containment measures planned will minimise the risk of release of solid/ liquid material spillages to the water environment. Containment measures will include storage of fuels on site in bunded containers or compartments. The design of all bunds will conform to standard bunding specifications - BS EN 1992-3:2006, *Design of Concrete Structures – Part 3: Liquid retaining and containment measures.*

Storm Water & Foul Sewer Drainage

As stated previously the proposed drainage system design has incorporated SuDS features throughout. The proposed discharge rates for the development and overall landholding have been addressed in the *Engineering Report* prepared by OPW, which accompanies this planning application. The allowable discharge rate (QBAR) applicable to the Proposed Development and future indicative masterplan is 18.9 l/s. for Bond Drive and 8.45 l/s for Yard 3 & 4.

The proposed surface water drainage infrastructure from the sites will outfall to the current Dublin Port stormwater sewer via 225 mm Ø connections.

Foul drainage for the Proposed Development will be in accordance with the relevant standards for design and construction.

6.7 PREDICTED IMPACT OF THE PROPOSED DEVELOPMENT

This section describes the predicted impact of the Proposed Development following the implementation of the remedial and mitigation measures.

6.7.1 Construction Phase

The implementation of mitigation measures highlighted in Section 6.6.2 will ensure that the potential impacts on the surface water environment do not occur during the construction phase and that the predicted impact will be ***short-term-imperceptible-neutral***.

6.7.2 Operational Phase

The implementation of mitigation measures highlighted in Section 6.6.3 will ensure that the potential impacts on the surface water environment do not occur during the operational phase and that the predicted impact will be ***long-term-imperceptible- neutral.***

6.8 RESIDUAL IMPACTS

The residual impacts relate to those impacts that would occur after the mitigation measures, as outlined in Section 7.6 above, have taken effect. In the case of the Proposed Development, there will be no significant residual impacts; the potential impact on surface water during operation (following the EPA Draft EIA Report Guidelines (2017) will be l***ong term, imperceptible*** and ***neutral*** i.e. an impact capable of measurement but without noticeable consequences. Following the NRA criteria for rating the magnitude and significance of impacts on the water and hydrological related attributes, the magnitude of impact is ***negligible.***

6.9 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (including other Brexit related developments at nearby sites T7, T9, T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 6.9.1 and 6.9.2 below.

6.9.1 Construction Phase

The potential for impact on hydrology during construction primarily arises from accidental leaks and spills to ground or run-off containing elevated suspended solids. The proposed development does not require significant dewatering and with standard mitigation in place (as outlined in Section 6.5) for management of accidental discharges, the effect due to construction in this area is considered to be a ***neutral*** on quality and an ***imperceptible*** significance. Contractors for the proposed development will be contractually required to operate in compliance with a CEMP which will include the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect soil and water quality in compliance with legislative standards for receiving water quality. As a result, there will be no cumulative potential for change in the hydrological regime. The cumulative impact is considered to be ***neutral*** *and* ***imperceptible***.

6.9.2 Operational Phase

Overall, there will be no local change in the hydrological regime due to these proposed and planned developments. There is no significant increase in hardstanding and the development will include additional measures for attenuation and management of water quality through the use of interceptors. The operation of the proposed development is concluded to have a ***long-term, imperceptible*** significance *with a* ***neutral*** impact on hydrology.

The proposed development includes measures to protect against any accidental discharges to ground e.g. adequate containment measures for oil storage, use of hardstand in loading areas and drainage through oil interceptors as well as attenuation of runoff to minimise potential for off-site flooding. As such the impact will be ***neutral*** and ***imperceptible*** in relation to hydrology*.* All developments will be required to manage sites in compliance with legislative standards for receiving water quality. Therefore, the cumulative impact is concluded to be ***neutral*** and ***imperceptible*** in relation to soil and water*.* Overall, the use of the land will be in line with current activities on the proposed development site, which is in line with the zoning of the area, and therefore the cumulative impact on land is considered to be ***neutral*** and ***imperceptible****.*

6.10 REFERENCES

- EPA, (2017). *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* (September 2017); Environmental Protection Agency, Co. Wexford, Ireland
- EPA, (2015). Draft *EPA Advice Notes for Preparation of Environmental Impact Statements*; Environmental Protection Agency, Co. Wexford, Ireland
- NRA, (2009). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*; June 2009. National Roads Authority, Dublin.
- Ordinance Survey of Ireland (2019) Geohive online mapping, accessed 1st December 2019
- OPW Engineering report (2019)

APPENDIX 6.1

CRITERIA FOR RATING SITE ATTRIBUTES – ESTIMATION OF IMPORTANCE OF HYDROLOGY ATTRIBUTES

NATIONAL ROADS AUTHORITY (NRA, 2009)

Table 1 Criteria for rating Site Attributes - Estimation of Importance of Hydrology Attributes (NRA)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

7.0 BIODIVERSITY; FLORA & FAUNA

7.1 INTRODUCTION

This chapter provides an assessment of the impacts of the proposed development on the ecological environment, i.e. flora and fauna; biodiversity. It has been compiled in compliance with the 2014 EIA Directive, the Planning and Development Act 2000 as amended, and the European Commission's guidance on the preparation of the EIA Report, and follows the revised EPA Draft EIA Report Guidelines 2017.

The development site is predominately comprised of artificial surfaces and considered to be of relatively low ecological value but the surrounding marine habitat of Dublin Bay is of high ecological value.

7.2 CHARACTERISTICS OF THE DEVELOPMENT

The subject sites are c. 5.4 hectares in extent and are located at Bond Drive Extension and Promenade Road, Dublin Port.

The proposed development would be developed at existing commercial sites which currently comprise warehouse buildings, existing hardstanding areas, and truck and car parking areas. The proposed development will primarily be built on existing hardstand/gravel surfaces, but some upgrade works will be undertaken for site entrance roadways etc. The site has an existing connection to the public sewer network and the Dublin Port Surface Water drainage system.

The proposed project will include standard design SuDS features such as attenuation, updates to the surface water drainage and sewerage network and petrol interception.

These features and updates will mitigate any potential pollution of the adjacent wetland habitat areas of the South Dublin Bay and River Tolka Estuary SPA.

A full description of the proposed development is provided in Chapter 2 (Description of the Proposed Development).

7.3 METHODOLOGY

This chapter of the EIA Report concentrates on ecological features within the development area of particular significance, primarily designated habitats and species. This includes habitats/species listed in Annex I, II and IV of the EU Habitats Directive, rare plants listed in the Flora Protection Order and other semi-natural habitats of conservation value.

The obligation to undertake appropriate assessment derives from Article 6(3) and 6(4) of the Habitats Directive. The first test is to establish whether, in relation to a particular plan or project, appropriate assessment is required. This is termed AA screening. Its purpose is to determine, on the basis of a preliminary assessment and objective criteria, whether a plan or project, alone and in combination with other plans or projects, could have significant effects on a Natura 2000 site in view of the site's conservation objectives.

A Natura Impact Statement was undertaken by Moore Group for the proposed development which is presented as Appendix 7.1 to this chapter.

7.3.1 Policy & Guidance

7.3.1.1 EU Habitats Directive

The “Habitats Directive” (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union and lists certain habitats and species that must be protected within wildlife conservation areas, considered to be important at a European as well as at a national level. A “Special Conservation Area” or SAC is a designation under the Habitats Directive. The Habitats Directive sets out the protocol for the protection and management of SACs.

The Habitats Directive sets out key elements of the system of protection including the requirement for “Appropriate Assessment” of plans and projects.

7.3.1.2 Birds Directive

The “Birds Directive” (Council Directive 79/409/EEC as amended by Directive 2009/147/EC on the Conservation of Wild Birds) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. The Birds Directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). A “Special Protection Area” or SPA, is a designation under The Birds Directive.

Special Areas of Conservation and Special Protection Areas form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires appropriate assessment.

7.3.1.3 Wildlife Acts (1976 - 2012)

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976. The aims of the wildlife act according to the National Parks and Wildlife Service are *“... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims.*” All bird species are protected under the Wildlife Act 1976. The Wildlife (Amendment) Act of 2000 amended the original Wildlife Act 1976 to improve the effectiveness of the Wildlife Act 1976 to achieve its aims.

Both the Habitats Directive and the Birds Directive have been transposed into Irish law by one set of regulations (i.e. The European Communities (Birds and Natural Habitats) Regulations 2011 to 2015 (as amended).

7.3.2 Habitat Survey

The habitat survey was carried out in three stages, firstly through desktop research to determine existing records in relation to habitats and species present in the study area (i.e. the area of the proposed development). This included research on the National Parks and Wildlife Service (NPWS) metadata website, the National Biodiversity Data Centre (NBDC) database and a literature review of published information on flora and fauna occurring in the proposed development areas.

Other environmental information for the area was reviewed, e.g. in relation to soils, geology, hydrogeology and hydrology. Interactions in terms of the chapters on these topics presented in this EIA Report were important in the determination of source vector pathways and links with potentially hydrologically connected areas outside the proposed development site.

The second phase of the survey involved site visits to establish the existing environment in the footprint of the proposed development area. Areas which were highlighted during desktop assessment were investigated in closer detail according to the Heritage Council Best Practice Guidance for Habitat Survey and Mapping (Smith *et al.*, 2011). Habitats in the proposed development area were classified according to the Heritage Council publication “A Guide to Habitats in Ireland” (Fossitt, 2000). This publication sets out a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. This form of classification uses codes to classify different habitats based on the plant species present. Species recorded in this report are given in both their Latin and English names. Latin names for plant species follow the nomenclature of “An Irish Flora” (Parnell & Curtis, 2012).

Habitats were surveyed on the 30th January, 26th February and 3rd April 2019 by conducting a study area walkovers covering the main ecological areas identified in the desktop assessment. The survey dates are outside the optimal survey period for botanical species. However, they are adequate for the purposes of this assessment given the artificial surfaces and buildings present.

Signs of mammals such as badgers and otters were searched for while surveying the study area noting any sights, signs or any activity in the vicinity especially along adjacent boundaries.

Birds were surveyed using standard transect methodology and signs were recorded where encountered during the field walkover surveys. Winter birds were surveyed by Dr. Chris Peppiatt on the 27th of November and the 4th of December 2019. Dr. Peppiatt’s report and avian impact assessment is presented as Appendix 7.2 to this EIAR. The attached report presents a separate methodology which is not repeated here. The initial timing of reporting was with regard to a target Brexit date and so only two survey dates were completed. However, these are considered adequate for assessment given the developed nature of the sites and the scale and type of development proposed.

Following desktop assessment an evaluation of the development area and determination of the potential impacts on the flora and fauna of the area is based on the following guidelines and publications:

- EPA Draft EIA Report Guidelines 2017;
- European Commission Guidance on the Preparation of the EIA Report (2017) as well as the European Commission Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (2013);

- Assessment of plans and projects significantly affecting Natura 2000 sites (EC, 2002);
- Managing Natura 2000 Sites (EC, 2000) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2000);
- Managing Natura 2000 Sites (EC, 2018) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC "*Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*" (EC, 2018);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, Rev. Feb. 2010); and
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018).

The following resources assisted in the production of this chapter of the report:

- Ordnance Survey Ireland maps;
- OSI, Google and Bing Aerial photography (1995 – 2020);
- NPWS Mapviewer: http://www.npws.ie/en/MapsData/;
- Designated sites (SACs, SPAs, NHAs);
- Records of protected species from 10km squares; and
- National Biodiversity Data Centre Records and Maps.

Other environmental information for the area was reviewed, e.g. in relation to soils, geology, hydrogeology and hydrology. Interactions in terms of the chapters on these topics presented in this EIA Report were important in the determination of source vector pathways and links with potentially hydrologically connected areas outside the proposed development site.

7.4 RECEIVING ENVIRONMENT

The site of the proposed development comprises two relatively small areas of open gravelled surfaces (Fossit Code ED2) and artificial surfaces and buildings (Fossit Code BL3). The northern and larger (c. 3.75 hectares) of the sections of the site of the proposed development is a rectangle of land with its long axis running from east to west (referred to as the Bond Drive Site). This rectangle of land is bordered on its northern and eastern boundaries by a strip of land from 25 to 35 metres in width and on which there is a soil bank or bund 10-15 metres wide and several metres high. A shelter belt of mixed woodland (WD2), mainly comprised of Sycamore, White Poplar and Scots Pine, has been planted on the soil bank and has now reached maturity.

The area to the north and east of this boundary zone is part of the River Tolka estuary and is designated as part of the South Dublin Bay and River Tolka Estuary SPA. The area of estuary adjacent to the northern wooded soil bank (and to the east of the VP used by the bird surveyor) is characterised by rocky shore fucoid reef (LR2; Natura 2000 1170). The channel of the River Tolka runs close to this shore so that here is very little exposed sediment, even at low tide.

There is a smaller (c. 1.6 hectares) site to the south which is referred to as Yard 3 & 4 which comprises a hardstand area and associated warehouses on Bond Drive Extension and Promenade Road respectively.

The following is a description of the flora and fauna of the existing environment in the study area.

7.4.1 Designated Conservation Areas

Department of the Environment, Heritage and Local Government (2009) Guidance on Appropriate Assessment suggests an assessment of European sites within a zone of impact of 15 km.

This distance is a guidance only and the zone of impact has been identified taking consideration of the nature and location of the proposed development to ensure all European sites with connectivity to it are considered in terms of a catchment-based assessment.

The zone of impact may be determined by connectivity to the proposed Project in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The guidance provides that, it is necessary to identify the sites and compile information on their qualifying interests and conservation objectives. In preparation for this, the potential for source pathway receptor connectivity is firstly identified and detailed information is then provided on sites with connectivity.

European sites that are located within 15 km of the Project are listed in Table 7.1 and presented in Figure 7.1 below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on the 8th April 2020.

Table 7.1 Details of European sites within the potential zone of influence of the project.

Site Code	Site name	Distance (km)[1]
000199	Baldoyle Bay SAC	7.23
000202	Howth Head SAC	7.72
000205	Malahide Estuary SAC	10.39
000206	North Dublin Bay SAC	1.97
000210	South Dublin Bay SAC	1.89
001209	Glenasmole Valley SAC	14.58
002122	Wicklow Mountains SAC	13.61
002193	Ireland's Eye SAC	10.88
003000	Rockabill to Dalkey Island SAC	8.07
004006	North Bull Island SPA	1.96
004016	Baldoyle Bay SPA	7.24
004024	South Dublin Bay and River Tolka Estuary SPA	0.02
004025	Malahide Estuary SPA	11.04
004040	Wicklow Mountains SPA	13.89
004113	Howth Head Coast SPA	10.37

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[1] Distances indicated are the closest geographical distance between the proposed Project and the European site boundary, as made available by the NPWS. Connectivity along hydrological pathways may be significantly greater.

Site Code	Site name	Distance (km)[1]
004117	Ireland's Eye SPA	10.68
004172	Dalkey Islands SPA	11.48

The nearest European sites to the proposed development is the South Dublin Bay and River Tolka Estuary SPA located c. 25m to the northern boundary of the site.

Figure 7.1 Site Location in relation to nearby European sites.

7.4.2 Non-Designated Habitats

The proposed development area is comprises buildings and artificial surfaces (BL3), see Figure 7.2 below. The footprint areas are composed of tarmac and of gravel or loose chippings and are artificial in nature.

Species recorded include ruderal species such as Dandelion (*Taraxacum officinale* agg.), Sow thistles (*Sonchus oleraceus, S asper*), Ragwort (*Senecio jacobaea*), Bucks-horn Plantain (*Plantago coronopus*), Ribwort and Broad plantain (*P. lanceolata, P. major*), Thistles (*Cirsium vulgare, C. arvense*) along with Nettle (*Urtica diocia*) Broad dock (*Rumex obtusifolius*) Red valerian (*Centranthus ruber*), Mugwort (*Artemisia vulgaris*), Teasel (*Dipsacus fullonum*) and Bramble (*Rubus fruticosus* agg).

Butterfly bushes (*Buddleia davidii*) are frequent as juvenile low growing plants along boundaries and in high density along the woodland fringe.

Figure 7.2 Showing the site boundaries and existing artificial surfaces and surrounding woodland strip.

The mixed broadleaved/conifer woodland strip (WD2) is comprised mostly of Pine (*Pinus* spp.) with White poplar (*Populus alba*), Alder (*Alnus* spp.) and Sycamore (*Acer pseudoplatanus*).

There are very small patches of scrub in the most easterly site plot which correspond to remnant encroachment of the woodland in that area which has been removed in preparation of the SIAC site compound for the Dublin Port Greenway development. Cordoned off scrub areas where Japanese Knotweed (*Fallopia japonica*) is being treated was noted during fieldwork.

There were no Flora Protection Order (2015) species recorded within or immediately adjacent to the Project sites.

7.4.3 Invasive Species

Japanese Knotweed has been previously recorded and mapped adjacent to the proposed development site, specifically in the area mentioned above and also along the woodland bund to the north, see Figure 7.3 below.

An Invasive Species Management Plan has been prepared by Enviroco which covers the area of the subject proposed development and adjacent woodland bund.

The plan is currently being implemented with final treatments due to take place in Summer 2020.

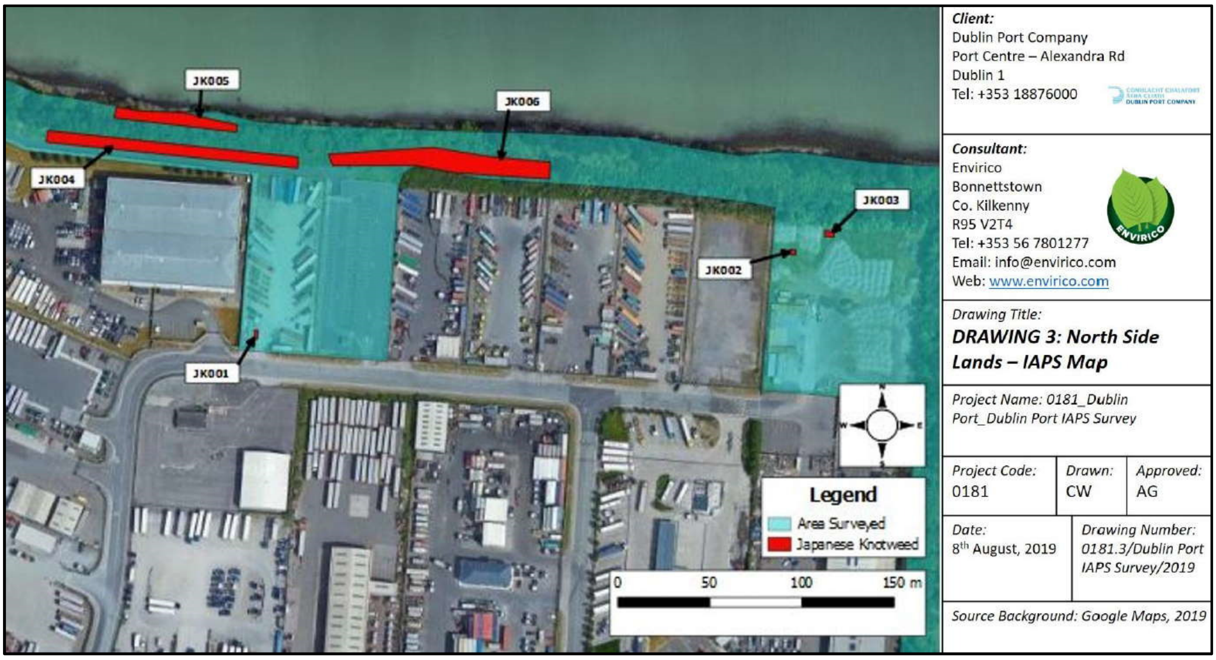

Figure 7.3 Showing location of JKW mapped by Enviroco in July 2019.

7.4.4 Fauna

Terrestrial Mammals

There are no suitable habitats for Badgers or Otters in the proposed development area. The proposed development area located in an urban lit environment is of low value to commuting bats.

An external survey of the warehouse on the southern section of the site did not reveal any signs of bats. Similarly previous surveys of the Crosbie's Yard site to the east of Dublin Port did not record any signs of bats.

The overall developed areas of this section of Dublin Port are of low value to bats. This has been established in a Report by Dr. Aughney in 2019 for the Redevelopment of the MP2 Areas of Dublin Port presented in the project EIAR. Walking Transect surveys did not record any bats. Dr. Aughney reports that Dublin Port is a highly industrialised and lit up zone with little vegetation for foraging bats. Therefore the survey area was deemed to have low potential for local bat populations and the buildings surveyed also deemed to have a low potential as a roosting site for bats.

Additionally, the EIS for the Alexandra Basin Redevelopment Project to the south of Dublin Port includes a bat survey carried out by Dr. Aughney in 2014. Dr. Aughney did not find any signs of roosting bats but does refer to a summer survey undertaken by RPS ecologists when two species of bats; Leisler's and Common Pipistrelle were recorded as probably foraging or commuting over the subject site. Dr. Aughney also confirms that these two species of bat have been frequently recorded foraging along coastal areas of Dublin while roosting further inland. Leisler's bats, in particular, will feed high over open water seeking plumes of insects. Common pipistrelles, on the other hand, will feed over open water close to either vegetation or structures, which are being used as shelter points by insects.

Marine Mammals

Dublin Bay and environs has a wealth of marine mammals including seals, harbour porpoise, dolphins and whales recorded in its waters. Its international importance is recognised through the designation of a number of Special Areas of Conservation. Grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are regularly observed within the Port and vicinity of the Tolka Estuary. Harbour porpoise (Phocoena phocoena) have been observed as far in as the North Bank Lighthouse in the navigation channel of Dublin Port (pers. comm. IWDG).

Birds

The tree lined boundary of the larger northern section of the site provides nesting habitat for smaller summer nesting birds. All nesting birds are protected under the Wildlife Acts 1976-2018. Species recorded included regular passerines such as Chaffinch (*Fringilla coelebs*), Goldfinch (*Carduelis carduelis*), Wren (*Troglodytes troglodytes*) and Blackbird (*Turdus merula*). Hooded Crow (*Corvus cornix*), Robin (*Erithacus rubecula*) and Blue Tit (*Parus caeruleus*) are also present throughout the year. Common Buzzard (*Buteo buteo*) were also recorded using the woodland bund as a perching area.

Magpie, Hooded Crow, Pied Wagtail and Feral Pigeon were also recorded at the site of the proposed development. None of the four is of particular conservation interest.

The results of a Winter Bird Survey are presented in Appendix 7.2 to this EIAR. Survey work was carried out by Dr. Chris Peppiatt, Consultant Ornithologist & Ecologist on two dates in December 2019 and January 2020.

No species listed in Annex I of the E.U. Birds Directive were recorded within the site of the proposed development. Of the six species of birds actually recorded at the site of the proposed development, only one is a special conservation interest (SCI) of the South Dublin Bay and River Tolka SPA, which has 13 SCI species in all. This species, Black-headed Gull, is listed as a wintering interest of the SPA. A maximum of one bird was recorded within the site of the proposed development. A single Herring Gull was also recorded on one occasion within the larger northern block of the site of the proposed development and gulls (i.e. both Herring and Black-headed) were also seen in flight over these areas. Both species are listed in the Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 red list in respect of breeding populations only.

There are two sites designated as Special Protection Areas (SPAs) for birds within a radius of five kilometres of the site of the proposed development.

The boundary of the South Dublin Bay and River Tolka Estuary SPA lies 35 metres north and 25 metres east of the site of the proposed development.

The North Bull Island SPA lies approximately 1.9 kilometres east of the site of the proposed development. The North Bull Island and South Dublin Bay and River Tolka Estuary SPAs border each other and it is difficult to see why the two were not designated as a combined Dublin Bay SPA. However, given the drainage mitigation that forms part of the proposed development and the distance of the site of the proposed development from the nearest part of the

North Bull Island SPA, it can be assumed that there is no potential for negative impacts (i.e. in the form of water pollution and/or disturbance) on this SPA. Accordingly, the South Dublin Bay and River Tolka Estuary SPA is the only SPA that needs to be considered in respect of the potential of the proposed development for negative impacts on birds and their habitats.

7.4.5 Habitat Evaluation

The ecological value of the site was assessed following the guidelines set out in the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (2016) and according to the Natura Scheme for evaluating ecological sites (after Nairn & Fossitt, 2004). Additionally, the TII Guidelines (formerly NRA) for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009) outlines the methodology for evaluating ecological impacts. Assessments on the evaluation were made using geographic frames of reference, e.g. European, National, Regional or Local.

There are no rare or protected habitats recorded inside the proposed development boundary. The proposed development area may be considered of Low Local Ecological Value.

The nearest European sites are located in North Dublin Bay.

There will be no direct impacts on the Dublin Bay European sites and there would be no habitat loss or fragmentation as a result of the proposed development due to the enclosed nature and location of the proposed development. Having considered direct impacts and ruling them out, indirect impacts are then considered in terms of source pathway vectors.

There will be no indirect impacts on the European sites in North Dublin Bay.

7.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

7.5.1 Impacts on Habitats

The proposed development area habitat is of low ecological value. The potential effects on local ecology are ***neutral*** and ***imperceptible*** for the construction and operational phases.

7.5.2 Impacts on Fauna

None of the qualifying habitats or species of the European sites occur under the footprint of the proposed works areas.

The proposed development area habitat is of low ecological value for fauna.

There will be no impacts on Bats, Otters or Badgers.

Marine Mammals

A scoping email was sent to the Irish Whale & Dolphin Group and a response received which is included as an Appendix to the Project EIAR. The core response of the IWDG is included here as follows.

IWDG Consulting believe that the risk of disrupting the life cycle of marine mammals in that area is extremely low. As the works are not occurring underwater, a marine mammal observer will not be required. The works are proposed to resurface hard-standing areas, to put in place addition surface water drainage to additional interception within the Dublin Port Drainage Scheme and to refurbish existing warehouses and erect low scale control points. There will be no blasting, major groundworks or coring and consequently there will be no significant noise or vibration generated during construction.

In summary, it is the expert opinion of the IWDG Consulting, that it is unlikely that these proposed works will have any significant impacts on marine mammals in the vicinity of the works nor have the conservation objectives of the Rockabill to Dalkey Island SAC been compromised.

Birds

Potential impacts on the South Dublin Bay and River Tolka Estuary SPA

(1) Loss of habitat

None of the site of the proposed development lies within any Natura 2000 site. There will be no direct loss of habitat in the SPA, therefore.

(2) Pollution

Construction of the proposed development will involve the redevelopment of an area that is already gravelled and where there are existing buildings to an area with new differing buildings and structures and with gravelled or possibly concrete standing. There will be earth works, but these will be relatively minor (some new foundations and the installation of some new drainage features). There is minor potential for mobile pollutants to reach the SPA via surface water runoff. The most likely potential for pollution is from silt displaced during earthworks or hydrocarbons escaping from machinery. This impact will be **short-term** and **minor/negligible**, it can be mitigated completely by suitable measures (e.g. silt fencing). It should be remembered that the site is effectively buffered from the SPA and Tolka estuary by the wooded bank or bund that separates it from them. During the operational phase the potential for pollution will be decreased. Assuming that proper arrangements are put in place to deal with any waste produced by the people who will be using the facility, the remaining potential source of pollution is via runoff. This **permanent minor** impact will be mitigated by means of standard design SuDS features such as attenuation, updates to the surface water drainage and sewerage network and petrol interception that are included in the design of the proposed development.

(3) Disturbance

(a) Construction disturbance

Construction activities will cause increased human presence and noise in area approximately 25-35 metres distant from the South Dublin Bay and River Tolka Estuary SPA. Construction itself will entail the redevelopment of an area that is already gravelled and where there are existing buildings to an area with new buildings and structures and with gravelled or possibly concrete standing. Earth works will be relatively minor, including some new foundations and the installation of some new drainage features, but major works (i.e. deep excavations, rock breaking or pile driving) will not be involved.

While the distances from the SPA (25-25 metres for the closest part of the proposed development) are not large it should be remembered that the SPA sheltered from construction disturbance visually largely to completely and acoustically at least to some extent by the soil bank and its woodland cover. The area is currently subject to certain amount of human disturbance, including traffic and in some parts is used by haulage trucks and so is not without potential background disturbance. The net result is that while there will be a short-term moderate disturbance impact within the site of the proposed development (which is not designated land), the **impact on the SCI species of the South Dublin Bay and River Tolka Estuary SPA** will be **negligible**.

(b) Disturbance during the operational phase

Disturbance during the operational phase of the development is expected to consist of human traffic and trucking traffic, much as it is today, but probably at a slightly increased intensity.

The same arguments that pertain to disturbance of SCI species within the boundary of the SPA (3a, above) are also relevant for disturbance during the operational phase.

It was noticed during the bird surveys at the site of the proposed development that the SPA shoreline immediately adjacent is characterised by a rocky shoreline (fucoid reef) and that there was little or no exposed fine sediment below these rocks even at low tide. The reason for this is that the channel of the River Tolka runs close to the shoreline in this area, so that the channel remains watered even at low tide. The numbers of waterbirds recorded using this area of shoreline were few (maxima of three Grey Heron, two Curlew, one Greenshank and one Common Gull during eight hours of watches at both high and low tides).

As is the case in 3a (above), the impact on the SPA SCI species will be **negligible**. This is by reason of the broadly similar current background operating disturbance, the shielding effect of the wooded soil bank, the lack of suitability of the habitats within the site of the proposed development as overspill habitat for the SPA SCI species, the low numbers of waterbirds recorded in the area immediately adjacent to the site of the proposed development (as opposed to areas of marine sediments that are available further away) and the large areas of suitable estuarine habitats that are available for wintering waterbird foraging or roosting in areas of the SPA that are further (i.e. 100 metres or more) from the site of the proposed development.

Thus, there will be **no significant operating disturbance impacts on the South Dublin Bay and River Tolka Estuary SPA SCI species**.

There is specific reference to the Tern colonies located in Dublin Bay and in particular the nearest pontoon in the concluding remarks of the Avian Impact Assessment as follows.

The nearest of the Common Tern breeding sites in the area is the pontoon that lies 760 metres east of the nearest part of the proposed development site (i.e.

the Bond Drive Extension site). The land areas (the pontoon is 100 metres offshore of the docks) between the site of the proposed development and the pontoon are all covered with existing and operating parts of the Dublin docks. The nearest area that is used by post-breeding/passage flocks of Common, Arctic and Roseate terns is at least two kilometres from the site of the proposed development. Terns are generally very little affected by human disturbance, except when it is at their nesting and/or resting sites; they routinely forage and commute very close to moving shipping and man-made coastal features like docks and piers. As such, it can be confidently stated that the proposed development will have no impact on tern species.

The numbers of birds occurring actually within the site of the proposed development are insignificant. While the possibility for disturbance (both during construction and operation) to waterbirds within the SPA has been noted, this will be a negligible impact. The indications are (i.e. from surveys held on the 27th November and the 4th of December 2019) that the numbers of waterbirds using the areas directly adjacent to the site of the proposed development are few. Even if minor disturbance occurs, there are large areas of suitable estuarine habitats within more distant parts of the SPA that will be available to SCI species.

When in operation, the sites of the proposed development will be subject to truck traffic and truck parking, this is the same as the current use of at least some of these areas, so that it can be said that the operational phase of the development will result in little or no change from the status quo.

7.5.3 Do Nothing Scenario

The Do Nothing scenario would involve the proposed development not taking place. The baseline environment would not change. Given the proposed development is located in an area of low ecological value, the do nothing scenario would have a neutral impact on biodiversity.

7.6 REMEDIAL AND MITIGATION MEASURES

There are no required mitigation measures with regard to biodiversity because there are no predicted impacts on biodiversity.

There will be no discharge of surface water to sea, and all surface water will discharge to the existing Dublin Port drainage system. The drainage plan will utilise attenuation and interceptors on the site, and there are further interceptors located along the extent of the Dublin Port system.

Specific precautionary mitigation measures are included in the CEMP for the proposed development.

7.7 PREDICTED IMPACTS OF THE DEVELOPMENT

The proposed development will have a ***neutral imperceptible*** effect on designated sites within the zone of impact of the development site.

The proposed development will have a ***neutral imperceptible*** effect on local biodiversity.

7.8 RESIDUAL IMPACTS

The proposed development is located in an area of low ecological value and as such predicted to have a ***neutral imperceptible*** effect on biodiversity.

7.9 CUMULATIVE IMPACTS ASSESSMENT

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (including other Brexit related developments at nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 7.9.1 and 7.9.2 below.

7.9.1 Assessment of Plans

Dublin Port Masterplan 2012 - 2040 (Reviewed 2018)

The Dublin Port Masterplan 2012 - 2040 (DPM) is the core document which guides the development in Dublin Port up to 2040. The DPM was first published in February 2012, by the Dublin Port Company (DPC), with the first review of the DPM completed in 2018. It is envisaged that the second review of the DPM will take place no earlier than 2023, and no later than 2028. The DPM is a non-statutory plan but has been compiled in within the context of prevailing EU, national, regional and local development plan policies. The DPM was developed by DPC with the intention to:

- Plan for future sustainable growth and changes in facilitating seaborne trade in goods and passenger movements to and from Ireland and the Dublin region in particular;
- Provide an overall context for future investment decisions;
- Reflect and provide for current national and regional policies, local guidelines and initiatives; and,
- Ensure there is harmony and synergy between the plans for the Port and those for the Dublin Docklands Area, Dublin City and neighbouring counties within the Dublin Region. Give some certainty to customers about how the Port will develop in the future to meet their requirements.

The DPM suggests options to facilitate Dublin Port handling up to 77 million gross tonnes by 2040.

The DPM outlines a number of strategic objectives to facilitate the effective operation of Dublin Port in the period to 2040. The most relevant of these to the proposed development are outlined below under their respective headings as defined in the DPM.

<u>Port Functions</u>

- Ensure the safe operation and sustainable development of the Port and its approach waters and provide appropriate infrastructure, facilities, services and accommodation for ships, goods, and passengers to meet future demand.
- Optimise the use of Port lands by rationalising the distribution and location of specific areas of activity (including Ro-Ro, Lo-Lo, passenger ferry services, Cruise Ships, Bulk Liquid, Bulk Solid and Break Bulk goods) with necessary reconfigurations of service facilities as required.
- Recover lands that are not being used for core port activities.

- Use new and developing technology to increase throughput to its environmentally sustainable maximum.
- Identify configurations for extending berthage and storage that mitigate impact on adjacent environmentally sensitive / designated areas.

Investment and Growth

- Utilise the Masterplan as a framework for investment and growth based on the Port's projected demand forecasts.

Movement and Access

- Develop a transport plan for the Port estate in conjunction with the NTA and DCC.

Environment and Heritage

- Integrate new development with the built and natural landscapes of the surrounding area.

The DPM shows the proposed Project site zoned as "lands currently used for Non-Core Activity for Future Redevelopment". This zoning aligns the proposed development site with the strategic objectives outlined above.

7.9.2 Assessment of Projects

The DCC Planning Department website was consulted in order to generate a list of granted planning permissions from the surrounding areas of the proposed development within the previous five years (since October 2014). The area under consideration for this search included the Dublin Port, East Wall and Ringsend areas. The outcome of this search is presented in Table 3.1 of Appendix 3.1. of the Project EIAR.

Notable applications granted planning permission, which will be undergoing construction at the same time as the proposed development are described below.

Dublin Port MP2 Project

The Dublin Port MP2 Project is a notable proposed development in Dublin Port, currently under consideration by An Bord Pleanála (ABP Reg. Ref. PL29N.304888), with a decision due by January 20th 2020. The development, applied for by the Dublin Port Company, consists of 15-year permission for development at Oil Berth 3 and Oil Berth 4, Eastern Oil Jetty and at Berths 50A, 50N, 50S, 51, 51A, 49, 52, 53 and associated terminal yards to provide for various elements including new Ro-Ro jetty and consolidation of passenger terminal buildings. Pending grant of planning permission, construction of this development, which will consist of both land and marine works across a number of phases, will commence in Q2 2022, and finish in Q1 2032.

Dublin Port Alexandra Basin Redevelopment

The Alexandra Basin Redevelopment consists of:

- the redevelopment of Alexandra Basin West including demolition of part of North Wall Quay Extension and its reconfiguration, new quay walls, dredging as well as excavation of contaminated materials, infilling of Graving Dock No2, provision for new berths and conservation measures including the excavation of Graving Dock No.1 and the construction of an interpretive centre on North Wall Quay Extension;

- The infilling of Berths Nos. 52 and 53 at the eastern end of the Port and the provision of new landside and berthing facilities, and;
- Dredging of the approach channel and provision of a marina protection structure to the north of the Poolbeg Yacht, Boat Club and Marina

Permission for these works was granted by An Bord Pleanála on 8th July 2015 (ABP Reg. Ref PL29N.PA0034). Works began in November 2016 and will continue within the 10-year planning permission timeframe.

Dublin Port Greenway

Comprising works to the Port's private internal road network and includes works on public roads at East Wall Road, Bond Road and Alfie Byrne Road, the Dublin Port Greenway development was granted permission by Dublin City Council in July 2016 (DCC Reg. Ref. 3084/16). The scheme is due to commence construction in early 2020, with the complete programme of works anticipated to be 24 – 42 months. The duration of works on the external road network is expected to be 6 – 12 months.

Other Nearby Brexit Related Developments

Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017).

There are no predicted in-combination effects with other developments given that they have been assessed for potential significant effects on European sites and granted permission with conditions to planning.

7.9.3 Conclusion of In-combination Effects

Given the inclusion of strict Best Practice Construction Measures to be included and enforced through a Construction Environmental Management Plan, the proposed development will have no predicted impacts on local ecology and biodiversity or on hydrologically linked European sites, therefore in-combination impacts can be ruled out.

7.10 INTERACTIONS

There are no predicted in-combination or cumulative impacts with regard to interaction with other aspects of the environment.

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APPENDIX 7.1

NATURA IMPACT STATEMENT

MOORE GROUP – ENVIRONMENTAL SERVICES (2020)

Natura Impact Statement

Appropriate Assessment

Dublin Port

Brexit Infrastructure at Dublin Port

Prepared by: Moore Group – Environmental Services

June 2020

On behalf of the Office of Public Works (OPW)

& An Bord Pleanála

Project Proponent	Office of Public Works (OPW)
Project	Brexit Infrastructure at Dublin Port
Title	Natura Impact Statement Appropriate Assessment Brexit Infrastructure at Dublin Port

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Moore Archaeological and Environmental Services Limited			

Abbreviations

AA	Appropriate Assessment
ABP	An Bord Pleanála
CEMP	Construction Environmental Management Plan
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
GIS	Geographical Information System
IW	Irish Water
LAP	Local Area Plan
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OSI	Ordnance Survey Ireland
OPW	Office of Public Works
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SuDS	Sustainable Drainage System

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1. Introduction

1.1. General Introduction

This Natura Impact Statement (NIS) has been prepared by Moore Group – Environmental Services on behalf of the Office of Public Works and An Bord Pleanála. The NIS report contains information to assist An Bord Pleanála in carrying out an Appropriate Assessment (AA) on the effects of the development of Brexit Infrastructure at Dublin Port (hereafter referred to as the proposed Project) on European sites, to ascertain whether or not the Project would adversely affect European site integrity.

This NIS informs the Appropriate Assessment process in the determination of the significance of potential impacts on the conservation objectives of European sites. It is necessary that the Project has regard to Article 6 of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (referred to as the Habitats Directive). This is transposed into Irish Law by Part XAB of the *Planning and Development Act 2000 (as amended)* and the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. 477) (referred to as the Habitats Regulations). The focus of the assessment is on objectively assessing by reference to the evidence as to whether the Project will adversely affect the integrity of the European sites in light of their conservation objectives.

The development will be granted approval by way of a Ministerial Order, which will be issued by reason of the impending withdrawal and/or the withdrawal of the United Kingdom from the European Union. Pursuant to this Order, the provisions of the Planning and Development Act 2000 (as amended) shall not apply to the development being carried out on behalf of the Minister by the Office of Public Works on the site specified in the text of the Order. Similar Orders have already been issued for several other projects undertaken by OPW in Dublin Port in response to Brexit. These projects were subject to an EIA and AA screening as appropriate.

The proposed development is being treated in accordance with the requirements outlined in S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019. S.I. No. 418/2019 amends as specified the *Planning and Development Act 2000 (as amended)*. Of particular relevance to the proposed development, are the insertions of subsections after subsection (2):

- "(2A)(b) Where development is proposed to be carried out by or on behalf of a Minister concerned pursuant to an order under subsection (2)(a) and the Minister concerned is satisfied, having had regard to Part X and Part XAB, that an environmental impact assessment or an appropriate assessment, or both such assessments of the proposed development is or are required, the Minister concerned shall prepare or cause to be prepared an application for approval, which shall include the documents and information referred to in paragraph (c), in respect of the development and shall apply to the Board for such approval."
- "(2A)(c) An application for approval referred to in paragraph (b) shall include a draft of the order the Minister concerned proposes to make under subsection (2)(a), the

> plans, drawings and particulars in relation to the proposed development and, other than where an exemption is granted under subsection (2I), an environmental impact assessment report or Natura impact statement, or both that report and that statement, as the case may be, in respect of the development."

In accordance with these subsections, an Environmental Impact Assessment Report and Natura Impact Statement are being submitted to ABP for approval in respect of the proposed development. The documents submitted to ABP will also be subject to public consultation and will be made available to the public online.

1.2. Legislative Background - The Habitats and Birds Directives

The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) is the main legislative instrument for the protection and conservation of biodiversity in the EU. Under the Directive Member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a European Union context.

The Birds Directive (Council Directive 79/409/EEC, amended by Council Directive 2009/147/EC on the Conservation of Wild Birds), is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to affect Natura 2000 sites.

Article 6(3) addresses the requirement to screen plans and projects and to carry out a further assessment if required (Appropriate Assessment (AA)); Article 6(4) establishes requirements in cases of imperative reasons of overriding public interest):

> Article 6(3): *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site*

> *concerned and, if appropriate, after having obtained the opinion of the general public."*
>
> Article 6(4): *"If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of the Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species the only considerations which may be raised are those relating to human health or public safety, to the beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest."*

These obligations in relation to Appropriate Assessment have been implemented in Ireland under Part XAB of the Planning and Development Act 2000, as amended, and in particular Section 177U and Section 177V thereof.

1.3. Methodology

The Commission's methodological guidance (EC, 2002) promotes a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1-2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

Stage 1 Screening: The process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans and considers whether these impacts are likely to be significant.

Stage 2 Appropriate Assessment: In this stage, there is a consideration of the impact of the project with a view to ascertain whether there will be any adverse effect on the integrity of the Natura 2000 site either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are predicted impacts, an assessment of the potential mitigation of those impacts is considered.

Stage 3 Assessment of Alternative Solutions: This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain: Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

1.4. Guidance

The NIS has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- 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 (European Commission Environment Directorate-General, 2002); hereafter referred to as the EC Article Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC (EC, 2018).

1.5. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites, and the environment within which they are located, are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
    - National Parks & Wildlife (NPWS) protected site boundary data;
    - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
    - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
    - Open Street Maps;
    - Digital Elevation Model over Europe (EU-DEM);

  - Google Earth and Bing aerial photography 1995-2020;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including:
  - Natura 2000 - Standard Data Form;
  - Conservation Objectives;
  - Site Synopses;
- National Biodiversity Data Centre records;
  - Online database of rare, threatened and protected species;
  - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans in neighbouring areas;
  - Dublin City Development Plan 2016 – 2022
  - Dublin Port Masterplan 2012 – 2040

1.6. Statement of Authority

This report was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has over 25 years' experience in environmental impact assessment and has completed numerous reports for Appropriate Assessment Screening and Natura Impact Statements in terrestrial and aquatic habitats.

Assessment of birds was provided by Dr. Chris Peppiatt, Consultant Ornithologist & Ecologist.

Engineering and technical data for the Project was supplied by AWN Consulting and Arup.

1.7. Description of the Project

Dublin Port is the main seaport and point of entry for ferry and container traffic into the Republic of Ireland. It is located east of the city centre. It is equipped with a ferry terminal, container terminals and storage facilities, as well as supporting infrastructure, including public roads. The proposed site for the proposed development is on an area of previously developed land within the boundary of Dublin Port.

The proposed development will consist of:

Various Sites along Bond Drive Extension, Dublin Port, Dublin 3

The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 5 single storey porta-cabin structures totalling 375m^2 (75m^2 each) to provide an import office, a facilities management office and driver welfare facilities;

Resurfacing and amalgamation of 8 existing yards including the modification of existing drainage and lighting infrastructure;

Parking for 175 heavy goods vehicles, 62 cars and 48 bicycles;

Gates, signage and all ancillary site works.

Former Bord na Mona site on Yard 3, Bond Drive Extension, Dublin Port, Dublin 3, D03 F9C1
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Installation of 2 single storey porta-cabin structures totalling 150m^2 (75m^2 each) to provide an export office and sanitary facilities;

Parking for 30 heavy goods vehicles and 10 cars;

Gates, signage and all ancillary site works.

Former O'Toole Transport site on Yard 4, Promenade Road, Dublin Port, Dublin 3, D03 F9C1
The proposed development of Brexit related facilities is to be provided within the existing boundary of lands of the Dublin Port Company, and will consist of:

Extension (the floor area of which extension is approximately 1760m^2) and refurbishment of an existing industrial building on Promenade Road to provide inspection facilities for customs, sanitary and phytosanitary (SPS) and health checks and controls;

Parking for 3 cars and 28 bicycles;

Gates, signage and all ancillary site works.

The overall planning application site area is approximately 5.4 hectares.

Surface Water Drainage

The proposed surface water drainage system has been designed for a 2-year storm return period, and with no surface flooding at any part of the site for storms up to and including the 1:100 year return period plus 20% for climate change. Run-off from currently developed/hardstanding/roofs sites enters the off site drainage system, therefore there should be a significant future reduction in discharge volumes as a result of increase in attenuation within the proposed development. Oil petrol interceptors will be provided on all discharges from newly developed which will improve the quality of run off entering the sewer. All restricted discharges will have a sump unit which will also reduce the amount of silt entering the receiving system. Overall, the drainage will discharge through the Dublin Port Drainage outfall which includes additional measures for spill mitigation.

Foul Drainage

Domestic effluent arising from occupation of the proposed development will be collected in the existing foul drainage network within the site and discharged to the existing foul sewer infrastructure within Dublin Port. The wastewater discharged from the site will ultimately discharge to the municipal Wastewater Treatment Plant (WWTP) at Ringsend.

Figure 1 shows the proposed Project location and Figure 2 shows a detailed view of the proposed Project boundary on recent aerial photography. Figure 3 presents a plan of the proposed Project.

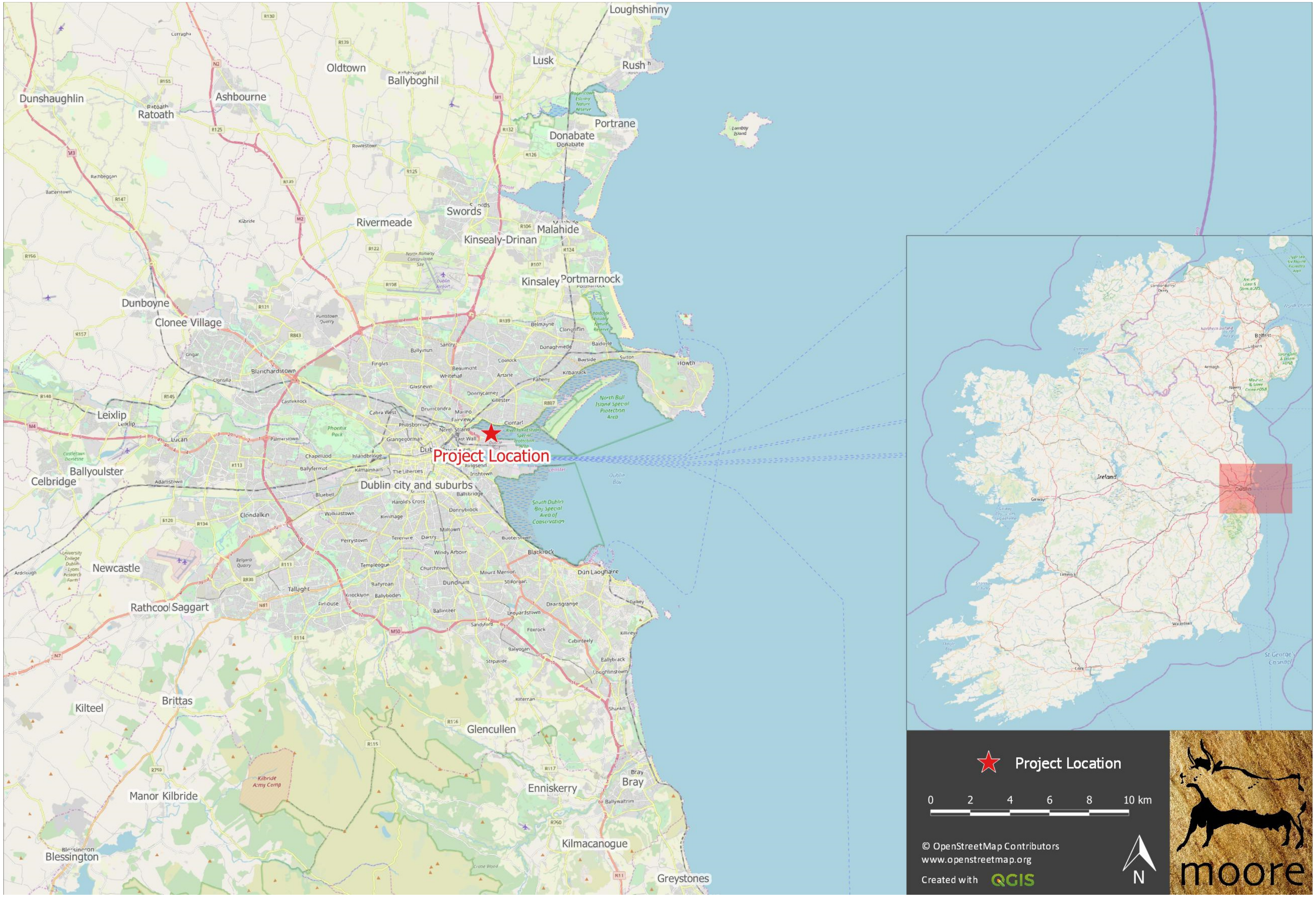

Figure 1. Showing the Project location at Dublin Port.

Figure 2. Showing the Project boundaries on recent aerial photography.

Figure 3. Plan of the proposed Project.

1.8. Construction Environmental Management

A Construction Environmental Management Plan (CEMP) has been prepared to manage the potential local impacts of construction activities associated with the development project.

The construction environmental management plan sets out the principles to be adhered to and outlines measures that will be implemented during the construction of the proposed development to ensure that potential environmental impacts and disturbance will be minimised or eliminated.

It will be the responsibility of the project proponent and contractor employed to update and add (where required) specific control measures relevant to the environmental management plan and procedures. The control measures will be amended by improvement with regards to environmental protection and will take cognisance of additional environmental commitments arising from planning conditions.

The Project Proponent will oversee the process through appointment of the contractor with input from the Project engineer and oversight from the planning and project team.

The main concern with regard to Biodiversity is the water quality of Dublin Bay. Good water quality status will be ensured by avoiding potential impacts during the construction phase and by the employment of appropriate design such as SuDS during the operational phase.

There will be no discharge to sea, and surface water will discharge to the existing Dublin Port drainage system. The drainage plan will utilise attenuation and interceptors on the site and further interceptors located along the extent of the Dublin Port system (see chapter 7 of the EIAR and Engineering report).

Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Due to the very low permeability of the Dublin Boulder Clay which underlies the site, infiltration to the underlying aquifer is not anticipated.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. All run-off will be prevented from directly entering into any water courses as no construction will be undertaken directly adjacent to open water.

No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavation is kept relatively dry.

Management measures will be put in place during the construction phase to ensure protection of surface waterbodies. These measures are in compliance with the relevant CIRIA guidance documents; Control of Water Pollution from construction Sites, Guidance for consultants and contractors (C532); and Environmental Good Practice on Site (3rd edition) (C692).

Detailed mitigation measures are outlined in Section 3.6 of this NIS which will be incorporated into the CEMP.

2. Stage 1 – Screening for Appropriate Assessment

Screening determines whether appropriate assessment is necessary by examining:

1) Whether a plan or project can be excluded from AA requirements because it is directly connected with or necessary to the management of the site, and;

2) The potential effects of a project or plan, either alone or in combination with other projects or plans, on a Natura 2000 site in view of its conservation objectives and considering whether these effects will be significant.

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process in certain circumstances, becomes overly complicated, then the process must proceed to Stage 2 (AA).

Department of Environment, Heritage and Local Government (2009) Guidance on Appropriate Assessment suggests an assessment of European sites within a zone of impact of 15 km. This distance is a guidance only and the zone of impact has been identified taking consideration of the nature and location of the proposed Project to ensure all European sites with connectivity to it are considered in terms of a catchment-based assessment.

The zone of impact may be determined by connectivity to the proposed Project in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The guidance provides that, at the screening stage, it is necessary to identify the sites and compile information on their qualifying interests and conservation objectives. In preparation for this, the potential for source pathway receptor connectivity is firstly identified and detailed information is then provided on sites with connectivity. European sites that are located within 15 km of the Project are listed in Table 1 and presented in Figures 4 and 5, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on the 14th April 2020.

Table 1 European Sites located within 15km or the potential zone of impact[2] of the Project.

Site Code	Site name	Distance (km)[3]
000199	Baldoyle Bay SAC	7.23

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[2] All European sites potentially hydrologically connected irrespective of the nature or scale of the proposed Project.

[3] Distances indicated are the closest geographical distance between the proposed Project and the European site boundary, as made available by the NPWS. Connectivity along hydrological pathways may be significantly greater.

Site Code	Site name	Distance (km)[3]
000202	Howth Head SAC	7.72
000205	Malahide Estuary SAC	10.39
000206	North Dublin Bay SAC	1.97
000210	South Dublin Bay SAC	1.89
001209	Glenasmole Valley SAC	14.58
002122	Wicklow Mountains SAC	13.61
002193	Ireland's Eye SAC	10.88
003000	Rockabill to Dalkey Island SAC	8.07
004006	North Bull Island SPA	1.96
004016	Baldoyle Bay SPA	7.24
004024	South Dublin Bay and River Tolka Estuary SPA	0.02
004025	Malahide Estuary SPA	11.04
004040	Wicklow Mountains SPA	13.89
004113	Howth Head Coast SPA	10.37
004117	Ireland's Eye SPA	10.68
004172	Dalkey Islands SPA	11.48

There are numerous European sites in the potential zone of impact of the proposed development. It has been noted that the site has existing connection to the Municipal Sewer and the Dublin Port Surface Water Drainage system. There are no rivers or streams in the vicinity of the proposed Project, as indicated in Ordnance Survey Ireland (OSI) Geographical Information System (GIS) data available from the Environmental Protection Agency (EPA).

The likelihood of contamination of surface water during the construction or operational phase is very low given the existing surface water drainage system of Dublin Port includes a series of interceptors and that additional interception will be put in place as outlined in Chapter 7 of the EIAR.

The site is located adjacent to the South Dublin Bay and River Tolka Estuary SPA (Site code 004024) and has proximal connectivity with the North Dublin Bay SAC (Site code 000206), the South Dublin Bay SAC (Site code 000210), the North Bull Island SPA (Site code 004006).

There is either no connectivity to the other European sites listed or they are located at too great a distance for significant impacts to occur and so only these latter four sites are brought forward for further consideration. Given the proximity of the proposed Project to Dublin Bay, a Construction Environmental Management Plan will be required and, therefore, Stage 2 NIS is required.

Stage 2 Appropriate Assessment of the Project has been prepared as follows.

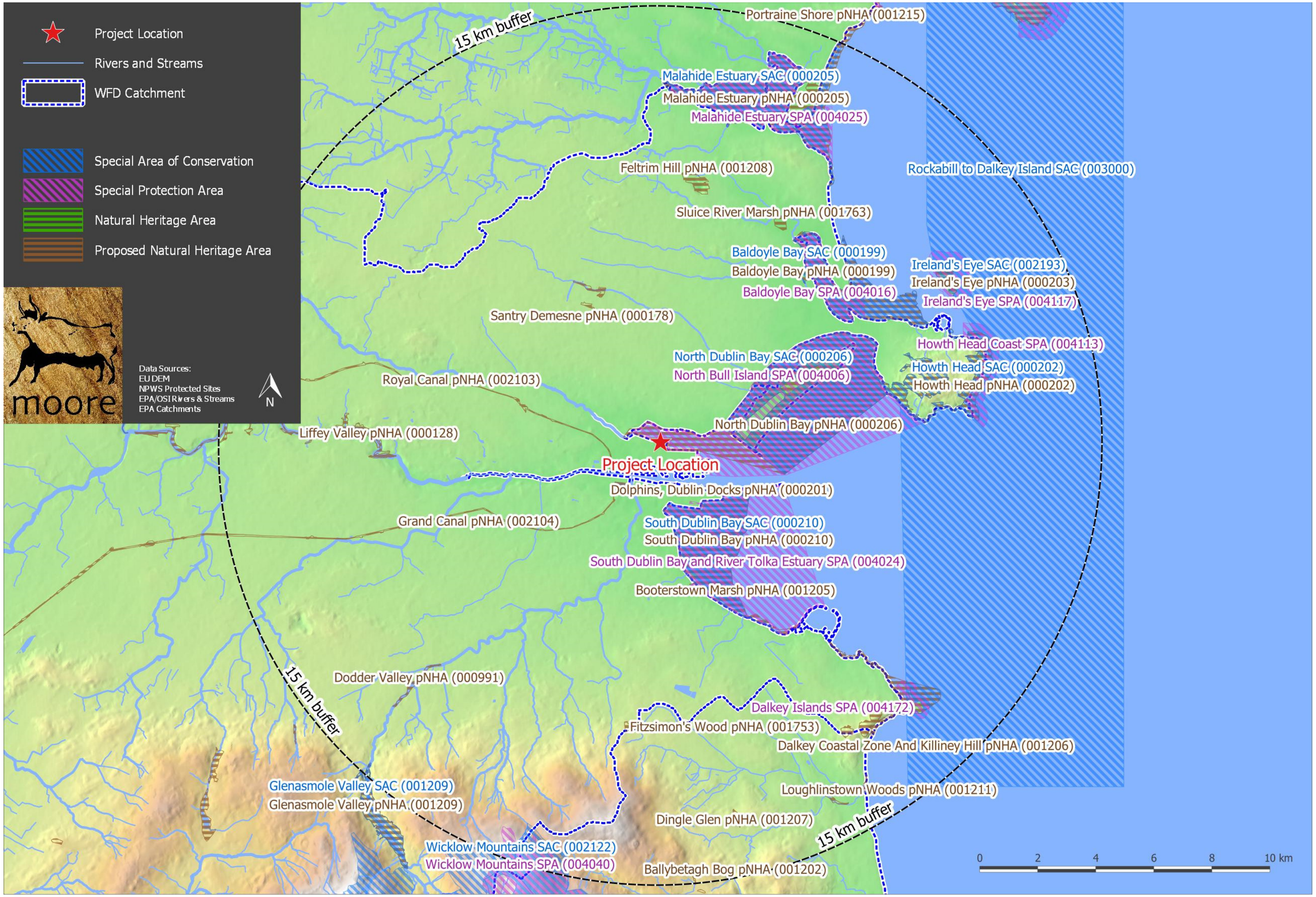

Figure 4. Showing European sites and NHAs/pNHAs within 15 km of the proposed Project.

Figure 5. Detailed view of European sites in the vicinity of the proposed Project.

3. Stage 2 – Appropriate Assessment

This stage considers whether the Project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The Stage 2 Appropriate Assessment comprises a scientific examination of the plan / project and the relevant European site; to identify and characterise any possible implications for the site in view of the site's conservation objectives, structure and function; taking account of in combination effects.

3.1. Description of European Sites Potentially Affected

Potential impacts on the following European sites have been identified and excerpts from the current sites synopses are provided (full site synopses are available from www.npws.ie).

3.1.1. North Dublin Bay SAC [000206]

The NPWS provides the following from Site Synopsis in relation to the North Dublin Bay SAC (Version date 12.08.2013, 000206_Rev13.Doc):

This site covers the inner part of north Dublin Bay, the seaward boundary extending from the Bull Wall lighthouse across to the Martello Tower at Howth Head. The North Bull Island is the focal point of this site.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[1140] Tidal Mudflats and Sandflats

[1210] Annual Vegetation of Drift Lines

[1310] Salicornia Mud

[1330] Atlantic Salt Meadows

[1410] Mediterranean Salt Meadows

[2110] Embryonic Shifting Dunes

[2120] Marram Dunes (White Dunes)

[2130] Fixed Dunes (Grey Dunes)*

[2190] Humid Dune Slacks

[1395] Petalwort (Petalophyllum ralfsii)

This site is an excellent example of a coastal site with all the main habitats represented. The site holds good examples of nine habitats that are listed on Annex I of the E.U. Habitats Directive; one of these is listed with priority status. Several of the wintering bird species have populations of international importance, while some of the invertebrates are of national importance. The site contains a number of rare and scarce plants including some which are legally protected. Its proximity to the capital city makes North Dublin Bay an excellent site for educational studies and research.

3.1.2. **North Dublin Bay SAC [000210]**

The NPWS provides the following from the Site Synopsis in relation to the South Dublin Bay SAC (Version date 10.12.2012, 000210_Rev15.Docx):

This site lies south of the River Liffey in Co. Dublin and extends from the South Wall to the west pier at Dun Laoghaire. It is an intertidal site with extensive areas of sand and mudflats. The sediments are predominantly sands but grade to sandy muds near the shore at Merrion Gates. The main channel which drains the area is Cockle Lake.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[1140] Tidal Mudflats and Sandflats

[1210] Annual vegetation of drift lines

[1310] Salicornia and other annuals colonising mud and sand

[2110] Embryonic shifting dunes

This site is a fine example of a coastal system, with extensive sand and mudflats, and incipient dune formations. South Dublin Bay is also an internationally important bird site.

3.1.3. **North Bull Island SPA [004006]**

The NPWS provides the following from the Site Synopsis in relation to the North Bull Island SPA (Version date 25.03.2014):

This site covers all of the inner part of north Dublin Bay, with the seaward boundary extending from the Bull Wall lighthouse across to Drumleck Point at Howth Head. The North Bull Island sand spit is a relatively recent depositional feature, formed as a result of improvements to Dublin Port during the 18th and 19th centuries. It is almost 5 km long and 1 km wide and runs parallel to the coast between Clontarf and Sutton. Part of the interior of the island has been converted to golf courses.

The North Bull Island SPA is an excellent example of an estuarine complex and is one of the top sites in Ireland for wintering waterfowl. It is of international importance on account of both the total number of waterfowl and the individual populations of Light-bellied Brent Goose, Black-tailed Godwit and Bar-tailed Godwit that use it. Also of significance is the regular presence of several species that are listed on Annex I of the E.U. Birds Directive, notably Golden Plover and Bar-tailed Godwit, but also Ruff and Short-eared Owl. North Bull Island is a Ramsar Convention site, and part of the North Bull Island SPA is a Statutory Nature Reserve and a Wildfowl Sanctuary.

3.2. Description of the Existing Environment

The site of the proposed development comprises two relatively small areas of open gravelled surfaces (Fossit Code ED2) and artificial surfaces and buildings (Fossit Code BL3). The northern and larger (c. 3.75 hectares) of the two sections of the site of the proposed development, Bond Drive Extension, is a rectangle of land with its long axis running from east to west. This rectangle of land is bordered on its northern and eastern boundaries by a strip of land from 25 to 35 metres in width and on which there is a soil bank or bund 10-15 metres wide and several metres high. A shelter belt of mixed woodland (WD2), mainly comprised of Sycamore, White Poplar and Scots Pine, has been planted on the soil bank and has now reached maturity.

The area to the north and east of this boundary zone is part of the River Tolka estuary and is designated as part of the South Dublin Bay and River Tolka Estuary SPA. The area of estuary adjacent to the northern wooded soil bank (and to the east of the VP used by the bird surveyor) is characterised by rocky shore fucoid reef (LR2; Natura 2000 1170). The channel of the River Tolka runs close to this shore so that here is very little exposed sediment, even at low tide.

There is a smaller (c. 1.65 hectares) site to the south which is referred to as Yard 3&4 comprises a hardstand area and associated warehouses on Promenade Road.

There is a Common Tern nesting pontoon located c. 760m to the northeast of the nearest part of the proposed development site (i.e. the Bond Drive Extension site). The land areas (the pontoon is 100 metres offshore of the docks) between the site of the proposed development and the pontoon are all covered with existing and operating parts of the Dublin docks. The nearest area that is used by post-breeding/passage flocks of Common, Arctic and Roseate terns is at least two kilometres from the site of the proposed development.

Dublin Bay and environs has a wealth of marine mammals including seals, harbour porpoise, dolphins and whales recorded in its waters. Its international importance is recognised through the designation of a number of Special Areas of Conservation. Grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are regularly observed within the Port and vicinity of the Tolka Estuary. Harbour porpoise (Phocoena phocoena) have been observed as far in as the North Bank Lighthouse in the navigation channel of Dublin Port (pers. comm. IWDG).

There are no rare or protected habitats recorded in the study areas inside the site boundary. The sites may be considered of Low Ecological Value at a Local level.

3.3. Conservation Objectives of European Sites

3.3.1. North Dublin Bay SAC (000206)

The following Conservation Objective is set out for the North Dublin Bay SAC – Version 1, 6th November 2013. Specific attributes, measures and targets are presented in the relevant Conservation Objectives documents and will be addressed in more detail if required after potential impacts have been determined.

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes
Community extent	Hectares	Maintain the extent of the *Mytilus edulis* -dominated community, subject to natural processes
Community structure: *Mytilus edulis* density	Individuals/m^2	Conserve the high quality of the *Mytilus edulis*-dominated community, subject to natural processes
Community distribution	Hectares	Conserve the following community types in a natural condition: Fine sand to sandy mud with *Pygospio elegans* and *Crangon crangon* community complex; Fine sand with *Spio martinensis* community complex.

1210 Annual vegetation of drift lines

To restore the favourable conservation condition of Annual vegetation of drift lines in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area increasing, subject to natural processes, including erosion and succession. Total area mapped: South Bull - 0.11ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and oraches (*Atriplex spp*.)
Vegetation structure: negative indicator species	Hectares	Negative indicator species (including non-natives) to represent less than 5% cover

1310 *Salicornia* and other annuals colonising mud and sand

To restore the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: North Bull Island - 29.10ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes

Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain, or where necessary restore, natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover	Maintain the presence of species-poor communities listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*). No new sites for this species and an annual spread of less than 1%

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To restore the favourable conservation condition of Atlantic salt meadows (*GlaucoPuccinellietalia maritimae*) in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: North Bull Island - 81.84ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of subcommunities with typical species listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

To maintain the favourable conservation condition of Mediterranean salt meadows (*Juncetalia maritimi*) in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: North Bull Island - 7.98ha.
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes.
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with characteristic species listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%

2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: North Bull - 2.64ha; South Bull - 3.43ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes.
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats, including transitional zones, subject to natural processes including erosion and succession
Vegetation composition: plant health of foredune grasses	Percentage cover	More than 95% of sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e.

Attribute	Measure	Target
		green plant parts above ground and flowering heads present)
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities with typical species: sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*)
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover

2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. North Bull - 2.20ha; South Bull - 0.97ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes.
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats, including transitional zones, subject to natural processes including erosion and succession
Vegetation composition: plant health of dune grasses	Percentage cover	95% of marram grass (*Ammophila arenaria*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities dominated by marram grass (*Ammophila arenaria*) and/or lymegrass (*Leymus arenarius*)
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover

2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation ('grey dunes') in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. For subsites mapped: North Bull - 40.29ha; South Bull - 64.56ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions

Attribute	Measure	Target
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Delaney et al. (2013)
Vegetation composition: negative indicator species (including *Hippophae rhamnoides*)	Percentage Cover	Negative indicator species (including non-natives) to represent less than 5% cover
Vegetation composition: scrub/trees	Percentage Cover	No more than 5% cover or under control

2190 Humid dune slacks

To restore the favourable conservation condition of Humid dune slacks in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area increasing, subject to natural processes including erosion and succession. For sub-sites mapped: North Bull - 2.96ha; South Bull - 9.15ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
Physical structure: hydrological and flooding regime	Water table levels; groundwater fluctuations (metres)	Maintain natural hydrological regime
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 5% of dune slack habitat, with the exception of pioneer slacks which can have up to 20% bare ground
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Delaney et al. (2013)
Vegetation composition: cover of *Salix repens*	Percentage cover; centimetres	Maintain less than 40% cover of creeping willow (*Salix repens*)
Vegetation composition: negative indicator species	Percentage Cover	Negative indicator species (including non-natives) to represent less than 5% cover
Vegetation composition: scrub/trees	Percentage Cover	No more than 5% cover or under control

1395 Petalwort *Petalophyllum ralfsii*

To maintain the favourable conservation condition of Petalwort in North Dublin Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Distribution of populations	Number and geographical spread of populations	No decline.
Population size	Number of individuals	No decline. Population at Bull Island estimated at a maximum of 5,824 thalli. Actual population is more likely to be 5% of this, or c. 300 thalli
Area of suitable habitat	Hectares	No decline. Area of suitable habitat at Bull Island is estimated at c. 0.04ha.
Hydrological conditions: soil moisture	Occurrence	Maintain hydrological conditions so that substrate is kept moist and damp throughout the year, but not subject to prolonged inundation by flooding in winter
Vegetation structure: height and cover	Centimetres and percentage	Maintain open, low vegetation with a high percentage of bryophytes (small acrocarps and liverwort turf) and bare ground

3.3.2. South Dublin Bay SAC (000210) - Version 1, 22nd August 2013

The following Conservation Objective is set out for the South Dublin Bay SAC. Specific attributes, measures and targets are presented in the relevant Conservation Objectives documents and will be addressed in more detail if required after potential impacts have been determined.

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in South Dublin Bay SAC, which is defined by the following list of attributes and targets.

Attribute	Measure	Target
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes
Community extent	Hectares	Maintain the extent of the *Zostera*-dominated community, subject to natural processes
Community structure: *Mytilus edulis* density	Individuals/m^2	Conserve the high quality of the *Zostera*-dominated community, subject to natural processes
Community distribution	Hectares	Conserve the following community types in a natural condition: Fine sands with *Angulus tenuis* community complex.

3.3.3. North Bull Island SPA (004006)

The following Conservation Objectives are set out for the North Bull Island SPA – Version 1, 9th March 2015. Specific attributes, measures and targets are presented in the relevant Conservation Objectives documents and will be addressed in more detail if required after potential impacts have been determined.

Generic Conservation Objectives

In the absence of specific conservation objectives, the following generic conservation objectives can be applied to each qualifying species listed. Species with specific conservation objectives are listed below.

To maintain the favourable conservation condition of [each qualifying species] in North Bull Island SPA, which is defined by the following list of attributes and targets:

[Qualifying Bird Species]

Attribute	Measure	Target
Population trend	Percentage change	Long term population trend stable or increasing
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by [each qualifying species], other than that occurring from natural patterns of variation

Specific Conservation Objectives

A99 Wetlands

To maintain the favourable conservation condition of the wetland habitat in North Bull Island SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

Attribute	Measure	Target
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 1,713 hectares, other than that occurring from natural patterns of variation.

3.3.4. South Dublin Bay and River Tolka Estuary SPA (004024)

The following Conservation Objectives are set out for the South Dublin Bay and River Tolka Estuary SPA – Version 1, 9th March 2015. Specific attributes, measures and targets are presented in the relevant Conservation Objectives documents and will be addressed in more detail if required after potential impacts have been determined.

Specific Conservation Objectives and Target Notes are set by the NPWS (Vers 1; 9th March 2015) for the South Dublin Bay and River Tolka Estuary SPA (004025) are set out in Table 2 as follows.

Table 2 Conservation objectives of the South Dublin Bay and River Tolka Estuary SPA.

SCI	Conservation Objectives	Attribute	Target
Light-bellied Brent Goose **A046**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that

			occurring from natural patterns of variation.
Oystercatcher **A130**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Ringed Plover **A137**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Grey Plover **A141**	Grey Plover is proposed for removal from the list of SCIs for the South Dublin Bay and River Tolka Estuary SPA. As a result, site specific conservation objectives have not been set for this species.	None	None
Knot **A143**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Sanderling **A144**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Dunlin **A149**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Bar-tailed Godwit **A157**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Redshank	To maintain the favourable conservation condition of the species	Population trend	Long term population trend stable or increasing.

A162	in the South Dublin Bay and River Tolka Estuary SPA	Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Black-headed Gull **A179**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Roseate Tern **A192**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Passage population: individuals	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns
Common Tern **A193**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Breeding population abundance: apparently occupied nests (AONs)	No significant decline
		Productivity rate: fledged young per breeding pair	No significant decline
		Passage population: individuals	No significant decline
		Distribution: breeding colonies	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at breeding site	Human activities should occur at levels that do not adversely affect the breeding population of this species.

		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns
Arctic Tern **A194**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Passage population: individuals	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns
Wetlands **A999**	To maintain the favourable conservation condition of the wetland habitat in the South Dublin Bay and River Tolka Estuary SPA as a resource for the regularly occurring migratory waterbirds that utilise it.	Habitat area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,192 hectares, other than that occurring from natural patterns of variation.

3.4. Consideration of Impacts on European Sites

3.4.1. Habitats Directive Annex I Habitats

There are no Annex I habitats located under the footprint or in the vicinity of the proposed development areas. There will be no direct impacts on River Barrow and River Nore SAC and there will be no habitat loss or fragmentation as a result of the proposed development. Having considered direct impacts and ruling them out, indirect impacts are then considered in terms of source pathway vectors.

Potential impacts on the South Dublin Bay and River Tolka Estuary SPA are considered in terms of hydrological connectivity and surface water runoff.

A worst-case scenario may arise were the project to result in a significant detrimental change in water quality in Dublin Bay either alone or in combination with other projects or plans as a result of indirect pollution, the effect would have to be considered in terms of changes in water quality which would significantly affect the habitats or food sources for which the Dublin Bay sites are designated.

This is considered further in terms of indirect impacts in section 3.5. below.

3.4.2. Habitats Directive Annex II Species

Cetaceans & Seals

A scoping email was sent to the Irish Whale & Dolphin Group and a response received which is included as an Appendix to the Project EIAR. The core response of the IWDG is included here as follows.

IWDG Consulting believe that the risk of disrupting the life cycle of marine mammals in that area is extremely low. As the works are not occurring underwater, a marine mammal observer will not be required. The works are proposed to resurface hard-standing areas, to put in place addition surface water drainage to additional interception within the Dublin Port Drainage Scheme and to refurbish existing warehouses and erect low scale control points. There will be no blasting, major groundworks or coring and consequently there will be no significant noise or vibration generated during construction.

In summary, it is the expert opinion of the IWDG Consulting, that it is unlikely that these proposed works will have any significant impacts on marine mammals in the vicinity of the works nor have the conservation objectives of the Rockabill to Dalkey Island SAC been compromised.

3.4.3. Birds Directive Annex I Species

An Avian Impact Assessment was undertaken by Dr. Chis Peppiatt and the full report is presented as an Appendix to the Project EIAR. The findings of that assessment with regard to Annex I Birds are include as follows.

No species listed in Annex I of the E.U. Birds Directive were recorded within the site of the proposed development. Of the six species of birds actually recorded at the site of the proposed development, only one is a special conservation interest (SCI) of the South Dublin Bay and River Tolka SPA, which has 13 SCI species in all. This species, Black-headed Gull, is listed as a wintering interest of the SPA. A maximum of one bird was recorded within the site of the proposed development. A single Herring Gull was also recorded on one occasion within the larger northern block of the site of the proposed development and gulls (i.e. both Herring and Black-headed) were also seen in flight over these areas. Both species are listed in the Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 red list in respect of breeding populations only. Four species of terrestrial birds- Magpie, Hooded Crow, Pied Wagtail and Feral Pigeon- were also recorded at the site of the proposed development. None of the four is of particular conservation interest (i.e. none are SCIs of any local SPA, are listed in Annex I of the EU Birds Directive, or in the current BoCCI Red or Amber lists).

Birds recorded in the vicinity of, but not within, the site of the proposed development (i.e. in the wooded shelter belt and in the River Tolka estuary) included six of the thirteen South Dublin Bay and River Tolka Estuary SPA SCI species: Light-bellied Brent Goose, Oystercatcher, Redshank, Dunlin, Bar tailed Godwit and Black-headed Gull. One species listed in Annex I of the E.U. Birds Directive, Bar tailed Godwit, was recorded during the surveys. Three species, Curlew, Redshank and Dunlin are in the Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 red list in respect of breeding and wintering populations, while a further three species, Woodcock, Black-headed Gull and Herring Gull, are in the red list in respect of breeding populations only.

3.4.4. **Ecological Network Supporting Natura 2000 Sites**

An analysis of the proposed Natural Heritage Areas and designated Natural Heritage Areas in terms of their role in supporting the species using Natura 2000 sites was undertaken. These supporting roles mainly relate to mobile fauna such as mammals and birds which may use pNHAs and NHAs as "stepping stones" between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the AA process.

There are no Natural Heritage Areas or proposed Natural Heritage Areas that will be affected by the proposed Project. Many of the European sites listed within the potential zone of impact also have proposed designation as pNHAs but are first considered under their higher European conservation status.

3.5. Impacts on the Qualifying Interests of European Sites

3.5.1. **Direct Impacts on Habitats**

There will be no direct impacts on the European sites located in Dublin Bay as a result of the implementation of the proposed Project. Direct impact refers to physical impacts defined in the Departmental Guidance as 'Loss of habitat area' and/or 'Habitat Fragmentation'. There are no direct impacts identified which may affect the Annexed habitats or species of the SACs. The proposed development will have **no impacts** upon the integrity or the site structure of the adjacent or nearby European sites. Direct Impacts on Birds.

Disturbance

(a) Construction disturbance

Construction activities will cause increased human presence and noise in area approximately 25-35 metres distant from the South Dublin Bay and River Tolka Estuary SPA. Construction itself will entail the redevelopment of an area that is already gravelled and where there are existing buildings to an area with new buildings and structures and with gravelled or possibly concrete standing. Earth works will be relatively minor, including some new foundations and the installation of some new drainage features, but major works (i.e. deep excavations, rock breaking or pile driving) will not be involved.

While the distances from the SPA (25-35 metres for the closest part of the proposed development) are not large it should be remembered that the SPA sheltered from construction disturbance visually largely to completely and acoustically at least to some extent by the soil bank and its woodland cover. The area is currently subject to certain amount of human disturbance, including traffic and in some parts is used by haulage trucks and so is not without potential background disturbance. The net result is that while there will be a short-term moderate disturbance impact within the site of the proposed development (which is not designated land), the impact on the SCI species of the South Dublin Bay and River Tolka Estuary SPA will be unmitigable, short-term and imperceptible.

(b) Disturbance during the operational phase

Disturbance during the operational phase of the development is expected to consist of human traffic and trucking traffic, much as it is today, but probably at a slightly increased intensity.

The same arguments that pertain to disturbance of SCI species within the boundary of the SPA (3a, above) are also relevant for disturbance during the operational phase.

It was noticed during the bird surveys at the site of the proposed development that the SPA shoreline immediately adjacent is characterised by a rocky shoreline (fucoid reef) and that there was little or no exposed fine sediment below these rocks even at low tide. The reason for this is that the channel of the River Tolka runs close to the shoreline in this area, so that the channel remains watered even at low tide. The numbers of waterbirds recorded using this area of shoreline were few (maxima of three Grey Heron, two Curlew, one Greenshank and one Common Gull during eight hours of watches at both high and low tides).

As is the case in 3a (above), the impact on the SPA SCI species will be unmitigable, short-term and imperceptible. This is by reason of the broadly similar current background operating disturbance, the shielding effect of the wooded soil bank, the lack of suitability of the habitats within the site of the proposed development as overspill habitat for the SPA SCI species, the low numbers of waterbirds recorded in the area immediately adjacent to the site of the proposed development (as opposed to areas of marine sediments that are available further away) and the large areas of suitable estuarine habitats that are available for wintering waterbird foraging or roosting in areas of the SPA that are further (i.e. 100 metres or more) from the site of the proposed development. Thus, there will be no significant operating disturbance impacts on the South Dublin Bay and River Tolka Estuary SPA SCI species.

The potential impacts of the proposed development on the special conservation interests (SCIs) of the South Dublin Bay and River Tolka Estuary SPA are shown in Table 3 below.

Table 3 Predicted impacts on the SCIs of the South Dublin Bay and River Tolka Estuary SPA.

SCI	Population	Distribution
Brent Goose (wintering)	During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Geese (*Branta bernicla hrota*); International Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 525 individuals. A maximum of 554 geese were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the geese were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Oystercatcher (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Oystercatcher (*Haematopus ostralegus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,263 individuals. A maximum of 15 Oystercatcher were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Oystercatcher were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Ringed Plover (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Ringed Plover (*Charadrius hiaticula*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 161 individuals. This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.
Grey Plover (wintering)	Not recorded during the surveys in the vicinity of study area.	This species is proposed for removal from the list of SCI species for the SPA and no site-specific conservation interests have been set for it.
Knot (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,151 individuals. This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.

Sanderling (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 349 individuals. This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.
Dunlin (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,753 individuals. A maximum of 177 Dunlin were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Dunlin were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Bar-tailed Godwit (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Bar-tailed Godwit (*Limosa lapponica*); National Importance. The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 866 individuals. A maximum of 164 Bar-tailed Godwit were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Bar-tailed Godwit were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Redshank (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Redshank (*Tringa totanus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 713 individuals. A maximum of 56 Redshank were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Redshank were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Black-headed Gull (wintering)	The winter mean peak number of Black-headed Gull (*Chroicocephalus ridibundus*) within the site during the baseline period (1995/96 – 1999/00) was 3,040	Due to the distance (approximately 400-500 metres) of the site from the areas that most of the Black-headed Gull were observed feeding and roosting and the minor disturbance that is

	individuals. This number exceeds the selection threshold set for this species. A maximum of 511 Black-headed Gull were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development (one was recorded visiting the site also), but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Roseate Tern (passage)	The SPA is selected as an important passage area for this migratory waterbird species based on significant concentrations recorded, 2,000 individuals recorded in 1999. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	This species nests on Rockabill Island (30 km NE of the site of the proposed development) and the Dalkey islands (12 SE of the site). During the breeding season the birds can forage widely, but stay as close as they can to their breeding colonies. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). As such, activities at the site of the proposed development have no potential to impact either breeding colonies, or the autumn roosting sites of this species. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Common Tern (breeding and passage)	During the breeding season this site supports a colony of Common Tern (*Sterna hirundo*) (52 pairs in 1995). This exceeds the All-Ireland 1% threshold for this Annex I species; National Importance. In 2018, there were 600 Common Tern nests in the SPA and the River Liffey channel. Additionally, there are significant numbers of Common Tern in the SPA in autumn as part of post-breeding tern aggregations in Dublin Bay, Namely, 5,000 individuals were recorded in 1999. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	Common Tern nest on two mooring dolphins in the River Liffey Channel, the CDL and ESB dolphins (these are approximately 2 km from the site; the ESB dolphin is part of the SPA, as a designated 'island' in the undesignated commercial channel). The terns also breed on two pontoons, one in the Liffey Channel and another that was deployed in the outer Tolka Estuary in 2013. This pontoon is 630 metres east of the site of the proposed development. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). The distance of the site from the breeding and passage roosting sites for this species are such that activities at the site will not have any potential to disturb the species within the SPA. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity.

		Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Arctic Tern (passage, occ. breeding)	The SPA is selected as an important passage area for this migratory waterbird species based on significant concentrations recorded, 20,000 individuals recorded in 1996. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	This species occasionally nests on the mooring dolphins in the River Liffey channel (approximately 2 km from the site). During the breeding season the birds can forage widely, but stay as close as they can to their breeding colonies. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). The distance of the site from the breeding and passage roosting sites for this species are such that activities at the site will not have any potential to disturb the species within the SPA. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Wetlands	The boundary of the South Dublin Bay and River Tolka Estuary SPA lies approximately 35 metres north and 25 metres east of the site of the proposed development. There will be no direct loss of habitat within this SPA.	No significant impacts on the range, timing or use of the SPA by the SCI species are expected from the minor changes to a small area of adjacent non-SPA land. Disturbance during construction will be short-term and limited to the immediate vicinity of the site. There is some potential for disturbance during the operational phase of the development, but this will be limited spatially (i.e. to the site and its immediate vicinity). The potential for runoff pollution will be mitigated by the new drainage and interception features that form part of the project design.

Having established this, the assessment emphasis is placed on potential indirect and cumulative impacts.

The primary consideration in terms of source-vector-pathways for indirect impacts relates to surface water and potential indirect impacts on hydrologically linked habitats and aquatic linked species.

3.5.2. **Indirect Impacts**

The potential for impact is considered whereby the Project would result in a significant detrimental change in water quality either alone or in combination with other projects or plans as a result of indirect pollution of surface water. The effect would have to be considered in terms of changes in water quality which would affect the habitats or species for which the Dublin Bay European sites are designated.

Consideration of impacts on Surface Water

The likelihood of impacts on hydrologically connected environmental sites is low and will be avoided by best practice construction management and appropriate design features such as interception.

Accidental spillages and contaminated runoff and will be avoided by construction management measures which will be set out in a Construction Environmental Management Plan (CEMP). Management measures will include appropriate site-specific measures in compliance with the relevant CIRIA guidance documents; Control of Water Pollution from construction Sites, Guidance for consultants and contractors (C532); and Environmental Good Practice on Site (3rd edition) (C692).

3.6. Mitigation Measures

The CEMP includes reference to this Appropriate Assessment and NIS for the Project which establishes the potential connectivity of the Project site to the Dublin Bay European sites and the requirement for avoidance in terms of indirect impacts from construction activity.

The contractor will be required to complete the Construction Environmental Management Plan (CEMP) which will include the following construction management as a minimum:

3.6.1. Site Environmental Training and Awareness Procedure

An initial site environmental induction and ongoing training will be provided to communicate the main provisions of this environmental plan to all site personnel.

Two-way communication will be encouraged to promote a culture of environmental protection.

The following outlines the information which must be communicated to site staff:

- Environmental procedures of the CEMP.
- Environmental buffers and exclusion zones.
- Housekeeping of materials and waste storage areas.
- Environmental emergency response plan.

Prior to any works, all personnel involved will receive an on-site induction relating to operations adjacent to water courses/bodies and the environmentally sensitive nature of Dublin Bay and re-emphasise the precautions that are required as well as the construction management measures to be implemented.

The project proponent will ensure that the engineer setting out the works is fully aware of the ecological constraints and construction management requirements.

3.6.2. **Environmental Emergency Response Plan**

In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure (to be finalised by contractor). The following outlines the information on the types of emergency which must be communicated to site staff:

- Release of hazardous substance – fuel or oil spill.
- Concrete spill or release of concrete.
- Flood event – extreme rainfall or rising river level event.
- Environmental buffers and exclusion zones breach.
- Housekeeping of materials and waste storage areas breach.
- Stop work orders due to environmental issue or concern (e.g. threat to ecological feature).

3.6.3. **Concrete Control Procedure**

Concrete will be used for wall foundations, wall forming structures and grouting of precast concrete. Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to water courses/bodies. The following measures will be implemented to prevent concrete entering watercourses:

- A hardstand area of the site will be prepared as a temporary storage compound and construction preparation area.
- Batch loads of concrete will be delivered, on an as needed basis, to the pre-prepared hardstand areas or designated site compound.
- Small batch concrete loads will be delivered to specific construction locations by mini dumper or other enclose contained system of transfer.
- Trucks that deliver concrete to site will be washed out at the supplier’s facilities and not on site.
- A designated trained operator experienced in working with concrete will be employed during concrete pouring.
- Disposal of raw or uncured waste concrete will be controlled to ensure that Dublin Bay will not be impacted.

- Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times will be implemented.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline, therefore, washing will not be permitted on site.

3.6.4. Fuel and Oil Management Plan

The appointed contractor will implement a fuel management plan which will incorporate the following elements:

- Chemicals used will be stored in sealed containers.
- Chemicals shall be applied in such a way as to avoid any spillage or leakage.
- All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and water courses/bodies and away from drains and water courses as far as reasonably practicable. Vehicles will not be left unattended during refuelling.
- Storage areas, machinery depots and site offices will be located within the site boundary.
- Spill kits will be made available and all staff will be properly trained on correct use.
- All fuels, lubricants and hydraulic fluids required to be stored on site will be kept in secure bunded areas at a minimum of 10m from the sea shore. The bunded area will accommodate 110% of the total capacity of the containers within it.
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.
- All plant shall be well maintained with any fuel or oil drips attended to on an ongoing basis.
- Any minor spillage during this process will be cleaned up immediately.
- Should any incident occur, the situation will be dealt with and coordinated by the nearest supervisor who will be responsible for instructions by the Local Authority.

3.6.5. Protection of Water Resources

(A) Silt

- Site boundary markings to safeguard features of interest/value, e.g. drainage connectivity with Dublin Bay will be established.
- Excavations: Water will be prevented from entering local excavations by way of cut-off drains. Personnel and/or plant will not disturb water in a local excavation. The means of dewatering excavations in the event there is ingress will include settlement tanks or a silt buster stream if required to ensure that any de-waterings do not increase background suspended solids levels in the environment.
- Spoil heaps: Small (<100m^3) topsoil/subsoil heaps will be located, protected and stabilised in the temporary compound in a way that will avoid the risk of contamination of drainage systems and local water courses.
- Site roads will be kept free from dust and mud deposits.

(B) Deliveries

- Special care will be taken during deliveries, especially when fuels and hazardous materials are being handled.
- All liquid deliveries will be supervised by a responsible person to ensure that (1) storage tank levels are checked before delivery to prevent overfilling and (2) the product is delivered to the correct tank.
- Contingency plans will be agreed and suitable materials available to deal with any incident.
- All employees will be briefed on the actions required in the event of a spillage.
- Spillages will be recorded and advised to the project manager who will inform local authorities if they deem it significant.

(C) Refuelling

- Mobile plant will be refuelled in the construction compound, on an impermeable surface away from any drains or water courses/bodies. A spill kit will be available at this location.
- Hoses and valves will be checked regularly for signs of wear and turned off and securely locked when not in use.
- Generators, diesel pumps and similar equipment will be placed on drip trays to collect minor spillages. These will be checked regularly, and any accumulated oil removed for disposal.

(D) Storage

- Leaking or empty oil drums will be removed from the site immediately and disposed of via a licensed waste disposal contractor.
- The contents of any tank will be clearly marked on the tank, and a notice displayed requiring that valves and hoses be locked when not in use.
- Any tanks or drums will be stored in a secure container or compound, which is to be kept locked when not in use.

3.6.6. **Management of Excavation and Spoil**

For the management of excavation and spoil, the contractor will:

- Erect all protective fencing.
- Implement a surface water management plan (including the installation of drainage infrastructure) prior to excavation and include areas dedicated to spoil storage with the drainage infrastructure.
- Ensure all spoil and excavated materials will be stored in the construction compound.
- Ensure stockpiles and adjacent features of drainage infrastructure will be monitored and maintained appropriately.
- A Waste Management Plan will identify any material such as dust, sand, rubble, concrete that may be generated during demolition works and address its storage and appropriate removal from the site to avoid pathways identified as having connectivity with Dublin Bay.

3.6.7. Monitoring

Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or other items, and that all storage is located at least 10m from surface water receptors. A regular log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.

3.7. Assessment of In-Combination Effects

The Commission services' interpretation document 'Managing Natura 2000 sites', makes clear that the phrase 'in combination with other plans or projects' in Article 3(3) refers to cumulative effects caused by the projects or plans that are currently under consideration together with the effects of any existing or proposed projects or plans. When impacts are assessed in combination in this way, it can be established whether or not there may be, overall, an impact which may have significant effects on a Natura 2000 site or which may adversely affect the integrity of a site.

As part of the Appropriate Assessment, in addition to the proposed works, other relevant projects and plans in the region must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination or cumulative effects / impacts of the proposed development with other such plans and projects on the Natura 2000 site.

3.7.1. Assessment of Plans

Dublin Port Masterplan 2012 - 2040 (Reviewed 2018)

The Dublin Port Masterplan 2012 - 2040 (DPM) is the core document which guides the development in Dublin Port up to 2040. The DPM was first published in February 2012, by the Dublin Port Company (DPC), with the first review of the DPM completed in 2018. It is envisaged that the second review of the DPM will take place no earlier than 2023, and no later than 2028. The DPM is a non-statutory plan but has been compiled in within the context of prevailing EU, national, regional and local development plan policies. The DPM was developed by DPC with the intention to:

- Plan for future sustainable growth and changes in facilitating seaborne trade in goods and passenger movements to and from Ireland and the Dublin region in particular;
- Provide an overall context for future investment decisions;
- Reflect and provide for current national and regional policies, local guidelines and initiatives; and,
- Ensure there is harmony and synergy between the plans for the Port and those for the Dublin Docklands Area, Dublin City and neighbouring counties within the Dublin Region. Give some certainty to customers about how the Port will develop in the future to meet their requirements.

The DPM suggests options to facilitate Dublin Port handling up to 77 million gross tonnes by 2040.

The DPM outlines a number of strategic objectives to facilitate the effective operation of Dublin Port in the period to 2040. The most relevant of these to the proposed development are outlined below under their respective headings as defined in the DPM.

Port Functions

- Ensure the safe operation and sustainable development of the Port and its approach waters and provide appropriate infrastructure, facilities, services and accommodation for ships, goods, and passengers to meet future demand.
- Optimise the use of Port lands by rationalising the distribution and location of specific areas of activity (including Ro-Ro, Lo-Lo, passenger ferry services, Cruise Ships, Bulk Liquid, Bulk Solid and Break Bulk goods) with necessary reconfigurations of service facilities as required.
- Recover lands that are not being used for core port activities.
- Use new and developing technology to increase throughput to its environmentally sustainable maximum.
- Identify configurations for extending berthage and storage that mitigate impact on adjacent environmentally sensitive / designated areas.

Investment and Growth

- Utilise the Masterplan as a framework for investment and growth based on the Port's projected demand forecasts.

Movement and Access

- Develop a transport plan for the Port estate in conjunction with the NTA and DCC.

Environment and Heritage

- Integrate new development with the built and natural landscapes of the surrounding area.

The DPM shows the proposed Project site zoned as "lands currently used for Non-Core Activity for Future Redevelopment". This zoning aligns the proposed development site with the strategic objectives outlined above.

3.7.2. **Assessment of Projects**

The DCC Planning Department website was consulted in order to generate a list of granted planning permissions from the surrounding areas of the proposed development within the previous five years (since October 2014). The area under consideration for this search included the Dublin Port, East Wall and Ringsend areas.

3.7.3. **Assessment of Projects**

The DCC Planning Department website was consulted in order to generate a list of granted planning permissions from the surrounding areas of the proposed development within the previous five years (since October 2014). The area under consideration for this search included the Dublin Port, East Wall and Ringsend areas. The outcome of this search is presented in Chapter 3 of the Project EIAR.

Brexit related developments

Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017).

Notable applications granted planning permission, which will be undergoing construction at the same time as the proposed development are described below.

Dublin Port MP2 Project

The Dublin Port MP2 Project is a notable proposed development in Dublin Port, currently under consideration by An Bord Pleanála (ABP Reg. Ref. PL29N.304888), with a decision due by January 20th 2020. The development, applied for by the Dublin Port Company, consists of 15-year permission for development at Oil Berth 3 and Oil Berth 4, Eastern Oil Jetty and at Berths 50A, 50N, 50S, 51, 51A, 49, 52, 53 and associated terminal yards to provide for various elements including new Ro-Ro jetty and consolidation of passenger terminal buildings. Pending grant of planning permission, construction of this development, which will consist of both land and marine works across a number of phases, will commence in Q2 2022, and finish in Q1 2032.

Dublin Port Alexandra Basin Redevelopment

The Alexandra Basin Redevelopment consists of:

- the redevelopment of Alexandra Basin West including demolition of part of North Wall Quay Extension and its reconfiguration, new quay walls, dredging as well as excavation of contaminated materials, infilling of Graving Dock No2, provision for new berths and conservation measures including the excavation of Graving Dock No.1 and the construction of an interpretive centre on North Wall Quay Extension;

- The infilling of Berths Nos. 52 and 53 at the eastern end of the Port and the provision of new landside and berthing facilities, and;
- Dredging of the approach channel and provision of a marina protection structure to the north of the Poolbeg Yacht, Boat Club and Marina

Permission for these works was granted by An Bord Pleanála on 8th July 2015 (ABP Reg. Ref PL29N.PA0034). Works began in November 2016 and will continue within the 10-year planning permission timeframe.

Dublin Port Greenway

Comprising works to the Port's private internal road network and includes works on public roads at East Wall Road, Bond Road and Alfie Byrne Road, the Dublin Port Greenway development was granted permission by Dublin City Council in July 2016 (DCC Reg. Ref. 3084/16). The scheme is due to commence construction in early 2020, with the complete programme of works anticipated to be 24 – 42 months. The duration of works on the external road network is expected to be 6 – 12 months.

There are no predicted in-combination effects with other developments given that they have been assessed for potential significant effects on European sites and granted permission with conditions to planning.

3.7.4. **Conclusion of In-combination Effects**

Given the inclusion of strict Best Practice Construction Measures to be included and enforced through a Construction Environmental Management Plan, the proposed development will have no predicted impacts on local ecology and biodiversity or on hydrologically linked European sites, therefore in-combination impacts can be ruled out.

The Dublin City Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of impact of the Project site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the development area and surrounding townlands in which the development site is located, would be avoided.

Any new applications for the Project area will be initially assessed on a case by case basis initially by Dublin City Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

4. Natura Impact Statement & Conclusion

This NIS has reviewed the predicted impacts arising from the Project and found that with the implementation of appropriate mitigation measures specifically with regard to surface water, significant effects on the integrity of the European sites identified in the receiving environment of Dublin Bay can be ruled out.

It is the conclusion of this NIS, on the basis of the best scientific knowledge available, and subject to the implementation of the mitigation measures set out under Section 3.6, that the possibility of any adverse effects on the integrity of the European Sites considered in this NIS, or on the integrity of any other European Site (having regard to their conservation objectives), arising from the proposed development, either alone or in combination with other plans or projects, can be excluded beyond a reasonable scientific doubt.

5. References

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NPWS (2020) National Parks and Wildlife Service Metadata available online at https://www.npws.ie/maps-and-data

APPENDIX 7.2

WINTER BIRD REPORT & AVIAN IMPACT ASSESSMENT

C. PEPPIATT (2020)

BREXIT INFRASTRUCTURE AT DUBLIN PORT

OFFICE OF PUBLIC WORKS

OFFICE OF PUBLIC WORKS

Bird surveys (November and December 2019) and avian impact assessment

Dr. Chris Peppiatt (Ph.D., MCIEEM)

December 2019

Introduction

The Office of Public Works is proposing to develop new Brexit Infrastructure on two sites on the Bond Drive Extension and Promenade Road on the north side of Dublin Port, adjacent to the River Tolka estuary.

The proposed development will form a major part of the new infrastructure at Dublin Port designed to accommodate the expected backlog of goods and vehicles attempting to enter Ireland through Dublin Port in a post-Brexit scenario, where the processing of documents for movements in and out of the UK may take significantly longer than at present.

This proposed development is designed to comply with the requirements for such a development outlined in the emergency order provisions of S.I. No. 418/2019 - European Union (Environmental Impact Assessment and Habitats) (Section 181 of the Planning and Development Act 2000) Regulations 2019.

Dublin Port is the main seaport and point of entry for ferry and container traffic into the Republic of Ireland. It is located east of the city centre. It is equipped with a ferry terminal, container terminals and storage facilities, as well as supporting infrastructure, including public roads. The proposed site for the proposed development is on an area of previously developed land within the boundary of Dublin Port.

The proposed development will include the following:

Bond Road Site

Establishment of a single compound measuring c. 368m x 100m, to provide parking facilities for 175 HGVs, together with associated internal access roads and a staff parking facility. Additional accommodation on site will include five single storey porta cabin structures, of 75m^2 each, for use as a Facilities Management office, two Import Offices, and two Driver Welfare facilities. The existing site boundary palisade fences will be renewed with continuous 3.0m high paladin fencing, and new access and egress gateways. Site lighting will include 6 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways.

Yards 3 & 4

The smaller of the two existing warehouses on site will be demolished, and the larger warehouse along the southern boundary will be refurbished and extended to provide c. 2,953 m^2 for use as an EHS & Revenue Building. Yards 3 & 4 will incorporate loading bays and dock levellers along the northern side of the EHS & Revenue Building, together with 30 HGV parking spaces and associated internal access roads. Two single storey porta cabins, 75m^2 each, will be installed at the northern side boundary for use as Export Offices. Site lighting will include 2 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways. Landscaping will include ground cover planting in the end bays of the HGV parking aisles and at the south western corner of the side along Promenade Road.

New Permanent Structures:

EHS & Revenue Building: Existing warehouse building (approx. 1193 sq. m) to be refurbished and additional floor area of approx.1760 sq. m to be constructed comprising of (approx. 796 sq. m) ground floor extension to the north of the existing warehouse and an additional first floor area (approx. 964 sq. m) to the existing warehouse. Total proposed overall area approx. 2953 sq. m).

Building to incorporate loading bays with dock levellers, bays to inspect curtain siders with dock levellers, driver accessible WC's, open plan unloading areas, male changing room, female changing room, accessible changing rooms, disinfect area, inspection rooms (c. 2 no. to be temperature controlled), ancillary unloading areas, chilled storage rooms, Comms. rooms, M&E plant room, secure store, interview rooms, tool room, drying room, cleaners store, no. open plan offices, staff canteen, male toilets, female toilets, accessible WC, welfare room, breakout space, meeting room, conference room, cellular offices, store rooms, external south facing first floor terrace.

The proposed project will include standard design SuDS features such as attenuation, updates to the surface water drainage and sewerage network and petrol interception. These features and updates will mitigate any potential pollution of the adjacent wetland habitat areas of the South Dublin Bay and River Tolka Estuary SPA.

Bird Survey Dates

This report presents the results of surveys carried out on the 27th of November and the 4th of December 2019.

Survey methodology

The study area was defined as the development site itself (two small areas in the existing Dublin Port by the Bond Drive Extension and Promenade Road totalling 5.4 hectares) and surrounding areas close by in the vicinity of the River Tolka Estuary.

The original site of the proposed development comprised two relatively small areas of open gravelled surfaces (Fossit Code ED2) and buildings (Fossit Code BL3). The northern and larger (3.75 hectares) of the two sections of the site of the proposed development is a rectangle of land with its long axis running from east to west. This rectangle of land is bordered on its northern and eastern boundaries by a strip of land from 25 to 35 metres in width and on which there is a soil bank or bund 10-15 metres wide and several metres high. A shelter belt of mixed woodland (WD2), mainly comprised of Sycamore, White Poplar and Scots Pine, has been planted on the soil bank and has now reached maturity.

The area to the north and east of this boundary zone is part of the River Tolka estuary and is designated as part of the South Dublin Bay and River Tolka Estuary SPA. The area of estuary adjacent to the northern wooded soil bank (and to the east of the VP used by the surveyor) is characterised by rocky shore fucoid reef (LR2; Natura 2000 1170). The channel of the River Tolka runs close to this shore so that here is very little exposed sediment, even at low tide.

The area of land on the southern side of the estuary and to the west of the surveyor's vantage point (VP), going westwards towards the mouth of the river, is mainly characterised by fine sand to sandy mud (LS2/LS3) sediments.

The final count areas were the area of the estuary (MW4) that was watered during the surveys and the area of shoreline on the northern side of the estuary (i.e. opposite the site of the surveyor's VP). This area of shoreline is bordered by rock walls on the southern side of Clontarf, adjacent to and south of the Clontarf Road. This area is characterised by varying amounts (i.e. depending on the state of the tide) of fine sand to sandy mud (LS2/LS3) sediments. Part of this section of the northern side of the estuary is a Nature Reserve.

The main focus of the surveys were waterbird species that are usually counted as part of the Irish Wetland Birds (I-W*e*BS) survey. However, terrestrial birds were also recorded within the wooded bund bank and within the two areas of the site of proposed development. The optical equipment used during the survey comprised Swarovski (Absam, Austria) EL 8.5 X 42 binoculars and a tripod-mounted Swarovski ATS telescope with 20-60 X zoom magnification and an 80 mm objective lens. Birds were surveyed visually within the study area and their numbers, positions and behaviour were recorded using paper survey sheets and maps. Surveys were carried out for four hours per day with at least one tide (i.e. high or low) occurring during each survey. The roads adjacent to the two areas of the site of the proposed development and the wooded soil bank were walked several times during each survey, although the majority of the time was spent surveying waterbirds in the Tolka estuary. A Vantage Point (VP), positioned at Irish Grid E318600 N235585, was used for the latter purpose.

Survey constraints

Details of the conditions under which the surveys were carried are shown in Table 1, below. The minimum visibility on any of the survey days was more than two kilometres, which allowed good coverage of the whole study area. A maximum allowable sea state for observing birds on the sea is approximately 4; the maximum sea state during any of the surveys was 2. Thus, the survey conditions on both dates were perfectly acceptable for winter bird surveying.

Table 1: Details of the weather conditions during the November and December surveys at the study area

Date	Survey Period	High Tide	Low Tide	Wind	Sea State	Rain	Visibility	Cloud %	Cloud height (m)	Tide cycle	Other
27/11/2019	12:00-16:00	11:44 (4.2 m)	17:27 (0.6 m)	NE 1	1	None	2 km +	100	150-500	Spring	
04/12/2019	10:30-14:30	17:26 (3.5m)	10:46 (1.7 m)	SW 2	2	None	2 km +	50	150-500	Neap	Sunny intervals

Results of the survey counts

The results of the day-long counts are shown in the Tables 2 and 3 (below). The figures are for the maximum number of birds of any species recorded during that day's four-hour survey period.

Table 2: Birds recorded at the site and environs 27.11.2019

Original development site (northern block)
Magpie
Pied Wagtail
Hooded Crow
Original development site (southern block)
Pied Wagtail
1 Herring Gull
Wooded bund bank
1 Common Buzzard
4 Hooded Crow
1 Woodcock (flushed)
Magpie
Robin
Blackbird
Blue Tit
Shoreline closest to north of site
1 Common Buzzard (bird from wooded bund, above, flew down to rocky shore)
1 Grey Heron
Shoreline to the west of site (i.e. in front of Eastpoint Business Park and back towards mouth of Tolka)
17 Redshank
3 Curlew
14 Bar-tailed Godwit
3 Great Black-backed Gull
5 Common Gull
300 Black-headed Gull
177 Herring Gull
Northern side of Tolka Estuary on south side of Clontarf (Nature Reserve)
2 Grey Heron
4 Greenshank
35 Redshank
15 Oystercatcher
21 Curlew
150 Bar-tailed Godwit
4 Common Gull
250 Black-headed Gull
126 Herring Gull
1 Great Black-backed Gull
6 Mallard
On water in Tolka Estuary
8 Mallard
54 Black-headed Gull
72 Herring Gull
2 Common Gull
2 Great Black-backed Gull
6 Pale-bellied Brent Goose
1 Red-breasted Merganser

Table 3: Birds recorded at the site and environs 04.12.2019

Original development site (northern block)
1 Black-headed Gull 4 Feral Pigeon
Original development site (southern block)
-
Wooded bund bank
Magpie (old nest recorded also), 5 Chaffinch, 3 Goldfinch Wren, Blackbird
Shoreline closest to north of site
3 Grey Heron 1 Common Gull 2 Curlew 1 Greenshank
Shoreline to the west of site (i.e. in front of Eastpoint Business Park and back towards mouth of Tolka)
16 Black-tailed Godwit 4 Bar-tailed Godwit 4 Redshank 1 Oystercatcher 1 Curlew 5 Teal 1 Herring Gull 1 Black-headed Gull
Northern side of Tolka Estuary on south side of Clontarf (Nature Reserve)
1 Grey Heron 21 Oystercatcher 231 Herring Gull 510 Black-headed Gull 2 Great Black-backed Gull 1 Common Gull 64 Redshank 177 Dunlin 510 Black-tailed Godwit 6 Bar-tailed Godwit 25 Curlew 3 Greenshank 3 Turnstone 66 Light-bellied Brent Goose
On water in Tolka Estuary
554 Pale-bellied Brent Goose 6 Red-breasted Merganser 175 Black-headed Gull 175 Herring Gull 1 Great Black-backed Gull

As mentioned above, the count figures shown in Tables 2 and 3 (above) are for the maximum numbers of any species recorded in any area in any of the day's four hour survey period. It is important to remember that (especially with changing tidal state) birds move around during a period of four hours, so that adding the maxima for birds species in all areas of the surveyed area will double count birds that have moved within the surveyed area. For example, the combined maximum number of Light-bellied Brent Goose for all seven surveyed areas on the 4th of December is 620, while the maximum count for this species in the surveyed area on that date is the 554 birds that were counted on the water in the River Tolka estuary at around 14:30.

No species listed in Annex I of the E.U. Birds Directive were recorded within the site of the proposed development. Of the six species of birds actually recorded at the site of the proposed development, only one is a special conservation interest (SCI) of the South Dublin Bay and River Tolka SPA, which has 13 SCI species in all. This species, Black-headed Gull, is listed as a wintering interest of the SPA. A maximum of one bird was recorded within the site of the proposed development. A single Herring Gull was also recorded on one occasion within the larger northern block of the site of the proposed development and gulls (i.e. both Herring and Black-headed) were also seen in flight over these areas. Both species are listed in the Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 red list in respect of breeding populations only. Four species of terrestrial birds- Magpie, Hooded Crow, Pied Wagtail and Feral Pigeon- were also recorded at the site of the proposed development. None of the four is of particular conservation interest (i.e. none are SCIs of any local SPA, are listed in Annex I of the EU Birds Directive, or in the current BoCCI Red or Amber lists).

Birds recorded in the vicinity of, but not within, the site of the proposed development (i.e. in the wooded shelter belt and in the River Tolka estuary) included six of the thirteen South Dublin Bay and River Tolka Estuary SPA SCI species: Light-bellied Brent Goose, Oystercatcher, Redshank, Dunlin, Bar-tailed Godwit and Black-headed Gull. One species listed in Annex I of the E.U. Birds Directive, Bar-tailed Godwit, was recorded during the surveys. Three species, Curlew, Redshank and Dunlin are in the Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 red list in respect of breeding and wintering populations, while a further three species, Woodcock, Black-headed Gull and Herring Gull, are in the red list in respect of breeding populations only.

Designated sites in the area

There are two sites designated as Special Protection Areas (SPAs) for birds within a radius of five kilometres of the site of the proposed development.

The boundary of the South Dublin Bay and River Tolka Estuary SPA lies 35 metres north and 25 metres east of the development site.

The North Bull Island SPA lies approximately 1.9 kilometres east of the site of the proposed development. The North Bull Island and South Dublin Bay and River Tolka Estuary SPAs border each other and it is difficult to see why the two were not designated as a combined Dublin Bay SPA. However, given the drainage mitigation that forms part of the proposed development and the distance of the site of the proposed development from the nearest part of the North Bull Island SPA, it can be assumed that there is no potential for direct negative impacts (i.e. in the form of water pollution and/or disturbance) on this SPA. Obviously, there is the potential for an indirect impact on the North Bull Island SPA, if (as seems very likely) the ranges of local populations of waterbirds overlap both SPAs. North Bull Island SPA has 17 species SCIs and South Dublin Bay and Tolka Estuary SPA has thirteen species SCIs. Nine species (Light-bellied Brent goose, Oystercatcher, Grey plover, Knot, Sanderling, Dunlin, Bar-tailed Godwit, Redshank and Black-headed Gull) are SCI species for both SPAs. However, the lack of significant negative impacts on the nearby South Dublin Bay and Tolka Estuary SPA would correspond to a lack of negative impacts on the North Bull Island SPA. Accordingly, the South Dublin Bay and River Tolka Estuary SPA is the SPA that needs to be considered first in respect of the potential of the proposed development for negative impacts on birds and their habitats.

I-W*e*BS count figures for the study area

The birds wintering in Dublin Bay have been counted for a number of years as part of the I-W*e*BS survey programme run by BirdWatch Ireland. The area covered by the Dublin Bay I-WeBS count is Dublin Bay approximately from Dun Laoghaire in the south to Sutton in the north. This count area is broadly equivalent to the area covered by both the South Dublin Bay and River Tolka Estuary SPA and the North Bull Island SPA together. The I-W*e*BS count results for the last five winters are shown in Table 4, below. The annual figures are of the season maximum counts and the five-year mean is also shown.

Table 4: I-W*e*BS count data for the Dublin Bay count for the winters 2011/12 to 2015/16

	1% National Population	1% International Population	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	Mean
Red-throated Diver	20	3000	8	8	7	2	7	6
Great Northern Diver	20	50	2		3		5	3
Little Grebe	20	4700	1	9	1	5		4
Great-crested Grebe	30	6300	930	254	755	143	307	478
Black-necked Grebe			4					4
Red-necked Grebe					1			1
Cormorant	110	1200	151	53	198	41	71	103
Shag		2000	19	23	36	3	71	30
Grey Heron	25	5000	28	15	68	40	44	39
Little Egret	20	1100	48	19	59	69	59	51
Water Rail		6400	1					1
Moorhen		37100	7	5	5		5	6
Mute Swan	90		2	2	5	6	9	5
Brent Goose	350	400	4102	6134	3717	4862	4195	4602
Shelduck	120	3000	603	731	961	2927	744	1193
Wigeon	560	140000	610	445	691	2201	1106	1011
Teal	340	5000	909	981	1378	1233	1291	1158
Mallard	280	53000	151	52	97	106	120	105
Gadwall	20	1200			2	2		2
Pintail	20	600	212	160	200	150	124	169
Shoveler	20	650	101	79	126	97	115	104
Long-tailed Duck		16000		2	1			2
Common Scoter	110	7500	20	10	42		40	28
Red-breasted Merganser	25	860	114	50	60	57	69	70
Goldeneye	40	11400	11	6		2	1	6
Oystercatcher	610	8200	3408	3025	3074	3315	3588	3282
Ringed Plover	120	540	314	217	139	121	109	180
Grey Plover	30	2000	200	307	310	452	240	302
Golden Plover	920	9300	390	404	1080	742	1155	754
Lapwing	850	72300	120	67	52	54	143	87

	1% National Population	1% International Population	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	Mean
Knot	160	5300	3435	3022	4547	4950	2495	3690
Sanderling	85	2000	411	405	510	266	841	487
Curlew Sandpiper		10000	1	1				1
Dunlin	460	13300	3559	4163	5907	3603	3376	4122
Purple Sandpiper	20	710	4	3	2	1	2	2
Snipe		100000	12	62	20		31	31
Black-tailed Godwit	200	1100	927	1362	1768	873	2185	1423
Bar-tailed Godwit	170	1500	1917	2141	1710	1658	2173	1920
Whimbrel		6700		1	2	4		2
Curlew	350	7600	1169	874	932	1424	567	993
Redshank	240	760	2509	2077	2460	1889	1648	2117
Spotted Redshank		1000	1		1		3	2
Greenshank	20	3300	40	46	34	47	78	49
Turnstone	95	1400	349	227	466	250	584	375
Mediterranean Gull		2400	113	23	39	27	64	53
Little Gull		1000	1					1
Black-headed Gull		31000	2269	1907	2649	1259	2768	2170
Ring-billed Gull		25500	2	1				2
Common Gull		16400	410	309	985	272	890	573
Lesser Black-backed Gull		5500	28	25	5	20	16	19
Herring Gull		14400	519	135	490	261	538	389
Yellow-legged Gull				1	1		2	1
Great Black-backed Gull		3600	358	116	190	52	263	196
Sandwich Tern			6	23	52		8	22
Common Tern			38	3	39		1	20
Arctic Tern			3					3
Roseate Tern			3					3
Kingfisher					1		1	1

Table 5 (below) shows the peak counts of the waterbird species recorded in the study area, along with the last available five year mean of peak counts for the Dublin Bay I-W*e*BS survey. It is important to remember that the Dublin Bay I-W*e*BS counts effectively cover both the South Dublin Bay and River Tolka estuary SPA and the North Bull Island SPA.

Taking a figure of 5% of the I-W*e*BS total to be significant, the data indicate that the area around the site of the proposed development is significant within the South Dublin Bay and Tolka Estuary SPA for wintering populations of the six non-SCI species Grey Heron, Mallard, Red-breasted Merganser, Black-tailed Godwit, Greenshank and Herring Gull and the three SCI species Light-bellied Brent Goose, Bar-tailed Godwit and Black-headed Gull. However, it should be remembered that no significant numbers of these birds were recorded at the areas of land that are the site of the proposed development and that minimal numbers of waterbirds were recorded in the area of the SPA most closely adjoining the site (i.e. maxima of three Grey Heron, one Common Gull, two Curlew and one Greenshank). Light-bellied Brent Goose, Bar-tailed Godwit, Black-headed Gull are also SCIs of the North Bull Island SPA and Black-tailed Godwit is an SCI of the North Bull Island SPA, but not the South Dublin Bay and Tolka Estuary SPA.

Table 5: Waterbird species peak counts made at the site of the proposed development and in surrounding areas compared with the mean peak figures for the Dublin Bay I-W*e*BS count as a whole

Species	5 year mean I-W*e*BS (2011/12 to 2015/16)	Site of the proposed development		Surrounding areas	
		Maximum count	% 5 year mean I-W*e*BS	Maximum count	% 5 year mean I-W*e*BS
Grey Heron	39	0	0	4	10.2
Brent Goose	4602	0	0	554	12.0
Teal	1158	0	0	5	0.4
Mallard	105	0	0	8	7.6
Red-breasted Merganser	70	0	0	6	8.6
Oystercatcher	3282	0	0	15	0.5
Dunlin	4122	0	0	177	4.3
Black-tailed Godwit	1423	0	0	510	35.8
Bar-tailed Godwit	1920	0	0	164	8.5
Curlew	993	0	0	28	2.8
Redshank	2117	0	0	52	2.5
Greenshank	49	0	0	4	8.2
Black-headed Gull	2170	1	0.1	511	23.5
Common Gull	573	0	0	11	1.9
Herring Gull	389	1	0.3	231	59.4
Great Black-backed Gull	196	0	0	6	3.1

Significance of the avifauna in the surrounding area

The South Dublin Bay and River Tolka Estuary SPA is of ornithological importance as it supports an internationally important population of Light-bellied Brent Goose and nationally important populations of a further nine wintering species. Furthermore, the site supports a nationally important colony of breeding Common Tern and is an internationally important passage/staging site for three tern species.

Both Dublin Bay as a whole and the North Bull Island SPA are of international importance by virtue of the total number of wintering waterfowl present. North Bull Island SPA supports internationally important wintering populations of Light-bellied Brent Goose, Black-tailed Godwit and Bar-tailed Godwit.

The maximum count of Light-bellied Brent Goose made during the surveys was 554 (4th December 2019) which is greater than the threshold (400) for international importance. There was also a count of 510 Black-tailed Godwit (also on the 4th of December 2019) that was greater than the national (all-Ireland) threshold (200) for importance. The former is an SCI of the South Dublin Bay and River Tolka Estuary SPA, while the latter is an SCI of the North Bull Island SPA. Accordingly, the significance of the local avifauna is judged to be 'International'.

Potential impacts on the South Dublin Bay and River Tolka Estuary SPA

(1) Loss of habitat

None of the site of the proposed development lies within any Natura 2000 site. There will be no direct loss of habitat in the SPA, therefore. None of the habitats within the site of the proposed development (ED2 and BL3) are of any real potential importance as feeding or roosting habitats for the wetland birds that are the SCIs of the South Dublin Bay and River Tolka Estuary SPA. Thus, no habitat that is of potential as overflow for wetland birds will be lost or affected.

No change.

(2) Pollution

Construction of the proposed development will involve the redevelopment of an area that is already gravelled and where there are existing buildings to an area with new differing buildings and structures and with gravelled or possibly concrete standing. There will be earth works, but these will be relatively minor (some new foundations and the installation of some new drainage features). There is minor potential for mobile pollutants to reach the SPA via surface water runoff. The most likely potential for pollution is from silt displaced during earthworks or hydrocarbons escaping from machinery. This impact will be **short-term** and **Not significant/Slight Effect**, it can be mitigated completely by suitable measures (e.g. silt fencing). It should be remembered that the site is effectively buffered from the SPA and Tolka estuary by the wooded bank or bund that separates it from them.

Residual impact: No change.

During the operational phase the potential for pollution will be decreased. Assuming that proper arrangements are put in place to deal with any waste produced by the people who will be using the facility, the remaining potential source of pollution is via runoff. This **Permanent**/**Not significant** impact will be mitigated by means of standard design SuDS features such as attenuation, updates to the surface water drainage and sewerage network and petrol interception that are included in the design of the proposed development.

Residual impact: No change.

(3) Disturbance

(a) Construction disturbance

Construction activities will cause increased human presence and noise in area approximately 25-35 metres distant from the South Dublin Bay and River Tolka Estuary SPA. Construction itself will entail the redevelopment of an area that is already gravelled and where there are existing buildings to an area with new buildings and structures and with gravelled or possibly concrete standing. Earth works will be relatively minor, including some new foundations and the installation of some new drainage features, but major works (i.e. deep excavations, rock breaking or pile driving) will not be involved.

While the distances from the SPA (25-35 metres for the closest part of the proposed development) are not large it should be remembered that the SPA sheltered from construction disturbance visually largely to completely and acoustically at least to some extent by the soil bank and its woodland cover. The area is currently subject to certain amount of human disturbance, including traffic and in some parts is used by haulage trucks and so is not without potential background disturbance. The net result is that while there will be a short-term moderate disturbance impact within the site of the proposed development (which is not designated land), the **impact on the SCI species of the South Dublin Bay and River Tolka Estuary SPA** will be **unmitigable**, **short-term** and **imperceptible**.

(b) Disturbance during the operational phase

Disturbance during the operational phase of the development is expected to consist of human traffic and trucking traffic, much as it is today, but probably at a slightly increased intensity.

The same arguments that pertain to disturbance of SCI species within the boundary of the SPA (3a, above) are also relevant for disturbance during the operational phase.

It was noticed during the bird surveys at the site of the proposed development that the SPA shoreline immediately adjacent is characterised by a rocky shoreline (fucoid reef) and that there was little or no exposed fine sediment below these rocks even at low tide. The reason for this is that the channel of the River Tolka runs close to the shoreline in this area, so that the channel remains watered even at low tide. The numbers of waterbirds recorded using this area of shoreline were few (maxima of three Grey Heron, two Curlew, one Greenshank and one Common Gull during eight hours of watches at both high and low tides).

As is the case in 3a (above), the impact on the SPA SCI species will be **unmitigable**, **short-term** and **imperceptible**. This is by reason of the broadly similar current background operating disturbance, the shielding effect of the wooded soil bank, the lack of suitability of the habitats within the site of the proposed development as overspill habitat for the SPA SCI species, the low numbers of waterbirds recorded in the area immediately adjacent to the site of the proposed development (as opposed to areas of marine sediments that are available further away) and the large areas of suitable estuarine habitats that are available for wintering waterbird foraging or roosting in areas of the SPA that are further (i.e. 100 metres or more) from the site of the proposed development.

Thus, there will be **no significant operating disturbance impacts on the South Dublin Bay and River Tolka Estuary SPA SCI species**.

Impacts on the SCIs of the South Dublin Bay and River Tolka Estuary SPA

The conservation objectives of the South Dublin Bay and River Tolka Estuary SPA are shown in Table 6, below.

Table 6: Conservation objectives of the South Dublin Bay and River Tolka Estuary SPA

SCI	Conservation Objectives	Attribute	Target
Light-bellied Brent Goose **A046**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Oystercatcher **A130**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Ringed Plover **A137**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Grey Plover **A141**	Grey Plover is proposed for removal from the list of SCIs for the South Dublin Bay and River Tolka Estuary SPA. As a result, site specific conservation objectives have not been set for this species.	None	None

Knot **A143**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Sanderling **A144**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Dunlin **A149**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Bar-tailed Godwit **A157**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Redshank **A162**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Black-headed Gull **A179**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Population trend	Long term population trend stable or increasing.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by this species, other than that occurring from natural patterns of variation.
Roseate Tern **A192**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Passage population: individuals	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns

Common Tern **A193**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Breeding population abundance: apparently occupied nests (AONs)	No significant decline
		Productivity rate: fledged young per breeding pair	No significant decline
		Passage population: individuals	No significant decline
		Distribution: breeding colonies	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at breeding site	Human activities should occur at levels that do not adversely affect the breeding population of this species.
		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns
Arctic Tern **A194**	To maintain the favourable conservation condition of the species in the South Dublin Bay and River Tolka Estuary SPA	Passage population: individuals	No significant decline
		Distribution: roosting areas	No significant decline
		Prey biomass available	No significant decline
		Barriers to connectivity	No significant decline
		Disturbance at roosting site	Human activities should occur at levels that do not adversely affect the numbers of this species among the post-breeding aggregation of terns
Wetlands **A999**	To maintain the favourable conservation condition of the wetland habitat in the South Dublin Bay and River Tolka Estuary SPA as a resource for the regularly occurring migratory waterbirds that utilise it.	Habitat area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,192 hectares, other than that occurring from natural patterns of variation.

The potential impacts of the proposed development on the special conservation interests (SCIs) of the South Dublin Bay and River Tolka Estuary SPA are shown in Table 7, below.

Table 7: Predicted impacts on the SCIs of the South Dublin Bay and River Tolka Estuary SPA

SCI	Population	Distribution
Brent Goose (wintering)	During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Geese (*Branta bernicla hrota*); International Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 525 individuals. A maximum of 554 geese were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the geese were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Oystercatcher (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Oystercatcher (*Haematopus ostralegus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,263 individuals. A maximum of 15 Oystercatcher were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Oystercatcher were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Ringed Plover (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Ringed Plover (*Charadrius hiaticula*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 161 individuals. This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.
Grey Plover (wintering)	Not recorded during the surveys in the vicinity of study area.	This species is proposed for removal from the list of SCI species for the SPA and no site-specific conservation interests have been set for it.
Knot (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,151 individuals. This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.
Sanderling (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 349 individuals.	Given that there was no indication that this species is regularly present in this part of the SPA and that disturbance impacts on this species are not expected, no significant decrease in the range, timing or use of the SPA are expected.

	This species was not recorded in the vicinity of the site of the proposed development during the two survey visits.	
Dunlin (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,753 individuals. A maximum of 177 Dunlin were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Dunlin were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Bar-tailed Godwit (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Bar-tailed Godwit (*Limosa lapponica*); National Importance. The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 866 individuals. A maximum of 164 Bar-tailed Godwit were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Bar-tailed Godwit were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Redshank (wintering)	During winter the site regularly supports 1% or more of the all-Ireland population of Redshank (*Tringa totanus*); National Importance. The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 713 individuals. A maximum of 56 Redshank were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development, but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that the Redshank were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Black-headed Gull (wintering)	The winter mean peak number of Black-headed Gull (*Chroicocephalus ridibundus*) within the site during the baseline period (1995/96 – 1999/00) was 3,040 individuals. This number exceeds the selection threshold set for this species. A maximum of 511 Black-headed Gull were recorded in the Tolka Estuary during the surveys from the VP adjacent to the site of the proposed development (one was recorded visiting the site also), but the vast majority of these were observed mainly on the Clontarf side of the estuary at distances ranging from 400 to 500 metres from the site.	Due to the distance (approximately 400-500 metres) of the site from the areas that most of the Black-headed Gull were observed feeding and roosting and the minor disturbance that is envisaged, it is considered that there will be no significant disturbance to this species. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.

Roseate Tern (passage)	The SPA is selected as an important passage area for this migratory waterbird species based on significant concentrations recorded, 2,000 individuals recorded in 1999. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	This species nests on Rockabill Island (30 km NE of the site of the proposed development) and the Dalkey islands (12 km SE of the site). During the breeding season the birds can forage widely, but stay as close as they can to their breeding colonies. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). As such, activities at the site of the proposed development have no potential to impact either breeding colonies, or the autumn roosting sites of this species. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Common Tern (breeding and passage)	During the breeding season this site supports a colony of Common Tern (*Sterna hirundo*) (52 pairs in 1995). This exceeds the All-Ireland 1% threshold for this Annex I species; National Importance. In 2018, there were 600 Common Tern nests in the SPA and the River Liffey channel. Additionally, there are significant numbers of Common Tern in the SPA in autumn as part of post-breeding tern aggregations in Dublin Bay, Namely, 5,000 individuals were recorded in 1999. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	Common Tern nest on two mooring dolphins in the River Liffey Channel, the CDL and ESB dolphins (these are approximately 2 km from the site; the ESB dolphin is part of the SPA, as a designated 'island' in the undesignated commercial channel). The terns also breed on two pontoons, one in the Liffey Channel and another that was deployed in the outer Tolka Estuary in 2013. This pontoon is 765 metres east of the site of the proposed development. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). The distance of the site from the breeding and passage roosting sites for this species are such that activities at the site will not have any potential to disturb the species within the SPA. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Arctic Tern (passage, occ. breeding)	The SPA is selected as an important passage area for this migratory waterbird species based on significant concentrations recorded, 20,000 individuals recorded in 1996. This species was not recorded during the site survey, as would be expected given that this species is unlikely to be present during the winter.	This species occasionally nests on the mooring dolphins in the River Liffey channel (approximately 2 km from the site). During the breeding season the birds can forage widely, but stay as close as they can to their breeding colonies. This species is a constituent of large post-breeding tern aggregations that can be found roosting at Sandymount Strand (2.5 km S of the site), Booterstown (4.5 km S) and, to a lesser extent, Dollymount Strand (3 km E). The distance of the site from the breeding and passage roosting sites for this species are such

		that activities at the site will not have any potential to disturb the species within the SPA. The feeding areas of this species mostly shallow marine (i.e. potentially in the Tolka Estuary area). Foraging terns show little potential to be disturbed by boats and other human activity. Thus, there should be no permanent significant decreases in the range, timing or use of the SPA.
Wetlands	The boundary of the South Dublin Bay and River Tolka Estuary SPA lies approximately 35 metres north and 25 metres east of the site of the proposed development. There will be no direct loss of habitat within this SPA.	No significant impacts on the range, timing or use of the SPA by the SCI species are expected from the minor changes to a small area of adjacent non-SPA land. Disturbance during construction will be short-term and limited to the immediate vicinity of the site. There is some potential for disturbance during the operational phase of the development, but this will be limited spatially (i.e. to the site and its immediate vicinity). The potential for runoff pollution will be mitigated by the new drainage and interception features that form part of the project design.

Concluding remarks

- There will be no loss of wetland habitat within the SPA and no loss of any potential overflow habitat for waterbirds.

- The potential for the pollution of SPA wetland habitat is minor at most and mitigation for this will be put in place as part of the design of the proposed development.

- There will be no significant disturbance impacts within the SPA itself.

- One of the 13 SCIs of the South Dublin Bay and River Tolka SPA was recorded using the site for feeding. This species was Black-headed Gull. One individual was noted at the site of the proposed development (out of a Dublin Bay wintering total of more than 2,000). Gulls will often forage in built-up areas for rubbish that has been dropped by humans and over time one would expect to see almost every open area close to the coast used by small numbers of them. Many public parks and sports grounds are often host to foraging gulls (including Black-headed Gull). It is considered that there is no potential for the site to be used by the other 12 SPA SCIs, although tern species (three of the SCI species) often overfly land close to the coast.

- The nearest of the Common Tern breeding sites in the area is the pontoon that lies 765 metres east of the nearest part of the proposed development site (i.e. the Bond Drive Extension site). The land areas (the pontoon is 100 metres offshore of the docks) between the site of the proposed development and the pontoon are all covered with existing and operating parts of the Dublin docks. The nearest area that is used by post-breeding/passage flocks of Common, Arctic and Roseate terns is at least two kilometres from the site of the proposed development. Terns are generally very little affected by human disturbance, except when it is at their nesting and/or resting sites; they routinely forage and commute very close to moving shipping and man-made coastal features like docks and piers. As such, it can be confidently stated that the proposed development will have no impact on tern species.

- The numbers of birds occurring actually within the site of the proposed development are insignificant. While the possibility for disturbance (both during construction and operation) to waterbirds within the SPA has been noted, this will be a negligible impact. The indications are (i.e. from surveys held on the 27th November and the 4th of December 2019) that the numbers of waterbirds using the areas directly adjacent to the site of the proposed development are few. Even if minor disturbance occurs, there are large areas of suitable estuarine habitats within more distant parts of the SPA that will be available to SCI species. Accordingly, no significant impacts on the South Dublin Bay and River Tolka Estuary SPA and its special conservation interest species are predicted.

- When in operation, the sites of the proposed development will be subject to truck traffic and truck parking, this is the same as the current use of at least some of these areas, so that it can be said that the operational phase of the development will result in little or no change from the status quo.

8.0 LAND, SOILS, GEOLOGY & HYDROGEOLOGY

8.1 INTRODUCTION

This chapter assesses and evaluates the potential impacts of the Proposed Development described in Chapter 2 (Description of the Proposed Development) on the land, soils, geological and hydrogeological environment.

8.2 METHODOLOGY

8.2.1 Guidelines

This assessment has been carried out generally in accordance with the following guidelines:
- EPA Draft EIA Report Guidelines 2017
- Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report, European Union 2017;
- Institute of Geologists of Ireland (IGI) '*Guidelines for the preparation of Soils Geology and Hydrogeology Chapters of Environmental Impact Statements*' (2013); and
- National Roads Authority (NRA) '*Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* (2009).

The principal attributes (and impacts) to be assessed include the following:

- Geological heritage sites in the vicinity of the perimeter of the subject site;
- Landfills, industrial sites in the vicinity of the site and the potential risk of encountering contaminated ground;
- The quality, drainage characteristics and range of agricultural uses of soil around the site;
- Quarries or mines in the vicinity, the potential implications (if any) for existing activities and extractable reserves;
- The extent of topsoil and subsoil cover and the potential use of this material on site as well as requirement to remove it off-site as waste for recovery or disposal;
- High-yielding water supply springs/wells in the vicinity of the site to within a 2 km radius and the potential for increased risk presented by the Proposed Development;
- Classification (regionally important, locally important etc.) and extent of aquifers underlying the site perimeter area and increased risks presented to them by the Proposed Development associated with aspects such as for example removal of subsoil cover, removal of aquifer (in whole or part), drawdown in water levels, alteration in established flow regimes, change in groundwater quality;
- Natural hydrogeological/ karst features in the area and potential for increased risk presented by the activities at the site;
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporally; and
  Vulnerability of the Proposed Development to major disasters from a geological and hydrogeological standpoint such as landslides and seismic activity.

8.2.2 Sources of Information

Desk-based geological and hydrogeological information on the substrata underlying the extent of the site and surrounding areas was obtained through accessing databases and other archives where available. Data was sourced from the following:

- Geological Survey of Ireland (GSI) (www.gsi.ie) - online mapping, Geo-hazard Database, Geological Heritage Sites & Sites of Special Scientific Interest, Bedrock Memoirs and 1:100,000 mapping;
- Teagasc soil and subsoil database;
- Ordnance Survey Ireland - aerial photographs and historical mapping;
- Environmental Protection Agency (EPA) – website mapping and database information;
- National Parks and Wildlife Services (NPWS) – Protected Site Register;
- Research papers referred to in this chapter.

Site specific data was derived from the following sources:

- Office of Public Works (OPW, 2019) Brexit Infrastructure at Dublin Port Engineering Report, and;
- Geotechnical Investigation Report (Priority Geotechnical Ireland, 2019).

8.3 RECEIVING ENVIRONMENT

The receiving environment is discussed in terms of; geology, soils, hydrogeology and site history including potential for contamination.

The subject sites are 5.4 hectares in extent and are located in Dublin Port, Dublin 3 (refer to Chapter 1 Figure 1.1).

8.3.1 Topography & Setting

The topography of the proposed development is mostly flat but varies slightly in its height above ordinance datum due to its nature (reclaimed man-made docks area) between 3.0 mAOD and 7.0 mAOD.

8.3.2 Areas of Geological Interest & Historic Land-Use

The GSI (2020) on-line mapping was reviewed to identify sites of geological heritage for the site and surrounding area. There are no recorded sites on/ at the development site, or which could be considered suitable for protection under this programme or recorded in the Dublin City Development Plan 2016 – 2022.

The nearest geological heritage site is the Oscar Wilde Statue, which is in Merrion Square, approximately 2.6 km to the southwest of the proposed development site.

Details of the site history and previous land use are included in Chapter 12 Archaeology, Architectural and Cultural Heritage. The assessment of site history confirms that the proposed development site was formerly part of the Liffey Estuary and was so until at least 1913, before being reclaimed for port use. The proposed development site has, according to the Dublin Port Authority, been in port use since at least the early-to-mid-1900s.

According to the EPA (2020) there are a number of licensed IPPC facilities within 1 km of the proposed development site. Details of these are supplied in Table 8.1 below.

Table 8.1 IPPC licenced facilities within 1 km of the proposed development site

Licence No.	Name	Address	Distance to Site
P1022-02	Dublin Port Company	Port Centre, Alexandra Road, Dublin.	c. 465m
P0579-03	Electricity Supply Board	North Wall Generating Station, Alexandra Road, Dublin 1, Dublin.	c. 450m
P0086-01	Irish Tar & Bitumen Suppliers	Alexandra Road, Dublin 1, Dublin.	c. 690m
P0298-01	Cahill Printers Limited	East Wall Road, Dublin 3, Dublin.	c. 850m

Also, according to the EPA, there are a number of licensed waste facilities within 1 km of the proposed development site. Details of these are supplied in Table 6.2 below. There are no known Section 22 illegal landfills or other historic landfills within 1 km of the site.

Table 8.2 Licenced waste facilities within 1 km of the proposed development site

Licence No.	Name	Address	Distance to Site
W0097	Swalcliffe Limited	116 Sheriff Street Upper, Dublin 1, Dublin	c. 890m
W0042	Dean Waste Company Ltd (Upper Sheriff Street)	Upper Sheriff Street, Dublin 1, Dublin	c. 960m

8.3.3 Regional Soils

Soils in the surrounding Dublin Port area are categorised as Made - Made ground. Figure 8.1 shows the regional soil coverage in the area of the Proposed Development site.

The Quaternary geological period extends from about 1.5 million years ago to the present day and can be sub-divided into the Pleistocene Epoch, which covers the Ice Age period and which extended up to 10,000 years ago, and the Holocene Epoch, which extends from that time to the present day.

The GSI/Teagasc subsoil mapping database of the quaternary sediments in the area of the subject site currently shows (Figure 8.2) the principal soil type in the surrounding Dublin Port area are defined as made ground. There is no available data on the site-specific ground conditions at the site with regard to superficial geology.

The exact depth to bedrock at the site is not known however based on a geotechnical investigation undertaken at the site in 2020 by Priority Geotechnical Ireland (refer to Appendix 8.2) bedrock depth in the study area has been shown to be circa 16.7 metres below ground level (mbgl) to 17.6 mbgl. Although there is no site-specific data available through the GSI, subsoil permeability in the surrounding port area is categorized as “Low” by the GSI. Due to the nature of the underlying strata at the site (made ground) permeability would increase in this section of Dublin Port. However, the prevalence of hard standing in area would provide additional protection to the underlying material.

8.3.3.1 Soil Quality

The soil results were compared to the Generic Assessment Criteria (GAC) concentrations. There are no legislated threshold values for soils in Ireland. As such soil samples were compared to a Generic Assessment Criteria (GAC) derived to be protective of human health, water bodies (including groundwater) and also ecology for a resident and commercial/industrial end use.

Generic Assessment Criteria in the UK has been derived using the Contaminated Land Exposure Assessment (CLEA) model to be protective of human health for a number of different land uses. LQM (Land Quality Management) and the CIEH (Chartered Institute of Environmental Health) developed a document in July 2009 detailing their own research and derivation of their own 'LQM GACs'. A total of 82 substances including many organic substances had LQM GACs derived, for the standard land uses of residential, commercial/industrial and allotments. This was updated in 2015 following further research and the derived results are now called LQM/CIEH Suitable 4 Use Level (S4UL). The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and as transparently derived and cautious "trigger values" above which further assessment of the risks or remedial action may be needed. For each contaminant S4ULs have been derived for six land use scenarios based on assessing exposure pathways in each planning scenario. In this instance the commercial scenario has been considered. Soil type and soil organic matter (SOM) has an influence on the behaviour of contaminants. S4ULs have been derived for three SOM contents (1%, 2.5% and 6%) to cover the likely range in soils. A prudent approach has been taken by considering the lower 1% SOM content.

The UK values do not have any legal standing within the Republic of Ireland and no statutory guidance for assessing the significance of soil contamination currently exists. However, the values do provide a means of placing the data within context when considering magnitude of risk and have been used in that capacity for this assessment.

The 19 no. soil samples were analysed by Chemtest in Newmarket, UK for the following parameters:

- Metals (As, BR, Cd, Cr, Pb, Se, Cu, Ni, and Zn),
- Total Phenols
- Polycyclic Aromatic Hydrocarbons (PAHs) and.
- Waste Acceptance Criteria (WAC) for inert waste landfills in accordance with the 2002 European Landfill Directive (2002/33/EC). This suite of parameters includes the following (carried out on 19 samples).
    - Mineral oil,
    - Total Polychlorinated Biphenyls
    - Total Polycyclic aromatic hydrocarbons (PAHs),
    - Total BTEX compounds (benzene, toluene, ethylbenzene and xylenes)
    - Total organic carbon (TOC),
    - Leachable component of a range of organic and inorganic parameters.

The full analytical laboratory report (EEL- 19-38616) is presented in Appendix 8.2. The soil results were compared to the Generic Assessment Criteria (GAC) concentrations. GACs are soil concentrations that have been derived for a defined set of generic assumptions and are used as trigger values in determining whether further risk management action is required in cases where detailed quantitative risk assessment is not being undertaken. There are no published Generic Assessment

Criteria for soils in the Republic of Ireland. Instead reliance is often placed on criteria from the UK and the Netherlands.

Solid soil sample analysis comparison tables are present in Appendix 8.3. These tables exhibit the soil quality across the site from the 19 representative samples taken across the subject site.

Metals

All metal parameter concentrations recorded values below the threshold value for the LQM/CIEH for HHRA (Human Health Risk Assessment) Commercial Threshold at 1% SOM. The majority were also below the most conservative Residential Thresholds values. There were some minor elevations of Arsenic for location TP10 at 0.5 mbgl (45 mg/l with a threshold of 40 mg/l) and Mercury at TP10 at depths of 0.5 mbgl and 2.0 mbgl (1.6 mg/l & 1.3 mg/l with a threshold of 1.2 mg/l) and TP1A with a value of 1.3 mg/ l.

PCBs

All parameters recorded below the laboratory's LOD for all samples collected across the subject site. Therefore, there are no exceedances recorded when these concentrations were compared to the most conservative threshold i.e. LQM/CIEH for HHRA Residential Threshold at 1% SOM.

PAHs

The majority parameters tested recorded values below threshold i.e. LQM/CIEH for HHRA Residential Threshold at 1% SOM. All but two samples analysed had levels were below the Commercial Thresholds as described above. Dibenzo(ah)anthracene at locations TP11 (0.5 mbgl) and TP1B were above the Commercial Threshold level of 3.5 mg/ at 18 mg/kg and 3.5 mg/kg respectively.

8.3.3.2 Waste Acceptance Criteria (WAC) Analysis

Nineteen samples were analysed and compared against Waste Acceptance Criteria (WAC) set out by the adopted EU Council Decision 2003/33/EC which established criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002).

The WAC analysis identifies that 13 pf the 19 samples tested are classified as Category C1 – Stable Non-Reactive mostly relating to elevated levels of sulphate and total dissolved solids (TDS). Five samples TP04 (shallow), TP05 (shallow), TP07 (shallow & deep) and TP9A can be categorised as Inert. The deep sample from TP1A had a total organic carbon (TOC) value of 7.9 % which was the only parameter which would categorise it as Category D – Hazardous. Further analysis of more samples once excavated is recommended to confirm WAC criteria for disposal. Based on the laboratory results and parametric concentrations obtained from the site investigation, material from the sample locations would be acceptable non-hazardous or hazardous waste facility (Category C or D). It should be noted that waste facilities develop facility specific criteria also and this should be considered should any soil/ material to be removed from site in the future. It is anticipated there will be no largescale excavations as part of the proposed development. If excavated material requires removal from site, it should be classified by an experienced and qualified environmental professional to ensure that the waste soil is correctly classified for transportation and recovery/disposal offsite at an appropriately licenced facility.

Asbestos

There were no asbestos fibres identified in any of the trial pit samples taken.

Figure 8.1 Soils map for the Proposed Development site (boundary indicated in red) (GSI, 2020)

Figure 8.2 Subsoils map for the Proposed Development site (boundary indicated in red) (GSI, 2020)

8.3.4 Regional Geology

Inspection of the available GSI mapping (GSI, 2020) shows bedrock in the greater Dublin region consists of Dinantian Upper Impure Limestone which is part of the Lucan Formation (see Figure 8.3). The limestone is colloquially known as Calp and is estimated to be up to 800 m thick. The homogeneous sequence consists of dark grey massive limestones, shaley limestones and massive mudstones.

The Calp is almost completely obscured across central Dublin under the Dublin Boulder Clay. There are no faults mapped in the vicinity of the site. The depth to bedrock is mapped as 15-25 m on the GSI GeoUrban viewer and confirmed by onsite investigations (Priority, 2019).

No bedrock outcrop was identified on the site. In terms of the structural relationship of the area, the GSI database (refer also to Figure 8.3) does not show any faults on the site or within the immediate vicinity of the site.

Figure 8.3 Bedrock geology map (boundary indicated in red) (GSI, 2020)

8.3.5 Regional Hydrogeology

8.3.5.1 Description of the Groundwater Body

The GSI has devised a system for classifying the bedrock aquifers in Ireland. The aquifer classification for bedrock depends on a number of parameters including, the area extent of the aquifer (km^2), well yield (m^3/d), specific capacity ($m^3/d/m$) and groundwater throughput (mm^3/d). There are three main classifications: regionally important, locally important, and poor aquifers. Where an aquifer has been classified as regionally important, it is further subdivided according to the main groundwater flow regime within it. This sub-division includes regionally important fissured aquifers (Rf) and regionally important karstified aquifers (Rk). Locally important aquifers are sub-divided into those that are generally moderately productive (Lm) and those that are generally moderately productive only in local zones (Ll). Similarly, poor aquifers are classed as either generally unproductive except for local zones (Pl) or generally unproductive (Pu).

The bedrock aquifers underlying the proposed development site are not defined according to the GSI National Draft Bedrock Aquifer Map based on the manmade nature of this section of Dublin Port. However, bedrock aquifer in the surrounding area have been defined as a Ll – locally important bedrock aquifer, described as bedrock which is moderately productive only in local zones. Ll aquifers are those in which fissure permeability is generally low due to a poorly connected network of fractures, fissures and joints. Generally, the lack of connection between the limited fissures results relatively poor aquifer storage and flow paths that may only extend a few hundred metres. Figure 8.4 presents the current bedrock aquifer map for the Proposed Development area.

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. Due to the nature of the flow of groundwater through bedrock in Ireland, which is almost completely through fissures/ fractures, the main feature that protects groundwater from contamination, and therefore the most important feature in the protection of groundwater, is the subsoil (which can consist solely of or of mixtures of peat, sand, gravel, glacial till, clays or silts).

The GSI does not have data regarding aquifer vulnerability at the proposed development site due to this section of the port being reclaimed from the Liffey Estuary. However, aquifer vulnerability in the neighboring area of Dublin Port is classified as 'Low' (L) which indicates an overburden depth of >10 m (refer to Figure 8.5). Based on onsite investigations (Appendix 8.2) overburden depth to bedrock has been shown to be > 16 mbgl which would confirm the GSI site categorization of "Low".

Figure 8.4 Aquifer Classification map (*Source:* www.gsi.ie)

Figure 8.5 Aquifer Vulnerability map (*Source: www.gsi.ie*)

8.3.5.2 Groundwater Wells and Flow Direction

The GSI Well Card Index is a record of wells drilled in Ireland, water supply and site investigation boreholes. It is noted that this record is not comprehensive as licensing of wells is not currently a requirement in the Republic of Ireland. This current index, however, shows a number of groundwater monitoring and abstraction wells within a 2 km radius of the site; the abstraction wells generally supply a mix of use ranging from domestic to public to industrial use.

Figure 8.6 below presents the GSI well search for the area surrounding the site (Note this source does not include all wells) and Table 8.2 below summarises the details of some of the wells present within this search area.

The uses of wells in the area close to the Proposed Development site have not been defined in GSI records. There exists no yield data for any of the wells recorded in the area close to the site. Due to the urban /industrial nature of the area it is believed the water supply primarily through mains and groundwater abstraction for potable water use would be minimal.

Table 8.2 GSI Well Search (*GSI, 2020*)

GSI Well Name	Drill Date	Well Type	Depth (meters)	Use
2923SEW036	December 16, 1995	Borehole	6.2	Unknown
2923SEW030	February 25, 1998	Borehole	7.8	Other
2923SEW029	February 25, 1998	Borehole	6.5	Other
2923SEW046	December 29, 1899	Spring	N/A	N/A

Perched water flow direction in the overburden generally follows no fixed pattern or trend. Flows of this nature are typical of low permeability clay strata with intermittent fill areas, where often the water level measures represent pore water seepages into the overburden monitoring well (opposed to bedrock wells) or perched groundwater conditions (not bedrock aquifer water). From onsite investigation (Priority, 2019) there was no perched groundwater observed in any of the trial pits excavated. Water seepage was noted in borehole RC02 and RC03 at 4.50 mbgl in both the stratum description stating the underlying strata consisted of clay fill material which is reducing the permeability at this depth. Higher volumes of water were noted at the interface of the overburden and bedrock (circa 17 mbgl) which was most likely saline water from the Liffey Estuary. Groundwater flow in the area is most likely radial flowing towards the Estuary. There will be no impact on local or regional groundwater resources (abstraction) as part of the Proposed Development.

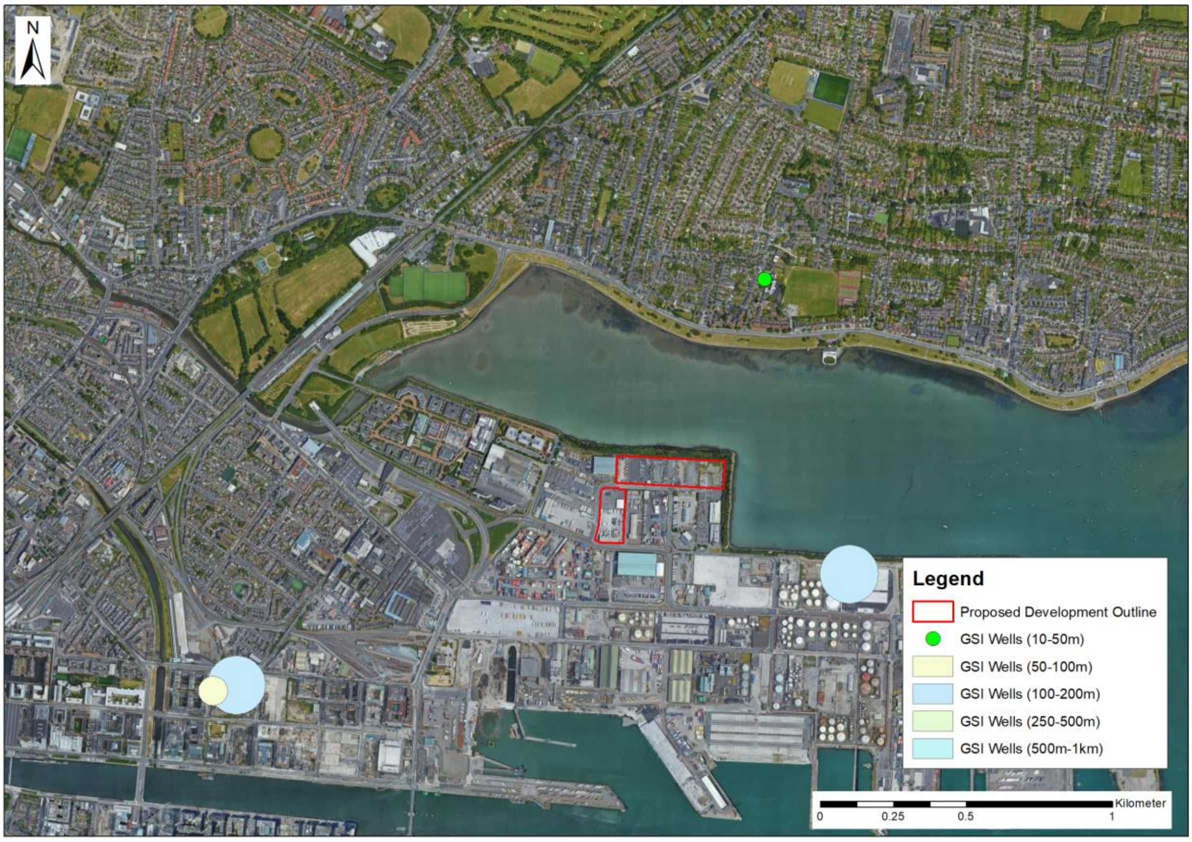


Figure 8.6 GSI Well Search (*GSI, 2020*)

8.3.5.3 Groundwater Quality

The European Communities Directive 2000/60/EC established a framework for community action in the field of water policy (commonly known as the Water Framework Directive [WFD]). The WFD required '*Good Water Status'* for all European water by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both *'Good Ecological Status'* and *'Good Chemical Status'*.

The Groundwater Body (GWB) underlying the site is the Dublin GWB (EU Groundwater Body Code: IE_EA_G_008). Currently, the EPA (2018) classifies the Dublin GWB as having 'Good Status', with a Ground Waterbody Risk score of *'not at risk'.* Figures 8.7 and 8.8 below present the most recent data from the EPA website.

Figure 8.7 GWB Risk Score *"Good"* (EPA, 2020) (proposed development site outlined in red)

Figure 8.8 GWB WFD Status (period 2013-2018) (EPA, 2020) (proposed development site outlined in red)

8.3.5.4 Hydrogeological Features

According to the GSI Karst database there is no evidence of karstification (bedrock prone to dissolution leading to underground drainage systems such as caves and large crevices) in this area.

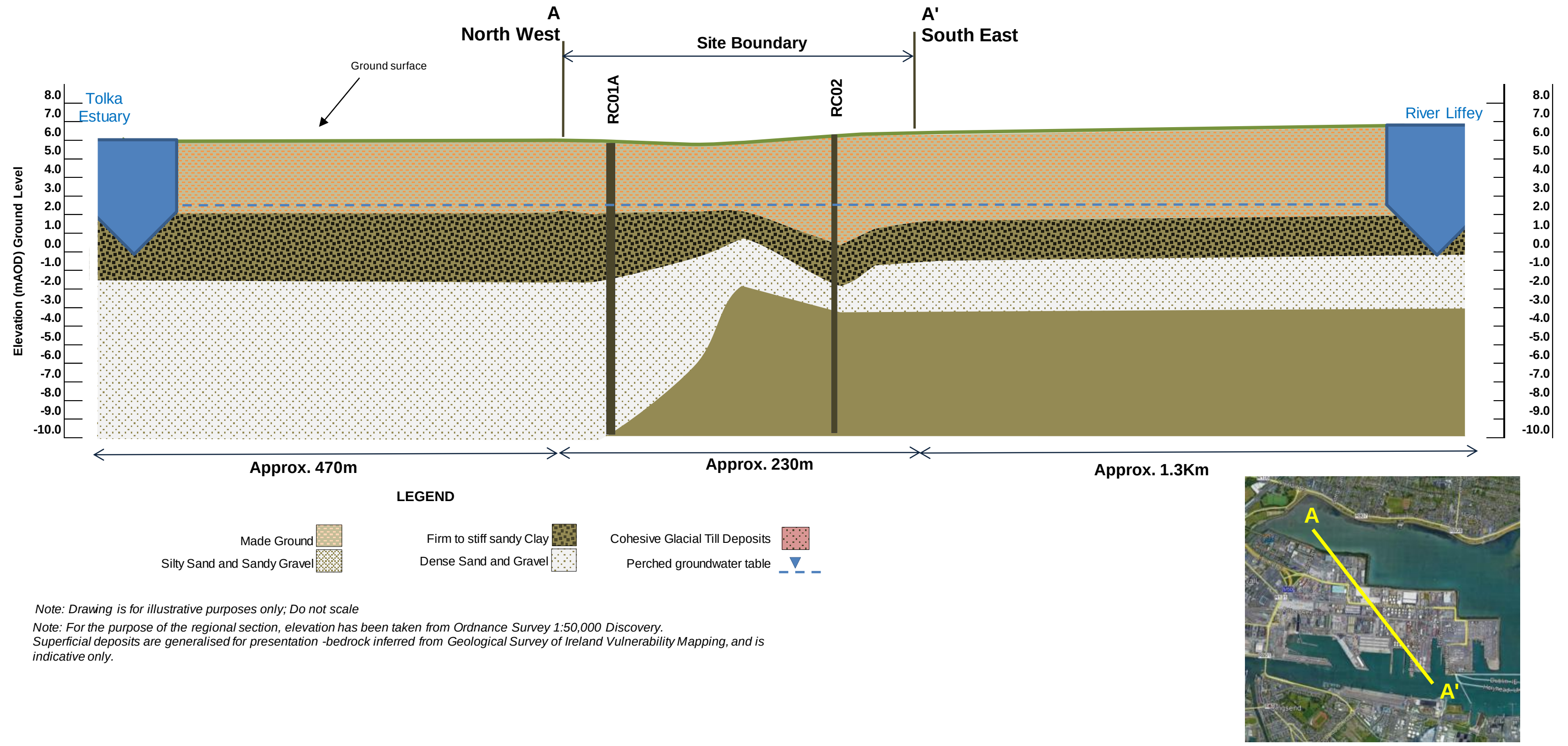
8.3.5.5 *Areas of Conservation*

The nearest European sites are South Dublin Bay and River Tolka Estuary SPA (Site Code 004024), which is located along the coast approximately 300 m to the north of the proposed Project, and North Bull Island SPA (Site Code 004006), which is located approximately 1.28 km north east of the proposed Project. Also, within relatively close proximity to the proposed site are North Dublin Bay SAC (Site Code 000206) and South Dublin Bay SAC (Site Code 000210). The Royal Canal and Grand Canal proposed Natural Heritage Areas (pNHA) are 1.8 km and 2.15 km to the south west of the proposed site. There is no direct hydrological link with these receptors. Refer to Chapter 6 Hydrology and Chapter 7 Biodiversity for further details.

8.3.5.6 *Cross Sections*

Figure 8.9 present the location of representative cross sections through the site to show the local and regional hydrogeology conceptual site model (CSM) which is as follows:

- The site is mostly between 4.0 and 7.0 mAOD and is located within the curtilage of Dublin Port.
- The profile on site comprises thin hardstand overlying > 4.5 m of MADE GROUND comprising mostly of sandy silty Gravels with fragments of redbrick concrete and other fill material. Beneath this to circa 12.5 m to 10 m older fill material most likely from the reclaiming of this part of Dublin Port from the Liffey Estuary in the early 1900’s consisting mostly of sandy silty GRAVELS with clays and sandy, silty, gravelly CLAYS.
- Onsite investigations proved bedrock to 17.60 mbgl in one location (RC01A) and 16.70 mbgl at RC02.
- Based on GSI mapping there is no underlying aquifer classification as this section of Dublin Port was filled and reclaimed in the early 1900’s. The surrounding aquifer is catagorised as LI – Locally Important.
- There is no proposal to abstract groundwater or discharge to ground as part of the Proposed Development. There is no source protection areas or public water schemes in the study area.
- A shallow perched water table may be present within the made ground. Localised seepage was encountered within the overburden in the two boreholes installed at the site at 4.5 mbgl. Shallow groundwater was also recorded at 9 mbgl in RC01A and 11.0 mbgl at RC02. Substantial water strikes were recorded at the interface of bedrock and overburden. This is most probably water from the Liffey Estuary and saline in nature.
- Regional groundwater flows are in an easterly direction towards Dublin Bay localised flows are most probably redial to the north and east into the Estuary
- Analysis of chemicals of concern, confirmed contamination in the fill/ shallow overburden underlying the site and has been shown to be contaminated to varying degrees. Comparison with LQMS/CIEH S4ULs showed two of the nineteen samples analysed exceeded levels for commercial land use. WAC analysis confirmed that soil (at locations where the inert WAC criteria is exceeded) can be disposed of a non-hazardous land fill apart from one location which exceeded hazardous limits for TOC only.



Note: Drawing is for illustrative purposes only; Do not scale

Note: For the purpose of the regional section, elevation has been taken from Ordnance Survey 1:50,000 Discovery. Superficial deposits are generalised for presentation -bedrock inferred from Geological Survey of Ireland Vulnerability Mapping, and is indicative only.

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Project:

Environmental Impact Assessment for Dublin Port (OPW)

Drawing:
Geological Cross Sections - Local Setting

Reference:
PC/19/11148

Figure 8.9 Schematic cross section

8.3.5.7 Rating of site importance of the geological and hydrogeological features

Based on the NRA methodology (refer Appendix 8.1), the criteria for rating site importance of hydrogeological features, the importance of the hydrogeological features at this site is rated as ***low importance***. This is based on the assessment that the attribute has no high-quality significance or value on a local scale. The is based on the classification of the aquifer underlying the proposed site.

8.3.6 Economic Geology

The EPA Extractive Industry Register and the GSI mineral database were consulted in April 2020 to determine whether there were/ are any mineral sites close to the subject site. There are no active quarries located in the immediate vicinity of the proposed development site. The nearest notable quarry is the Huntstown Quarry, which located approximately 8.8 km to the northwest of the proposed development site. The Huntstown Quarry is operated by Roadstone Ltd. There will be no impact to mineral resources in the area as a result of the Proposed Development

8.3.7 Radon

According to the EPA (now incorporating the Radiological Protection Institute of Ireland) the proposed development site is located in a Very Low Radon Area where is it estimated that between 1% - 5% of dwellings will exceed the Reference Level of 200 Bq/m^3. This is the second lowest of the five radon categories which are assessed by the EPA.

8.3.8 Geohazards

Much of the Earth's surface is covered by unconsolidated sediments which can be especially prone to instability. Water often plays a key role in lubricating slope failure. Instability is often significantly increased by man's activities in building houses, roads, drainage and agricultural changes. Landslides, mud flows, bog bursts (in Ireland) and debris flows are a result. In general, Ireland suffers few landslides. Landslides are more common in unconsolidated material than in bedrock, and where the sea constantly erodes the material at the base of a cliff and leads to recession of the cliffs. Landslides have also occurred in Ireland in recent years in upland peat areas due to disturbance of peat associated with construction activities. There have been no recorded landslide events at the site.

The GSI landslide database was consulted and the nearest recorded landslide occurred c. 9.5 km to the south of the proposed development site, at the on ramp at Ballinteer Interchange on the M50 motorway (GSI Event ID: GSI_LS03-0053). While the exact date of this landslide event was not recorded, it is recorded as being caused by an *artificial slope at edge of carriageway on ramp*, which …*became unstable during heavy precipitation after a prolonged dry spell*. This event resulted in one lane of the carriageway being closed. There have been no recorded landslide events at the proposed development site. Due to the local topography and the underlying strata there is a negligible risk of a landslide event occurring at the site.

In Ireland, seismic activity is recorded by the Irish National Seismic Network operated by the Geophysics Section of the School of Cosmic Physics at the Dublin Institute for Advanced Studies (DIAS) which has been recording seismic events in Ireland since 1978. The station configuration has varied over the years. However, currently there are five permanent broadband seismic recording stations in Ireland operated by DIAS. The seismic data from the stations comes into DIAS in real-time and is studied for local and regional events. Records since 1980 show that the nearest seismic activity to the proposed location was in the Irish Sea (1.0 – 2.0 M_l magnitude) and ~80 km to the south in the Wicklow Mountains. There is a very low risk of seismic activity on the Proposed Development site. Therefore, there are no potential effects from geohazards.

There are no active volcanoes in Ireland so there is no risk from volcanic activity.

8.3.9 Land Take

The proposed development site is currently in use for port-related activities. The site is also zoned as lands currently used for Non-Core Activity for Future Redevelopment and Multi-Purpose Transit Storage. The proposed development will not result in land take (i.e. the removal of productive land from potential agricultural or other beneficial uses).

8.3.10 Summary & Type of Geological/Hydrogeological Environment

Based on the regional and site-specific information available the type of Geological/ Hydrogeological Environment as per the IGI Guidelines is:

Type A – Passive geological / hydrogeological environments

A summary of the site geology and hydrogeology is outlined thus:

- The Proposed Development site overlies an area of no aquifer classification (GSI, 2020)
- The proposes site and the area surrounding it was reclaimed from the Estuary in the early 1900s so is manmade.

8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

A detailed description of the Proposed Development is provided in Chapter 2 of this EIA Report. The activities associated with the Proposed Development which are relevant to the land, soils, geology and hydrogeological environment are detailed in Table 8.3.

Table 8.3 Site Activities Summary

Phase	Activity	Description
Construction	Earthworks: Excavation of Superficial Deposits	Minimal cut and fill will be required to facilitate construction of the proposed development. Some construction works will be required for office space etc. Excavation depths will be minimal. There will be no excavation of bedrock required as part of the Proposed Development Subsoil stripping and localised stockpiling of soil will be required during construction. It is estimated that approximately 32,208 m^3 of soils will be excavated to facilitate construction of the development. It is currently envisaged that majority of the excavated material will require removal offsite.
	Storage of hazardous Material	Bunded fuel storage and wet concrete during construction phase.

Phase	Activity	Description
	Import/Export of Materials	It is currently envisaged that majority of the excavated material (c. 32,208m^3) will require removal offsite. The removal of waste from the site will be carried out in accordance with Waste Regulations, Regional Waste Plan (Eastern Midland Region) and Waste Hierarchy/Circular Economy Principals. Refer to Chapter 15 Waste Management for further detail.
Operation	Storage of hazardous Material	Fuel oil storage (diesel) will only be required for back up generators c. 180 litres per site stored in fully contained belly tanks.

As outlined in Table 8.3 the activities required for the construction phase of the Proposed Development represents the greatest risk of potential impact on the geological environment. These activities primarily pertain to the site preparation, excavation, levelling and infilling activities required to facilitate construction of Proposed Development and ancillary services.

8.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

The potential geological and hydrogeological impacts during the construction and operations are presented below. Remediation and mitigation measures included in the design of this project to address these potential impacts are presented in section 8.6.

8.5.1 Construction Phase

The following potential effects to land soil and groundwater have been considered:

- Excavated and stripped soil can be disturbed and eroded by site vehicles during the construction. Rainfall and wind can also impact on non-vegetated/uncovered areas within the excavation or where soil is stockpiled. This can lead to run-off with high suspended solid content which can impact on water bodies. The potential risk from this indirect impact to water bodies and/or habitats from contaminated water would depend on the magnitude and duration of any water quality impact.
- As with all construction projects there is potential for water (rainfall and/or groundwater) to become contaminated with pollutants associated with construction activity. Contaminated water which arises from construction sites can pose a significant short-term risk to groundwater quality for the duration of the construction if contaminated water is allowed percolate to the aquifer. The potential main contaminants include:
  - Suspended solids (muddy water with increase turbidity) – arising from excavation and ground disturbance;
  - Cement/concrete (increase turbidity and pH) – arising from construction materials;
  - Hydrocarbons (ecotoxic) – accidental spillages from construction plant or onsite storage;
  - Wastewater (nutrient and microbial rich) – arising from poor on-site toilets and washrooms.

These potential impacts are not anticipated to occur following the implementation of mitigation measures outlined in section 8.6.1.

8.5.2 Operational Phase

The following risks have been considered in relation to the operational phase of the development:

- During the operational phase there is only a potential for localized leaks and spillages from back up generator belly tanks and spillages from vehicles along access roads, loading bays and in parking areas. Any accidental emissions of oil, petrol or diesel could cause soil/groundwater contamination if the emissions are unmitigated.

Groundwater abstraction or discharge to ground does not form part of the Proposed Development. There will be no impact on local or regional groundwater resources (abstraction) as a result of the Proposed Development. The proposed development will result in removal of contaminated soil and replacement with clean infill.

These potential impacts are not anticipated to occur following the implementation of mitigation measures outlined in section 8.6.2.

8.5.3 Do Nothing Scenario

Should the Proposed Development not take place, the land, soils, geological and hydrogeological environment would not be subject to changes with no soil removal. The site would remain in its current use as a site comprising of hard standing for port activities, until such time as a similar or alternative development consistent with the land use zoning is granted permission and constructed.

8.6 REMEDIAL AND MITIGATION MEASURES

This section describes a range of mitigation measures designed to avoid or reduce any potential adverse geological and hydrogeological impacts identified.

8.6.1 Construction Phase

In order to reduce impacts on the soils, geology and hydrogeological environment a number of mitigation measures will be adopted as part of the construction works on site. The measures will address the main activities of potential impact which include:

- Control of soil excavation and export from site;
- Sources of fill and aggregates for the Proposed Development;
- Fuel and chemical handling, transport and storage; and
- Control of water during construction.

Construction Environment Management Plan
In advance of work starting on site the works Contractor will author a Construction Methodology document taking into account their approach and any additional requirements of the Design Team or Planning Regulator.

An outline Construction Environmental Management Plan (CEMP) has been prepared by AWN Consulting for the Proposed Development and is included with the planning documentation. It is proposed that a detailed CEMP will be prepared and maintained by the appointed contractors during the construction phase of the proposed project to minimise the impact of all aspects of the construction works on the local environment. The CEMP will include emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction.

Control of Soil Excavation

Subsoil will be excavated to facilitate the construction of foundations, site levelling, expansion of drainage connections and other ancillary works. The Proposed Development will incorporate the reduce, reuse and recycle approach in terms of soil excavations on site. The construction will be carefully planned to ensure only material required to be excavated will be with as much material left in situ as possible. Excavation arisings will be reused on site where possible however it is envisioned that c. 32,208 m^3 will be exported from site.

Soil samples which are tested for waste classification have been assessed with reference to the landfill acceptance criteria specified in Council Decision 2003/33/EC. Full laboratory waste assessment criteria results are presented in Appendix 8.2. This criterion classifies the material into 3 No. waste categories as follows:

- Inert.
- Non-Hazardous and;
- Hazardous.

Onsite testing has shown the majority underlying subsurface material onsite can be categorized as Stable Non-Reactive as per WAC guidelines. Material Excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated from clean/inert soil. In the unlikely event that any potentially contaminated soils are encountered, they should be tested and classified as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication, HazWasteOnline tool or similar approved method. The material will then need to be classified as inert, non-hazardous, stable non-reactive hazardous or hazardous in accordance with *EC Decision 2003/33/EC*. It should then be removed from site by a suitably permitted waste contractor to an authorised waste facility.

Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated against through the implementation of an appropriate earthworks handling protocol during construction. It is anticipated that any stockpiles will be formed within the boundary of the site and there will be no direct link or pathway from this area to any surface water body.

Dust suppression measures (e.g. damping down during dry periods), vehicle wheel washes, road sweeping, and general housekeeping will ensure that the surrounding environment are free of nuisance dust and dirt on roads.

Export of Material from Site

It is envisioned that the majority of excavated material will be removed off-site either as a waste or, where appropriate, as a by-product. Where the material is to be reused on another site as a by-product (and not as a waste), this will be done in accordance with Article 27 of the *European Communities (Waste Directive) Regulations 2011*. EPA agreement will be obtained before re-using the spoil as a by-product. However, it is not currently anticipated that any excavated material will be removed offsite or imported onto the site for reuse as a by-product. Where material cannot be reused off site it will be sent for recovery or disposal at an appropriately authorised facility. Refer to Chapter 15 Waste Management for further detail.

Waste soils requiring removal from site will be classified by an experienced and qualified environmental professional to ensure that the waste soil is correctly classified for transportation and recovery/disposal offsite. Refer to Chapter 15 Waste Management for further relevant information.

Sources of Fill and Aggregates

All fill and aggregate for the Proposed Development will be sourced from reputable suppliers. All suppliers will be vetted for:

- Aggregate compliance certificates/declarations of conformity for the classes of material specified for the Proposed Development;
- Environmental Management status; and
- Regulatory and Legal Compliance status of the Company.

It is anticipated that approximately engineered fill will be required to facilitate construction. There will be no impact to mineral resources in the area as a result of the Proposed Development

Fuel and Chemical Handling

The following mitigation measures will be taken at the construction stage in order to prevent any spillages to ground of fuels and prevent any resulting soil and/or groundwater quality impacts:

- Designation of a bunded refuelling areas on the site;
- Provision of spill kit facilities across the site;
- Where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
    - The pump or valve will be fitted with a lock and will be secured when not in use;
    - All bowsers to carry a spill kit
    - Operatives must have spill response training; and
    - Drip trays used on any required mobile fuel units.

In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted:

- Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded area;
- Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage;
- All drums to be quality approved and manufactured to a recognised standard;
- If drums are to be moved around the site, they will be secured and on spill pallets; and
- Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment.

The aforementioned list of measures is non-exhaustive and will be included in the CEMP.

Control of Water During Construction

Run-off from excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation. Due to the very low permeability of the overburden and the relative shallow nature for foundation excavations, infiltration to the underlying aquifer is not anticipated.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. All run-off will be prevented from directly entering into any water courses/ drainage ditches.

Should any discharge of construction water be required during the construction phase, discharge will be to sewer under agreement with the regulator requirement permits. Pre-treatment and silt reduction measures on site will include a combination of silt fencing, settlement measures (silt traps, silt sacks and settlement tanks/ponds) and hydrocarbon interceptors. Active treatment systems such as Siltbusters or similar may be required depending on turbidity levels and discharge limits.

8.6.2 Operational Phase

During the operational phase of the Proposed Development site there is limited potential for site activities to impact on the geological and hydrogeological environment of the area. There will be no emissions to ground or the underlying aquifer from operational activities. There will be no impact on local or regional groundwater resources (abstraction) as a result of the Proposed Development.

Environmental Procedures
As detailed in Section 2.4.2 in Chapter 2, the operator implements an Environmental Safety and Health Management System at each of its facilities. Prior to operation of the Proposed Development, a comprehensive set of operational procedures will be established (based on those used at other similar facilities) which will include site-specific mitigation measures and emergency response measures.

Fuel Storage
The primary potential impact relates to a failure within the belly tank containment structure within the back-up generators.

In order to minimise any impact on the underlying subsurface strata from material spillages, the belly tanks are located in hardstand areas and are regularly checked in accordance with manufacturer requirements. Delivery of fuel will be undertaken following a documented procedure which minimises risk of spills and spill containment/clean-up kit shall be readily available on site. It is anticipated that the back-up generators will rarely be used.

Increase in hard stand
The proposed development site is currently under hardstand. The area of hardstanding on the proposed development site will be slightly increased as a result of the proposed development and will incorporate SuDs requirements. The proposed site drainage will include oil-petrol interceptors on each site which then flows to the Dublin Port separator before entering the Liffey Estuary/ Dublin Bay. Flow levels will be controlled by a hydro break or similar.

8.7 Predicted Impact of the Proposed Development

This section describes the predicted impact of the Proposed Development following the implementation of the remedial and mitigation measures.

8.7.1 Construction Phase

The implementation of mitigation measures outlined in Section 8.6.1 will ensure that the predicted impacts on the geological and hydrogeological environment do not occur during the construction phase and that the residual impact will be ***short-term-imperceptible-neutral**.* Following the NRA criteria for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered ***negligible**.*

8.7.2 Operational Phase

The implementation of mitigation measures highlighted in Section 8.6.2 will ensure that the predicted impacts on the geological and hydrogeological environment do not occur during the operational phase and that the residual impact will be ***long-term-imperceptible-neutral.*** Following the NRA criteria for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered ***negligible**.*

8.8 RESIDUAL IMPACTS

Based on the natural conditions present and with appropriate mitigation measures (see Section 8.6) to reduce the potential for any impact of accidental discharges to ground during this phase, the potential impact on land soils, geology and hydrogeology during construction (following EPA, 2017) are considered to have a ***short-term, imperceptible*** significance, with a ***neutral*** impact on quality.

There are no likely significant impacts on the land, geological or hydrogeological environment associated with the proposed operational development of the site with mitigation in place. As such the impact is considered to have a ***long-term, imperceptible*** significance with a ***neutral*** impact on quality i.e. no effects of effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.

Following the NRA criteria for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered ***negligible*** for the construction and operational phases.

8.9 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact of the proposed development with including other Brexit related developments at the nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 8.9.1 and 8.9.2 below.

8.9.1 Construction Phase

The potential for impact on land, soils and groundwater during construction primarily arises from accidental leaks and spills to ground or dewatering. The proposed development does not require dewatering and with standard mitigation in place (as outlined in Section 7.5) for management of accidental discharges, the effect due to construction in this area is considered to be a ***neutral*** on quality and an ***imperceptible*** significance. Contractors for the proposed development will be contractually required to operate in compliance with a CEMP which will include the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect soil and water quality in compliance with legislative standards for receiving water quality. As a result, there will be no cumulative potential for change in soil quality or the natural groundwater regime. The cumulative impact is considered to be ***neutral*** *and* ***imperceptible***.

8.9.2 Operational Phase

Overall, there will be no local change in recharge pattern due to these proposed and planned developments. As such, based on the overall size of the underlying aquifer and measures to protect soil and water quality there will be no overall change on the groundwater body status. The operation of the proposed development is concluded to have a ***long-term, imperceptible*** significance *with a* ***neutral*** impact on soil and water quality.

The proposed development includes measures to protect against any accidental discharges to ground e.g. adequate containment measures for oil storage, use of hardstand in loading areas and drainage through oil interceptors. As such the impact will be ***neutral*** and ***imperceptible*** in relation to soil and water. All developments will be required to manage sites in compliance with legislative standards for receiving water quality. Therefore, the cumulative impact is concluded to be ***neutral*** and ***imperceptible*** in relation to soil and water.

Overall, the use of the land will be in line with current activities on the proposed development site, which is in line with the zoning of the area, and therefore the cumulative impact on land is considered to be ***neutral*** and ***imperceptible****.*

8.10 REFERENCES

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APPENDIX 8.1

NRA CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE

NATIONAL ROADS AUTHORITY (NRA, 2009)

Table 1 Criteria for rating site importance of Geological Features (NRA, 2009)

Magnitude of Impact	**Criteria**	**Typical Example**
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or high fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

Table 2 Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on soil / geology attribute (NRA, 2009)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

Table 3 Criteria for rating Site Attributes - Estimation of Importance of Hydrogeology Attributes (NRA, 2009)

Magnitude of Impact	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple well fields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source

High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

Table 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeology Attribute (NRA, 2009)

Magnitude of Impact	**Criteria**	**Typical Examples**
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of

		pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

Table 5: Rating of Significant Environmental Impacts at EIS Stage (NRA, 2009)

Importance of Attribute	**Magnitude of Importance**			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

APPENDIX 8.2

SITE GEOTECHNICAL REPORT & LABORATORY RESULTS

Priority Geotechnical Ireland (2019)

Our Ref: JMS/Rp/P19232 (*.pdf)

09th December, 2019

Messrs. The Office of Public Works
Civil & Structural Engineering Services,
52 St Stephens Green,
Dublin 2.

Re: Stage 1 – Geotechnical Investigation at Dublin Port – Factual report.

Introduction

In November 2019, Priority Geotechnical were requested by The Office of Public Works (OPW) to undertake an investigation as part of the Dublin Port – Stage 1 Preliminary Geotechnical Investigation, Dublin.

Objectives

The purpose of this investigation is to provide suitable geotechnical and environmental data in order to inform the engineering design solutions for potential future development.

Scope

The scope of the ground investigation, which was specified by the OPW, comprised of the following:

- 02Nr. Rotary boreholes;
- 12Nr. Trial pits;
- All associated sampling;
- Laboratory testing and
- All associated reporting.

This report presents a summary of the factual records, data obtained with regard to the geotechnical investigation at Dublin Port. This report should be read in conjunction with the exploratory logs and laboratory test data accompanying this factual report.

Site Works

This investigation was carried out in accordance with the contract specification: Specification and Related Documents for Ground Investigation in Ireland (Engineers Ireland, October 2006), Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests.

The investigation fieldworks were undertaken between the 14th and the 21st November, 2019 under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this factual report.

Rotary Boreholes

Three (03) rotary boreholes were advanced to depths 2.2m below existing ground level (bgl) to 21.0m bgl using PGL's Deltabase 500 7t rotary rig. The exploratory records are attached, herein.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC01	2.2	20/11/2019
RC01A	21.0	20/11/2019
RC02	20.0	21/11/2019

Trial Pits

Twelve (12) trial pit excavations were dug to depths 0.5m bgl to 3.0m bgl using a JCB Back-hoe excavator. The exploratory records are attached, herein.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP01A	2.6	15/11/2019
TP01B	0.7	15/11/2019
TP02	0.7	14/11/2019
TP03	2.4	14/11/2019
TP04	1.9	14/11/2019

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP05	3.0	15/11/2019
TP07	2.3	15/11/2019
TP08	0.5	15/11/2019
TP09	0.5	15/11/2019
TP09A	0.5	15/11/2019
TP10	2.3	14/11/2019
TP11	3.0	14/11/2019

Sampling

Nineteen (19) environmental samples (ENV) were taken between 0.5m bgl and 2.0m bgl at trial pit locations. These were placed immediately in air-tight containers, which were filled to the top of the sample container. The sample suite consisted of: 2No. small disturbed samples (D) not less than 1.0kg, 2No. 250g amber glass sample containers and 2No. 60g amber glass sample containers.

The preparation for and methods of taking environmental samples, together with their size, preservation and handling was in accordance with British Standard BS 5930: 1981- Code of Practice for Site investigation, the contract documents and the Association of Geotechnical and Geoenvironmental Specialists (AGS) guide to environmental sampling, September 2010.

Survey and Drawings

The 'as built' survey data will be presented at a later date.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC01	-	-	-	2.2	20/11/2019
RC01A	-	-	-	21.0	20/11/2019
RC02	-	-	-	20.0	21/11/2019
TP01A	-	-	-	2.6	15/11/2019
TP01B	-	-	-	0.7	15/11/2019
TP02	-	-	-	0.7	14/11/2019
TP03	-	-	-	2.4	14/11/2019
TP04	-	-	-	1.9	14/11/2019
TP05	-	-	-	3.0	15/11/2019
TP07	-	-	-	2.3	15/11/2019
TP08	-	-	-	0.5	15/11/2019
TP09	-	-	-	0.5	15/11/2019

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP09A	-	-	-	0.5	15/11/2019
TP10	-	-	-	2.3	14/11/2019
TP11	-	-	-	3.0	14/11/2019

Laboratory Testing

Laboratory testing was scheduled by the OPW and carried out by Chemtest Ltd. (UK) on behalf of PGL in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and the ISRM suggested methods for rock characterisation, testing and monitoring.

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outline above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

The laboratory data is attached and summarised as follows;

SUMMARY OF LABORATORY TESTING

Type	Nr.	Remarks
Environmental Suite D	19	See attached results
Environmental Suite E	19	See attached results
Environmental Suite H	19	See attached results

Published Geology

The geology of the study area (GSI 1:100,000 mapping Sheet 16) is characterised by the Lucan Formation (LU), described as dark Limestone & Shale Calp.

Teagasc subsoil mapping indicates that the area is underlain by Made Ground deposits. The national groundwater vulnerability mapping indicated the area is of low vulnerability.

Ground Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002)– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the site investigation.

Groundwater conditions

Groundwater is recorded when encountered during boring over a period of 20 minutes, noting any changes that may occur.

Groundwater conditions observed in the excavations are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or tidal variations etc.

Groundwater was encountered between 4.5m bgl and 16.5m bgl during the period of works. The groundwater regime should be assessed from monitoring standpipes where available.

Excavations were backfilled with gravel, bentonite and arisings.

▨ ARISINGS Backfill

Should you have any queries in relation to the data presented, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**

S McSweeney

James McSweeney BSc
Engineering Geologist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations. Where additional information becomes available any assessment may be subject to review and change.

This report has been prepared for the employer Ireland and their Representative(s) as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60° cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

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Key Sheet

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** AK **Logged By:**		Borehole No. **RC01** Sheet 1 of 1
Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**	**Hole Type** Rotary cored
Location: Dublin		**Level:**	**Scale** 1:50
Client: Office of Public Works (OPW)		**Dates:** 20/11/2019 20/11/2019	

Well	**Water Strike (m)**	**Depth (m)**	**Type /Fs (min, max, avg)**	**Coring (%)** TCR	SCR	RQD	**Depth (m) / FI (/m)**	**Level (mOD)**	**Legend**	**Stratum Description**	
▨							1.50		▨	Open hole boring. Driller described: (MADE GROUND) 'Dry' gravelly Clay.	1
▨							2.20		▨	Open hole boring. Driller described: (MADE GROUND) Steel obstruction.	2
										End of Borehole at 2.200m	3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.20	131	131

Equipment:	Deltabase 520
Method:	Compressed air

Remarks:

Borehole terminated at 2.20m bgl due to steel obstruction. Borehole relocated to RC01A.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
Dry	20/11/2019 08:00	0.00	Start of shift.
	20/11/2019 18:00	2.20	End of borehole.

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Drilled By:	AK	**Borehole No.**	**RC01A**
Logged By:			Sheet 1 of 3
Project Name:	Stage 1 - Dublin Port SI	**Project No.**	P19232
Co-ords:		**Hole Type**	Rotary cored
Location:	Dublin	**Level:**	
Scale	1:50		
Client:	Office of Public Works (OPW)	**Dates:**	20/11/2019 – 20/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
							3.00		▩	Open hole boring. Driller described: (MADE GROUND) Gravel with cobble content.
	▼						4.50		▩	Open hole boring. Driller described: (MADE GROUND) Gravel with rubber tyre inclusions.
							6.00		▤	Open hole boring. Driller described: White, Clay.
							7.50		▤	Open hole boring. Driller described: 'Wet' gravelly Clay.
	▼						9.00		▤	Open hole boring. Driller described: Grey, gravelly Clay.

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50 9.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
21.00	102	131

Equipment:	Deltabase 520
Method:	Compressed air

Remarks:

Borehole terminated at 21.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
4.5	20/11/2019 08:00 20/11/2019 18:00	0.00 21.00	Start of shift. End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** AK **Logged By:**	Borehole No. **RC01A** Sheet 2 of 3
Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**	**Hole Type** Rotary cored
Location: Dublin		**Level:**	**Scale** 1:50
Client: Office of Public Works (OPW)		**Dates:** 20/11/2019 20/11/2019	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
▨							10.50			Open hole boring. Driller described: Silty Gravel.	10
▨	▼						16.50			Open hole boring. Driller described: Clay.	11 12 13 14 15 16
▨							17.60			Open hole boring. Driller described: Gravel/ Weathered Rock.	17
▨										Down the hole hammer. Driller described: Limestone.	18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50				See shift data.
9.00				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
21.00	102	131

Equipment: Deltabase 520

Method: Compressed air

Remarks:

Borehole terminated at 21.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/11/2019 08:00	0.00	Start of shift.
4.5	20/11/2019 18:00	21.00	End of borehole.

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Drilled By:	Borehole No.
AK	**RC01A**
Logged By:	Sheet 3 of 3

Project Name:	Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**	**Hole Type** Rotary cored
Location:	Dublin		**Level:**	**Scale** 1:50
Client:	Office of Public Works (OPW)		**Dates:**	20/11/2019 20/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
▨									▨	Down the hole hammer. Driller described: Limestone.	19 20
							21.00			End of Borehole at 21.000m	21 22 23 24 25 26 27

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50 9.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
21.00	102	131

Equipment:	Deltabase 520
Method:	Compressed air

Remarks:

Borehole terminated at 21.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/11/2019 08:00	0.00	Start of shift.
4.5	20/11/2019 18:00	21.00	End of borehole.

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Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**	**Hole Type** Rotary cored
Location: Dublin		**Level:**	**Scale** 1:50
Client: Office of Public Works (OPW)		**Dates:** 21/11/2019	22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
▨							1.50		▨	Open hole boring. Driller described: (MADE GROUND) Gravel.
▨							3.00		▨	Open hole boring. Driller described: (MADE GROUND) Gravely Clay.
▨	▼						4.50		▨	Open hole boring. Driller described: (MADE GROUND) Gravely Sand with timber inclusions.
▨							6.00		▨	Open hole boring. Driller described: (MADE GROUND) Gravelly Clay with timber inclusions.
▨							7.50		▨	Open hole boring. Driller described: (MADE GROUND) Sandy Clay with strong odour.
▨									▨	Open hole boring. Driller described: Sandy clayey Gravel.

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50 11.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
20.00	76	131

Equipment: Deltabase 520

Method: Compressed air

Remarks:

Borehole terminated at 20.00m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	21/11/2019 08:00	0.00	Start of shift.
4.5	21/11/2019 18:00	16.70	End of shift.
4.0	22/11/2019 08:00	16.70	Start of shift.
4.0	22/11/2019 18:00	20.00	End of borehole.

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Drilled By:	AK
Logged By:	OD
Borehole No.	**RC02**
	Sheet 2 of 3

Project Name:	Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**		**Hole Type** Rotary cored
Location:	Dublin		**Level:**		**Scale** 1:50
Client:	Office of Public Works (OPW)		**Dates:**	21/11/2019	22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
							10.50			Open hole boring. Driller described: Sandy clayey Gravel.
	▼						14.25			Open hole boring. Driller described: Silty Gravel.
							15.00			Open hole boring. Driller described: Sandy clayey Gravel.
	▼						16.70			Open hole boring. Driller described: Sandy Silty Gravel.
										Down the hole hammer. Driller described: Bedrock. Assumed Limestone lithology. High volume of water noted.

Depth scale: 10, 11, 12, 13, 14, 15, 16, 17, 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50 11.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
20.00	76	131

Equipment:	Deltabase 520
Method:	Compressed air

Remarks:

Borehole terminated at 20.00m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	21/11/2019 08:00	0.00	Start of shift.
4.5	21/11/2019 18:00	16.70	End of shift.
4.0	22/11/2019 08:00	16.70	Start of shift.
4.0	22/11/2019 18:00	20.00	End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** AK **Logged By:** OD	Borehole No. **RC02** Sheet 3 of 3

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:**	**Hole Type** Rotary cored
Location: Dublin		**Level:**	**Scale** 1:50
Client: Office of Public Works (OPW)		**Dates:** 21/11/2019	22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
▨							20.00			Down the hole hammer. Driller described: Bedrock. Assumed Limestone lithology. High volume of water noted.	19 20
										End of Borehole at 20.000m	21 22 23 24 25 26 27

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.50 11.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
20.00	76	131

Equipment:	Deltabase 520
Method:	Compressed air

Remarks:

Borehole terminated at 20.00m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	21/11/2019 08:00	0.00	Start of shift.
4.5	21/11/2019 18:00	16.70	End of shift.
4.0	22/11/2019 08:00	16.70	Start of shift.
4.0	22/11/2019 18:00	20.00	End of borehole.

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Trial Pit No
TP01A
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:** **Level:**	**Date** 15/11/2019
Location: Dublin		**Dimensions (m):** 3.10 × 0.70	**Scale** 1:25
Client: Office of Public Works (OPW)		**Depth:** 2.60m BGL	**Logged** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.15		▨	(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
▨	0.50	ENV				▨	(MADE GROUND) Brown, very silty sandy GRAVEL with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 600mm dia, sub-angular to sub-rounded.
▨	2.00	ENV				▨	
				2.60			End of Pit at 2.600m

Stability: Poor
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.60m bgl due to large boulders.

Photographic Record

Number:	**TP01A**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP01A**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

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Trial Pit No
TP01B
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:** **Level:**	**Date** 15/11/2019
Location: Dublin		**Dimensions (m):** 5.00 × 0.70	**Scale** 1:25
Client: Office of Public Works (OPW)		**Depth:** 0.70m BGL	**Logged** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.20		▨	(MADE GROUND) Grey, sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
▨				0.25		▨	(MADE GROUND) Brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
▨	0.50	ENV		0.70		▨	(MADE GROUND) Grey, silty sandy GRAVEL with low cobble content and low boulder content with fill (red brick, concrete, metal sheets, cables). Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded.
							Very hard strata - Concrete.
							End of Pit at 0.700m

1
2
3
4
5

Stability: Moderate
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 0.70m bgl, refusal on concrete.

Photographic Record

Number:	**TP01B**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP01B**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP02
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:** **Level:**	**Date** 14/11/2019
Location: Dublin	**Dimensions (m):** 3.30 × 0.70		**Scale** 1:25
Client: Office of Public Works (OPW)	**Depth:** 0.70m BGL		**Logged** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.10		▨	(MADE GROUND) Grey, slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
▨	0.50	ENV		0.70		▨	(MADE GROUND) Grey brown, sandy very silty GRAVEL with red brick, concrete, plastic inclusions.
							Concrete obstruction.
							End of Pit at 0.700m

1
2
3
4
5

Stability: Moderate.
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 0.70m bgl due to concrete. Pit extended at right angle for 2.00m in attempt to avoid concrete., still present.

Photographic Record

Number:	**TP02**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Number:	**TP02**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

Trial Pit No
TP03
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI

Project No. P19232

Co-ords:

Level:

Date 14/11/2019

Location: Dublin

Dimensions (m): 3.20 × 0.80

Scale 1:25

Client: Office of Public Works (OPW)

Depth: 2.40m BGL

Logged PH

Water Strike & Backfill	Samples & In Situ Testing Depth (m)	Samples & In Situ Testing Type	Samples & In Situ Testing Results	Depth (m)	Level (m OD)	Legend	Stratum Description
▨				0.15		▩	Bituminous surfacing.
▨				0.30		▩	(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
▨	0.50 2.00	ENV ENV		2.40		▩	(MADE GROUND) Brown grey, sandy very silty GRAVEL with low cobble content and red brick, concrete and re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
							End of Pit at 2.400m

Stability: Moderate
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.40m bgl due to obstruction, possible concrete.

Photographic Record

Number:	**TP03**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP03**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP04
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI

Project No. P19232

Co-ords:

Level:

Date 14/11/2019

Location: Dublin

Dimensions (m):

Scale 1:25

Client: Office of Public Works (OPW)

Depth: 1.90m BGL

Logged PH

Water Strike & Backfill	**Samples & In Situ Testing**			**Depth (m)**	**Level (m OD)**	**Legend**	**Stratum Description**
	Depth (m)	**Type**	**Results**				
▨				0.20		▩	Bituminous surfacing.
▨	0.50	ENV				▨	(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content and red brick, concrete, re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
	1.90	ENV		1.90			End of Pit at 1.900m

Stability:
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 1.90m bgl due to concrete blocks.

Photographic Record

Number:	**TP04**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP04**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

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Trial Pit No
TP05
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI
Project No. P19232
Co-ords:
Level:
Date 15/11/2019
Location: Dublin
Dimensions (m): 3.30 0.70
Scale 1:25
Client: Office of Public Works (OPW)
Depth: 3.00m BGL
Logged PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.10		▨	(MADE GROUND) Grey, clayey GRAVEL. Gravel is fine to coarse.
▨	0.50	ENV				▨	(MADE GROUND) Grey, silty sandy GRAVEL with low cobble content, low boulder content and plastic, red brick inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded.
▨	2.00	ENV				▨	
				3.00			End of Pit at 3.000m

Stability: Moderate
Plant: JCB
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 3.00m bgl, required depth.

Photographic Record

Number:	**TP05**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP05**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

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Trial Pit No
TP07
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:** **Level:**	**Date** 15/11/2019
Location: Dublin		**Dimensions (m):** 3.20 × 0.70	**Scale** 1:25
Client: Office of Public Works (OPW)		**Depth:** 2.30m BGL	**Logged** PH

Water Strike & Backfill	**Samples & In Situ Testing**			**Depth (m)**	**Level (m OD)**	**Legend**	**Stratum Description**
	Depth (m)	**Type**	**Results**				
▨				0.20		▨	(MADE GROUND) Grey, slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
▨	0.50	ENV		1.00		▨	(MADE GROUND) Grey, sandy very silty GRAVEL with plastic, red brick, timber and iron bar inclusions. *0.20m to 1.00m: Engineer noted 'damp' layer.*
▨	2.00	ENV		2.30		▨	(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content, low boulder content and red brick, concrete blocks, steel, cables and plastic. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded.
							End of Pit at 2.300m

Stability: Very poor
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl due to obstruction of concrete blocks.

Number:	**TP07**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP07**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP08
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI
Project No. P19232
Co-ords:
Level:
Date 15/11/2019
Location: Dublin
Dimensions (m): 0.40 × 0.30
Depth: 0.50m BGL
Scale 1:25
Client: Office of Public Works (OPW)
Logged PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.20			(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
	0.50	ENV		0.50			(MADE GROUND) Grey brown, sandy very silty GRAVEL with low cobble content and red brick inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
							End of Pit at 0.500m

1
2
3
4
5

Stability: Moderate
Plant: Hand dug
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 0.50m bgl, required depth.

Photographic Record

Number:	**TP08**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP08**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP09
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI

Project No. P19232

Co-ords:

Level:

Date 15/11/2019

Location: Dublin

Dimensions (m): 0.40 × 0.30

Scale 1:25

Client: Office of Public Works (OPW)

Depth: 0.50m BGL

Logged PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	**Type**	**Results**				
▨				0.20		▨	(MADE GROUND) Grey, sandy GRAVEL.
▨	0.50	ENV		0.50		▨	(MADE GROUND) Grey brown, silty sandy GRAVEL with low cobble content and red brick inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
							End of Pit at 0.500m

Depth scale: 1, 2, 3, 4, 5

Stability: Moderate
Plant: Hand dug
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 0.50m bgl, required depth.

Photographic Record

Number:	**TP09**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

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Trial Pit No
TP09A
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI

Project No. P19232

Co-ords:

Level:

Date 15/11/2019

Location: Dublin

Dimensions (m): 0.40 × 0.40

Scale 1:25

Client: Office of Public Works (OPW)

Depth: 0.50m BGL

Logged PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	**Type**	**Results**				
▨				0.15		▨	(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
▨	0.50	ENV		0.50		▨	(MADE GROUND) Grey, sandy GRAVEL with low cobble content and red brick, concrete inclusions. Sand is fine to coarse. gravel is fine to coarse, angular to sub-angular. Cobbles are 63mm to 200mm dia, angular to sub-angular.
							End of Pit at 0.500m

1
2
3
4
5

Stability: Moderate
Plant: Hand dug
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 0.50m bgl, required depth.

Photographic Record

Number:	**TP09A**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP09A**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP10
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	**Project No.** P19232	**Co-ords:** **Level:**	**Date** 14/11/2019
Location: Dublin		**Dimensions (m):** 2.60 × 0.70	**Scale** 1:25
Client: Office of Public Works (OPW)		**Depth:** 2.30m BGL	**Logged** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.20		▩	Bituminous surfacing.
▨	0.50	ENV				▩	(MADE GROUND) Brown, slightly sandy gravelly SILT with red brick, glass, timber, concrete and re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
▨	2.00	ENV		2.30		▩	
							End of Pit at 2.300m

Stability: Very poor
Plant: JCB
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl due to instability.

Photographic Record

Number:	**TP10**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

Photographic Record

Number:	**TP10**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

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Trial Pit No
TP11
Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI
Project No. P19232
Co-ords:
Level:
Date 14/11/2019
Location: Dublin
Dimensions (m): 3.30 × 0.70
Scale 1:25
Client: Office of Public Works (OPW)
Depth: 3.00m BGL
Logged PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.30		▨	(MADE GROUND) Grey, slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fin to coarse, angular to sub-rounded.
▨	0.50	ENV		0.80		▨	(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content and red brick. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded.
▨	2.00	ENV		3.00		▨	(MADE GROUND) Brown, slightly gravelly very clayey SAND with red brick, concrete and re-bar inclusions.
							End of Pit at 3.000m

Stability: Poor
Plant: JCB
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 3.00m bgl, required depth.

Photographic Record

Number:	**TP11**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW

Photographic Record

Number:	**TP11**	**Project** **Project No** **Client**	Dublin Port OPW P19232 OPW	

KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO_3	% - Total Sulphate Content (acid soluble)	
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Yb	Bulk Density	
Yd	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ_3	Cell Pressure	
σ_1-σ_3	Deviator Stress	
c	Cohesion	
c_	Effective Cohesion Intercept	
ϕ	Angle of Shearing Resistance - Degrees	
ϕ_	Effective Angle of Shearing Resistance	
εf	Strain at Failure	
*	Failed under 1st Load	
**	Failed under 2nd Load	
#	Untestable	
##	Excessive Strain	
p_o	Effective Overburden Pressure	
m_v	Coefficient of Volume Decrease	
c_v	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	

Key sheet

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TESTING
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The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-38616-1		
Initial Date of Issue:	02-Dec-2019		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P19232 Dublin port OPW		
Quotation No.:	Q17-09116	**Date Received:**	18-Nov-2019
Order No.:	12334	**Date Instructed:**	19-Nov-2019
No. of Samples:	19		
Turnaround (Wkdays):	7	**Results Due:**	27-Nov-2019
Date Approved:	02-Dec-2019		
Approved By:			
Details:	Glynn Harvey, Laboratory Manager		

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	**Chemtest Sample ID.:**				927205	927206	927207	927208	927209	927210	927211	927212	927213
Order No.: 12334	Client Sample Ref.:				ENV.1	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2
	Sample Location:				TP02	TP03	TP03	TP10	TP10	TP11	TP11	TP04	TP04
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	0.50	2.00	0.50	2.00	0.50	2.00	0.50	1.90
	Date Sampled ($):				14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	5.7	10	13	15	12	9.4	14	6.1	13
pH	U	2010		N/A	8.4	11.0	10.7	8.6	9.3	8.8	8.1	9.7	10.2
pH (2.5:1)	N	2010		N/A	8.5	10.8	10.3	8.6	9.4	8.9	8.2	9.6	10.2
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.015	< 0.010	< 0.010	< 0.010	0.018	< 0.010	0.013	< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.34	0.72	1.3	0.21	1.1	0.13	0.91	0.63	1.2
Total Sulphur	U	2175	%	0.010	0.20	0.26	0.52	0.23	0.30	0.13	0.30	0.30	0.40
Chloride (Water Soluble)	U	2220	g/l	0.010	0.068	0.064	0.015	0.011	0.026	0.020	0.049	0.030	0.043
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	1.3	< 0.50	3.0	< 0.50	< 0.50	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.13	0.54	0.99	0.15	0.48	0.097	0.70	0.32	0.73
Arsenic	U	2450	mg/kg	1.0	37	27	26	45	29	32	13	27	26
Boron	N	2450	mg/kg	0.40	4.0	6.7	5.8	8.5	8.0	4.4	3.8	6.9	9.8
Cadmium	U	2450	mg/kg	0.10	0.72	0.85	1.2	1.9	1.2	1.1	0.30	1.0	1.4
Chromium	U	2450	mg/kg	1.0	32	20	28	33	23	16	13	18	26
Copper	U	2450	mg/kg	0.50	53	43	63	160	60	45	13	54	56
Mercury	U	2450	mg/kg	0.10	0.30	0.82	3.9	1.6	1.3	0.56	0.18	0.47	1.1
Nickel	U	2450	mg/kg	0.50	37	28	38	43	37	33	17	30	37
Lead	U	2450	mg/kg	0.50	180	170	1100	660	380	300	38	210	490
Zinc	U	2450	mg/kg	0.50	160	190	300	600	290	180	43	150	260
Organic Matter	U	2625	%	0.40	3.8	2.2	4.0	7.6	4.7	2.4	0.84	3.5	5.5
Total TPH >C6-C40	U	2670	mg/kg	10	580	170	340	140	160	120	< 10	230	160
Naphthalene	U	2700	mg/kg	0.10	< 0.10	2.4	1.8	0.72	0.33	0.29	< 0.10	0.90	0.17
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	1.0	1.2	1.7	1.0	0.60	< 0.10	0.88	0.24
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	1.3	0.47	0.64	0.41	0.69	< 0.10	0.21	0.45
Fluorene	U	2700	mg/kg	0.10	< 0.10	4.7	0.52	2.8	2.2	0.16	< 0.10	0.91	0.56
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	3.3	0.95	2.6	3.3	0.80	< 0.10	6.6	3.9
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.81	0.12	0.62	0.75	0.21	< 0.10	2.2	0.69
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	3.4	1.1	4.1	5.1	1.3	< 0.10	8.4	6.0
Pyrene	U	2700	mg/kg	0.10	< 0.10	4.8	2.1	5.7	6.6	2.4	< 0.10	8.1	6.2
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	1.3	0.41	2.3	2.5	< 0.10	< 0.10	3.7	3.0
Chrysene	U	2700	mg/kg	0.10	< 0.10	2.1	0.97	3.3	3.5	< 0.10	< 0.10	4.6	3.7
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	2.6	< 0.10	5.5	4.1	< 0.10	< 0.10	3.9	3.5
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	0.60	< 0.10	1.3	1.2	< 0.10	< 0.10	1.4	1.4
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	1.6	< 0.10	2.7	2.5	0.13	< 0.10	3.3	3.1

Chemtest
The right chemistry to deliver results

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	**Chemtest Sample ID.:**				927205	927206	927207	927208	927209	927210	927211	927212	927213
Order No.: 12334	Client Sample Ref.:				ENV.1	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2
	Sample Location:				TP02	TP03	TP03	TP10	TP10	TP11	TP11	TP04	TP04
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	0.50	2.00	0.50	2.00	0.50	2.00	0.50	1.90
	Date Sampled ($):				14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	0.78	< 0.10	1.9	1.7	< 0.10	< 0.10	2.0	1.9
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.7	0.92	18	< 0.10	0.80	0.90
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	1.7	< 0.10	2.0	1.9	23	< 0.10	2.1	2.1
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	32	9.6	40	38	48	< 2.0	50	38
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	**Chemtest Sample ID.:**				927214	927215	927216	927217	927218	927219	927220	927221	927222
Order No.: 12334	Client Sample Ref.:				ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1
	Sample Location:				TP05	TP05	TP08	TP07	TP07	TP9A	TP1A	TP1A	TP1B
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	2.00	0.50	0.50	2.00	0.50	0.50	2.00	0.50
	Date Sampled ($):				15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	5.7	12	7.9	7.5	11	6.6	14	24	9.1
pH	U	2010		N/A	8.7	8.1	9.6	9.8	10.4	9.0	8.5	8.1	8.2
pH (2.5:1)	N	2010		N/A	8.8	8.1	9.5	9.8	10.4	9.0	8.6	8.1	8.2
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.010	0.026	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.034	0.017
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.39	1.4	0.91	0.30	0.36	0.12	0.10	1.6	1.4
Total Sulphur	U	2175	%	0.010	0.25	1.8	0.40	0.25	0.18	0.17	0.11	0.56	0.52
Chloride (Water Soluble)	U	2220	g/l	0.010	0.010	0.021	0.019	0.014	0.038	< 0.010	< 0.010	0.059	0.022
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.5	1.8	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.13	7.7	0.48	0.19	0.24	0.11	0.091	0.36	0.60
Arsenic	U	2450	mg/kg	1.0	39	22	35	32	35	38	69	32	30
Boron	N	2450	mg/kg	0.40	2.8	7.4	6.9	5.9	9.5	2.8	5.6	13	4.8
Cadmium	U	2450	mg/kg	0.10	0.94	1.0	1.6	0.92	3.2	1.0	1.5	1.5	1.2
Chromium	U	2450	mg/kg	1.0	11	19	25	17	29	14	33	52	11
Copper	U	2450	mg/kg	0.50	28	46	130	62	360	33	110	150	140
Mercury	U	2450	mg/kg	0.10	0.25	0.87	0.95	0.49	1.3	0.27	0.78	1.3	0.48
Nickel	U	2450	mg/kg	0.50	24	31	47	38	56	24	48	45	18
Lead	U	2450	mg/kg	0.50	120	310	450	210	690	150	700	920	270
Zinc	U	2450	mg/kg	0.50	140	220	370	170	990	170	500	650	290
Organic Matter	U	2625	%	0.40	2.8	4.1	4.5	3.6	4.5	2.4	5.3	14	3.8
Total TPH >C6-C40	U	2670	mg/kg	10	140	160	320	420	360	230	290	310	740
Naphthalene	U	2700	mg/kg	0.10	< 0.10	0.32	0.44	0.42	0.42	0.31	0.95	3.4	1.1
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	0.34	0.31	0.30	0.27	0.23	1.0	0.60	0.90
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	0.84	0.39	0.42	< 0.10	0.28	0.24	1.2	1.2
Fluorene	U	2700	mg/kg	0.10	< 0.10	0.43	0.34	0.27	0.22	0.27	1.4	1.3	1.7
Phenanthrene	U	2700	mg/kg	0.10	0.66	1.8	2.4	1.5	2.3	2.5	6.3	4.6	7.3
Anthracene	U	2700	mg/kg	0.10	0.22	0.45	0.62	0.50	0.65	0.62	1.8	2.4	2.8
Fluoranthene	U	2700	mg/kg	0.10	1.6	2.8	5.0	3.4	4.1	3.0	10	8.5	15
Pyrene	U	2700	mg/kg	0.10	1.7	2.7	4.9	3.9	4.7	2.8	12	8.4	16
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.62	1.1	2.3	1.5	2.3	1.1	5.9	3.5	7.6
Chrysene	U	2700	mg/kg	0.10	0.70	1.4	3.0	1.9	2.9	1.5	7.6	4.0	8.0
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	1.2	1.4	3.1	2.8	3.1	1.3	8.7	2.7	9.0
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.47	0.54	1.2	1.1	1.4	0.45	3.1	2.3	3.1
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.3	1.4	2.9	2.4	3.0	1.3	7.0	5.1	7.9

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	**Chemtest Sample ID.:**				927214	927215	927216	927217	927218	927219	927220	927221	927222
Order No.: 12334	Client Sample Ref.:				ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1
	Sample Location:				TP05	TP05	TP08	TP07	TP07	TP9A	TP1A	TP1A	TP1B
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	2.00	0.50	0.50	2.00	0.50	0.50	2.00	0.50
	Date Sampled ($):				15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.76	0.87	1.9	1.8	3.0	1.3	4.7	3.1	4.3
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.57	0.69	1.1	0.81	2.4	1.4	2.2	2.1	3.5
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	0.99	0.94	2.2	1.9	3.3	1.3	5.2	3.9	5.5
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	11	18	32	25	34	20	78	57	95
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	19-38616
Quotation No.: Q17-09116				**Chemtest Sample ID.:**	927223
Order No.: 12334				Client Sample Ref.:	ENV.1
				Sample Location:	TP09
				Sample Type:	SOIL
				Top Depth (m):	0.50
				Date Sampled ($):	15-Nov-2019
				Asbestos Lab:	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	9.3
pH	U	2010		N/A	8.5
pH (2.5:1)	N	2010		N/A	8.6
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.015
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.81
Total Sulphur	U	2175	%	0.010	0.30
Chloride (Water Soluble)	U	2220	g/l	0.010	0.052
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.39
Arsenic	U	2450	mg/kg	1.0	27
Boron	N	2450	mg/kg	0.40	5.0
Cadmium	U	2450	mg/kg	0.10	1.0
Chromium	U	2450	mg/kg	1.0	15
Copper	U	2450	mg/kg	0.50	52
Mercury	U	2450	mg/kg	0.10	0.44
Nickel	U	2450	mg/kg	0.50	27
Lead	U	2450	mg/kg	0.50	250
Zinc	U	2450	mg/kg	0.50	190
Organic Matter	U	2625	%	0.40	2.6
Total TPH >C6-C40	U	2670	mg/kg	10	830
Naphthalene	U	2700	mg/kg	0.10	0.10
Acenaphthylene	U	2700	mg/kg	0.10	0.74
Acenaphthene	U	2700	mg/kg	0.10	0.19
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	1.1
Anthracene	U	2700	mg/kg	0.10	0.42
Fluoranthene	U	2700	mg/kg	0.10	3.0
Pyrene	U	2700	mg/kg	0.10	3.7
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.8
Chrysene	U	2700	mg/kg	0.10	2.6
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	2.7
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	1.0
Benzo[a]pyrene	U	2700	mg/kg	0.10	2.8

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				19-38616
Quotation No.: Q17-09116	**Chemtest Sample ID.:**				927223
Order No.: 12334	Client Sample Ref.:				ENV.1
	Sample Location:				TP09
	Sample Type:				SOIL
	Top Depth (m):				0.50
	Date Sampled ($):				15-Nov-2019
	Asbestos Lab:				COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	1.5
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.79
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.8
Coronene	N	2700	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	24
Total Phenols	U	2920	mg/kg	0.30	< 0.30

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927205						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP02						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	580	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.011	0.11	0.5	2	25
Barium	1450	U	0.024	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.024	0.24	0.5	10	70
Copper	1450	U	0.0037	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.049	0.49	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0058	0.058	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	6.0	60	800	15000	25000
Fluoride	1220	U	0.32	3.2	10	150	500
Sulphate	1220	U	71	710	1000	20000	50000
Total Dissolved Solids	1020	N	210	2100	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	9.1	91	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	5.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927206						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	1.3	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	170	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0080	0.080	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0027	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0093	0.093	0.5	10	30
Nickel	1450	U	0.043	0.43	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0031	0.031	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.017	< 0.50	4	50	200
Chloride	1220	U	1.3	13	800	15000	25000
Fluoride	1220	U	0.34	3.4	10	150	500
Sulphate	1220	U	110	1100	1000	20000	50000
Total Dissolved Solids	1020	N	270	2700	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.2	62	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927207						
Sample Ref:	ENV.2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.3	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	340	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0078	0.078	0.5	2	25
Barium	1450	U	0.045	< 0.50	20	100	300
Cadmium	1450	U	0.00023	< 0.010	0.04	1	5
Chromium	1450	U	0.024	0.24	0.5	10	70
Copper	1450	U	0.0031	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.038	0.38	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0043	0.043	0.06	0.7	5
Selenium	1450	U	0.0021	0.021	0.1	0.5	7
Zinc	1450	U	0.12	1.2	4	50	200
Chloride	1220	U	2.8	28	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	780	7800	1000	20000	50000
Total Dissolved Solids	1020	N	780	7800	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Chemtest
The right chemistry to deliver results

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landflll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927208						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP10						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	4.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	140	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0078	0.078	0.5	2	25
Barium	1450	U	0.037	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.027	0.27	0.5	10	70
Copper	1450	U	0.0067	0.067	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.025	0.25	0.4	10	40
Lead	1450	U	0.0030	0.030	0.5	10	50
Antimony	1450	U	0.011	0.11	0.06	0.7	5
Selenium	1450	U	0.0015	0.015	0.1	0.5	7
Zinc	1450	U	0.018	< 0.50	4	50	200
Chloride	1220	U	1.3	13	800	15000	25000
Fluoride	1220	U	1.4	14	10	150	500
Sulphate	1220	U	74	740	1000	20000	50000
Total Dissolved Solids	1020	N	190	1900	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	9.4	94	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616
Chemtest Sample ID: 927209
Sample Ref: ENV.2
Sample ID:
Sample Location: TP10
Top Depth(m): 2.00
Bottom Depth(m):
Sampling Date ($): 14-Nov-2019

					Landfill Waste Acceptance Criteria Limits		
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	2.7	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0025	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0092	0.092	0.5	10	30
Nickel	1450	U	0.021	0.21	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0093	0.093	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.042	< 0.50	4	50	200
Chloride	1220	U	2.8	28	800	15000	25000
Fluoride	1220	U	0.44	4.4	10	150	500
Sulphate	1220	U	400	4000	1000	20000	50000
Total Dissolved Solids	1020	N	450	4500	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.8	68	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927210						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP11						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	1.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	120	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0062	0.062	0.5	2	25
Barium	1450	U	0.024	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0031	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.019	0.19	0.4	10	40
Lead	1450	U	0.0073	0.073	0.5	10	50
Antimony	1450	U	0.0064	0.064	0.06	0.7	5
Selenium	1450	U	0.0010	0.010	0.1	0.5	7
Zinc	1450	U	0.0069	< 0.50	4	50	200
Chloride	1220	U	27	270	800	15000	25000
Fluoride	1220	U	0.73	7.3	10	150	500
Sulphate	1220	U	35	350	1000	20000	50000
Total Dissolved Solids	1020	N	120	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	11	110	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.4

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927211						
Sample Ref:	ENV.2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP11						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	0.49	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0037	< 0.050	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0077	0.077	0.5	10	30
Nickel	1450	U	0.019	0.19	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.062	0.62	4	50	200
Chloride	1220	U	11	110	800	15000	25000
Fluoride	1220	U	0.37	3.7	10	150	500
Sulphate	1220	U	560	5600	1000	20000	50000
Total Dissolved Solids	1020	N	630	6300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.7	57	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927212						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP04						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	14-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.0	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	230	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0081	0.081	0.5	2	25
Barium	1450	U	0.018	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.025	0.25	0.5	10	70
Copper	1450	U	0.0095	0.095	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.018	0.18	0.4	10	40
Lead	1450	U	0.0018	0.018	0.5	10	50
Antimony	1450	U	0.0044	0.044	0.06	0.7	5
Selenium	1450	U	0.0029	0.029	0.1	0.5	7
Zinc	1450	U	0.014	< 0.50	4	50	200
Chloride	1220	U	4.5	45	800	15000	25000
Fluoride	1220	U	0.27	2.7	10	150	500
Sulphate	1220	U	74	740	1000	20000	50000
Total Dissolved Solids	1020	N	200	2000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.1

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Chemtest
The right chemistry to deliver results

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616
Chemtest Sample ID: 927213
Sample Ref: ENV.2
Sample ID:
Sample Location: TP04
Top Depth(m): 1.90
Bottom Depth(m):
Sampling Date ($): 14-Nov-2019

					Landfill Waste Acceptance Criteria Limits		
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	3.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.013	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.020	0.20	0.5	10	70
Copper	1450	U	0.0028	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.015	0.15	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0023	0.023	0.06	0.7	5
Selenium	1450	U	0.0011	0.011	0.1	0.5	7
Zinc	1450	U	0.018	< 0.50	4	50	200
Chloride	1220	U	4.3	43	800	15000	25000
Fluoride	1220	U	0.39	3.9	10	150	500
Sulphate	1220	U	160	1600	1000	20000	50000
Total Dissolved Solids	1020	N	270	2700	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616
Chemtest Sample ID: 927214
Sample Ref: ENV.1
Sample ID:
Sample Location: TP05
Top Depth(m): 0.50
Bottom Depth(m):
Sampling Date ($): 15-Nov-2019

Determinand	SOP	Accred.	Units		Landfilll Waste Acceptance Criteria Limits		
					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	1.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	140	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0064	0.064	0.5	2	25
Barium	1450	U	0.020	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.026	0.26	0.5	10	70
Copper	1450	U	0.0033	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0063	0.063	0.5	10	30
Nickel	1450	U	0.021	0.21	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0025	0.025	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0061	< 0.50	4	50	200
Chloride	1220	U	4.0	40	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	25	250	1000	20000	50000
Total Dissolved Solids	1020	N	85	850	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.7	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	5.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landflll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927215						
Sample Ref:	ENV.2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP05						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0054	0.054	0.5	2	25
Barium	1450	U	0.040	< 0.50	20	100	300
Cadmium	1450	U	0.00019	< 0.010	0.04	1	5
Chromium	1450	U	0.029	0.29	0.5	10	70
Copper	1450	U	0.0055	0.055	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.020	0.20	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0030	0.030	0.06	0.7	5
Selenium	1450	U	0.0012	0.012	0.1	0.5	7
Zinc	1450	U	0.22	2.2	4	50	200
Chloride	1220	U	3.5	35	800	15000	25000
Fluoride	1220	U	0.17	1.7	10	150	500
Sulphate	1220	U	1700	17000	1000	20000	50000
Total Dissolved Solids	1020	N	1400	14000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	8.2	82	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927216						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP08						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	320	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0055	0.055	0.5	2	25
Barium	1450	U	0.027	< 0.50	20	100	300
Cadmium	1450	U	0.0018	0.018	0.04	1	5
Chromium	1450	U	0.033	0.33	0.5	10	70
Copper	1450	U	0.0053	0.053	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	0.0097	0.097	0.4	10	40
Lead	1450	U	0.0021	0.021	0.5	10	50
Antimony	1450	U	0.015	0.15	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.060	0.60	4	50	200
Chloride	1220	U	12	120	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	450	4500	1000	20000	50000
Total Dissolved Solids	1020	N	530	5300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	14	140	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927217						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP07						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.1	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	420	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0084	0.084	0.5	2	25
Barium	1450	U	0.0073	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.029	0.29	0.5	10	70
Copper	1450	U	0.0043	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0066	0.066	0.5	10	30
Nickel	1450	U	0.0092	0.092	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0016	0.016	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0071	< 0.50	4	50	200
Chloride	1220	U	2.3	23	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	32	320	1000	20000	50000
Total Dissolved Solids	1020	N	160	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.5	65	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.5

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Chemtest
The right chemistry to deliver results

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927218						
Sample Ref:	ENV.2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP07						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	360	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0045	< 0.050	0.5	2	25
Barium	1450	U	0.015	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.027	0.27	0.5	10	70
Copper	1450	U	0.0026	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0051	0.051	0.5	10	30
Nickel	1450	U	0.012	0.12	0.4	10	40
Lead	1450	U	0.0014	0.014	0.5	10	50
Antimony	1450	U	0.0011	0.011	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	4.8	48	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	44	440	1000	20000	50000
Total Dissolved Solids	1020	N	120	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.6	56	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-38616						
Chemtest Sample ID:	927219						
Sample Ref:	ENV.1						
Sample ID:							
Sample Location:	TP9A						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	1.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	230	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0045	< 0.050	0.5	2	25
Barium	1450	U	0.0089	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.026	0.26	0.5	10	70
Copper	1450	U	0.0015	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0037	< 0.050	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0054	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.14	1.4	10	150	500
Sulphate	1220	U	14	140	1000	20000	50000
Total Dissolved Solids	1020	N	49	490	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.3	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.6

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927220						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP1A						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	3.1	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	290	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.012	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.021	0.21	0.5	10	70
Copper	1450	U	0.0018	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0045	< 0.050	0.5	10	30
Nickel	1450	U	0.012	0.12	0.4	10	40
Lead	1450	U	0.0014	0.014	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0052	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.43	4.3	10	150	500
Sulphate	1220	U	13	130	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	7.1	71	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfilll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927221						
Sample Ref:	ENV.2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP1A						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	7.9	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	310	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0035	< 0.050	0.5	2	25
Barium	1450	U	0.022	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.021	0.21	0.5	10	70
Copper	1450	U	0.0012	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0085	0.085	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0030	0.030	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.017	< 0.50	4	50	200
Chloride	1220	U	1.5	15	800	15000	25000
Fluoride	1220	U	3.2	32	10	150	500
Sulphate	1220	U	110	1100	1000	20000	50000
Total Dissolved Solids	1020	N	200	1900	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.4	54	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	24

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landflll Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927222						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP1B						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	2.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	740	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0060	0.060	0.5	2	25
Barium	1450	U	0.019	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.017	0.17	0.5	10	70
Copper	1450	U	0.0023	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0051	0.051	0.5	10	30
Nickel	1450	U	0.011	0.11	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0019	0.019	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	89	890	1000	20000	50000
Total Dissolved Solids	1020	N	160	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.6	56	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.1

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No:	19-38616				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	927223						
Sample Ref:	ENV.1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP09						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date ($):	15-Nov-2019						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	U	%	1.5	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	830	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0047	< 0.050	0.5	2	25
Barium	1450	U	0.012	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.019	0.19	0.5	10	70
Copper	1450	U	0.0016	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0038	< 0.050	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0069	< 0.50	4	50	200
Chloride	1220	U	5.7	57	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	42	420	1000	20000	50000
Total Dissolved Solids	1020	N	100	1000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.9	69	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.3

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
$	This information has been supplied by the client and can affect the integrity of test data.

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX 8.3

LABORATORY RESULTS COMPARISON TABLES

AWN (2020)

Laboratory Test Results: SOIL Metals Suite

Client: OPW
Location: Dublin Port
AWN Ref: Brexit Infrastructure at Dublin Port EIAR
Ref: 19/11148

					SOIL									
Sample ID					**TP02**	**TP03**	**TP03**	**TP10**	**TP10**	**TP11**	**TP11**	**TP04**	**TP04**	**TP05**
Depth					Composite Samples									
Laboratory	Details				EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL
Sample Type					Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Sample Date					14/11/2019 - 15/11/2019									
Depth					0.5	0.5	2	0.5	2	0.5	2	0.5	1.9	0.5
Parameters	**Units**	**MDL**	**LQM/CIEH S4ul for HHRA Residental Threshold at 1% SOM (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)**										
Arsenic	mg/kg	<0.5	40	640	37	27	26	45	29	32	13	27	26	39
Cadmium	mg/kg	<0.1	85	190	0.72	0.85	1.2	1.9	1.2	1.1	0.3	1	1.4	0.94
Chromium	mg/kg	<0.5	910	8600	32	20	28	33	23	16	13	18	26	11
Copper	mg/kg	<1	7100	68000	53	43	63	160	60	45	13	54	56	28
Lead	mg/kg	<5	*nv*	*nv*	180	170	1100	660	380	300	38	210	490	120
Mercury	mg/kg	<0.1	1.2	25.8	0.3	0.82	3.9	1.6	1.3	0.56	0.18	0.47	1.1	0.25
Nickel	mg/kg	<0.7	180	980	37	28	38	43	37	33	17	30	37	24
Selenium	mg/kg	<1	430	12000	-	-	0.021	0.015	-	0.01	-	0.029	0.011	-
Zinc	mg/kg	<5	40000	730000	160	190	300	600	290	180	43	150	260	140
Natural Moisture Content	%	<0.1	*nv*	*nv*	5.7	10	13	15	12	9.4	14	6.1	13	5.7

Key

▨	*Value exceeds the LQM Residential Threshold Value without homegrown produce*	
Underlined	*Value exceeds the LQM Commerical Threshold Value*	
MDL	*Method Detection Limit*	
-	*Less than the MDL*	
nv	*No Value*	*nt* Not Tested

Laboratory Test Results: SOIL Volatile Organic Compounds (VOCs)

Client: OPW

Location: Dublin Port

AWN Ref: Brexit Infrastructure at Dublin Port EIAR

Ref: 19/11148

						SOIL								
Sample ID						**TP02**	**TP03**	**TP03**	**TP10**	**TP10**	**TP11**	**TP11**	**TP04**	**TP04**
Depth						Composite Samples								
Laboratory	Details					EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL
Sample Type						Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Sample Date						Date								
Parameters	**Units**	**MDL**	**LQM/CIEH S4ul for HHRA Residental Threshold at 1% SOM (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)**										
Dichlorodifluoromethane	mg/kg	0.002	*nv*	*nv*		-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	mg/kg	0.002				-	-	-	-	-	-	-	-	-
Chloromethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Vinyl Chloride	mg/kg	0.002				-	-	-	-	-	-	-	-	-
Bromomethane	mg/kg	0.001				-	-	-	-	-	-	-	-	-
Chloroethane	mg/kg	0.002				-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	mg/kg	0.002				-	-	-	-	-	-	-	-	-
1,1-Dichloroethene (1,1 DCE)	mg/kg	0.006				-	-	-	-	-	-	-	-	-
C (DCM)	mg/kg	0.03				-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	mg/kg	0.003	0.0092	0.67		-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	mg/kg	0.003	*nv*	*nv*		-	-	-	-	-	-	-	-	-
cis-1-2-Dichloroethene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	mg/kg	0.004				-	-	-	-	-	-	-	-	-
Bromochloromethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Chloroform	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	mg/kg	0.003	9	660		-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	mg/kg	0.003	*nv*	*nv*		-	-	-	-	-	-	-	-	-
Carbon tetrachloride	mg/kg	0.004				-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	mg/kg	0.004				-	-	-	-	-	-	-	-	-
Benzene	mg/kg	0.003	0.38	27		-	-	-	-	-	-	-	-	-
Trichloroethene (TCE)	mg/kg	0.003	*nv*	*nv*		-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	mg/kg	0.006				-	-	-	-	-	-	-	-	-
Dibromomethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Bromodichloromethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	mg/kg	0.004				-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.003	869	869		-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	mg/kg	0.003	*nv*	*nv*		-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Tetrachloroethene (PCE)	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Dibromochloromethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Chlorobenzene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	0.003	83	518		-	-	-	-	-	-	-	-	-
p/m-Xylene	mg/kg	0.005	79	576		-	-	-	-	-	-	-	-	-
o-Xylene	mg/kg	0.003	88	478		-	-	-	-	-	-	-	-	-
Styrene	mg/kg	0.003	*nv*	*nv*		-	-	-	-	-	-	-	-	-
Bromoform	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Isopropylbenzene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg	0.003				-	-	-	-	-	-	-	-	-
Bromobenzene	mg/kg	0.002				-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	mg/kg	0.004				-	-	-	-	-	-	-	-	-
Propylbenzene	mg/kg	0.004				-	-	-	-	-	-	-	-	-
2-Chlorotoluene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
4-Chlorotoluene	mg/kg	0.003				-	-	-	-	-	-	-	-	-
tert-Butylbenzene	mg/kg	0.005				-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg	0.006				-	-	-	-	-	-	-	-	-
sec-Butylbenzene	mg/kg	0.004				-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	mg/kg	0.004				-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.004	0.44	30		-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.004	61	4400		-	-	-	-	-	-	-	-	-
n-Butylbenzene	mg/kg	0.004	*nv*	*nv*		-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.004	24	2000		-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg	0.004	*nv*	*nv*		-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.007	2.6	220		-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.004	0.32	31		-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	0.027	*nv*	*nv*		-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg	0.007				-	-	-	-	-	-	-	-	-

Key

▨	*Value exceeds the LQM Residential Threshold Value without homegrown produce*
<u>Underlined</u>	*Value exceeds the LQM Commerical Threshold Value*
MDL	*Method Detection Limit*
-	*Less than the MDL*
nv	*No Value* *nt* Not Tested

Laboratory Test Results: SOIL Semi-Volatile Organic Compounds (SVOCs)

Client: OPW
Location: Dublin Port
AWN Ref: Brexit Infrastructure at Dublin Port EIAR
Ref: 19/11148

						SOIL									
Sample ID	Details					**TP02**	**TP03**	**TP03**	**TP10**	**TP10**	**TP11**	**TP11**	**TP04**	**TP04**	**TP05**
Depth						Composite Samples									
Laboratory						EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL	EEL
Sample Type						Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Sample Date						14/11/2019 - 15/11/									
Depth						0.5	0.5	2	0.5	2	0.5	2	0.5	1.9	0.5
Parameters	**Units**	**MDL**	**LQM/CIEH S4ul for HHRA Residental Threshold at 1% SOM (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)**											
Naphthalene	mg/kg	0.1	2.3	190		-	2.4	1.8	0.72	0.33	0.29	-	0.9	0.17	-
Acenaphthylene	mg/kg	0.1	170	83000		-	1	1.2	1.7	1	0.6	-	0.88	0.24	-
Acenaphthene	mg/kg	0.1	210	8400		-	1.3	0.47	0.64	0.41	0.69	-	0.21	0.45	-
Fluorene	mg/kg	0.1	170	63000		-	4.7	0.52	2.8	2.2	0.16	-	0.91	0.56	-
Phenanthrene	mg/kg	0.1	95	22000		-	3.3	0.95	2.6	3.3	0.8	-	6.6	3.9	0.66
Anthracene	mg/kg	0.1	2400	520000		-	0.81	0.12	0.62	0.75	0.21	-	2.2	0.69	0.22
Fluoranthene	mg/kg	0.1	280	23000		-	3.4	1.1	4.1	5.1	1.3	-	8.4	6	1.6
Pyrene	mg/kg	0.1	620	54000		-	4.8	2.1	5.7	6.6	2.4	-	8.1	6.2	1.7
Benzo(a)anthracene	mg/kg	0.1	7.2	170		-	1.3	0.41	2.3	2.5	<0.10	-	3.7	3	0.62
Chrysene	mg/kg	0.1	15	350		-	2.1	0.97	3.3	3.5	<0.10	-	4.6	3.7	0.7
Benzo(a)pyrene	mg/kg	0.1	2.2	35		-	1.6	-	2.7	2.5	0.13	-	3.3	3.1	1.3
Indeno(123cd)pyrene	mg/kg	0.1	*nv*	*nv*		-	0.78	-	1.9	1.7	<0.10	-	2	1.9	0.76
Dibenzo(ah)anthracene	mg/kg	0.1	0.24	3.5		-	<0.10	-	1.7	0.92	18	-	0.8	0.9	0.57
Benzo(ghi)perylene	mg/kg	0.1	320	3900		-	1.7	-	2	1.9	23	-	2.1	2.1	0.99
PAH 16 Total	mg/kg	0.1	*nv*	*nv*		-	32	9.6	40	38	48	-	50	38	11
Benzo(b)fluoranthene	mg/kg	0.1	2.6	44		-	2.6	-	5.5	4.1	-	-	3.9	3.5	1.2
Benzo(k)fluoranthene	mg/kg	0.1	77	1200		-	0.6	-	1.3	1.2	-	-	1.4	1.4	0.47

Key

▨	*Value exceeds the LQM Residential Threshold Value without homegrown produce*
Underlined	*Value exceeds the LQM Commerical Threshold Value*
MDL	*Method Detection Limit*
-	*Less than the MDL*
nv	*No Value* *nt* Not Tested

Collinstown Due Diligence - WAC Analysis

Sample Type						SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample ID						TP02	TP03	TP03	TP10	TP10	TP11	TP11	TP04	TP04	TP05	TP05	TP08	TP07	TP07	TP9A	TP1A	TP1A
Material Description						SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Depth (m)						Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Date Sampled						14/11/2019	14/11/2019	14/11/2019	14/11/2019	14/11/2019	14/11/2019	14/11/2019	14/11/2019	14/11/2019	15/11/2019	15/11/2019	15/11/2019	15/11/2019	15/11/2019	15/11/2019	15/11/2019	15/11/2019
Lab Reference						19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616	19/38616
Proposed Disposal Category						**Category C1**	**Category C1**	**Category C1**	**Category C1**	**Category C1**	**Category C1**	**Category C1**	**Category A**	**Category C1**	**Category A**	**Category C1**	**Category C1**	**Category A**	**Category A**	**Category A**	**Category C**	**Category D**
Parameters	**Units**	**MDL**	**Inert Waste Criteria**	**Stable Non Reactive**	**Hazardous Criteria**																	
Hydrocarbons																						
Mineral Oil (C8 - C40)	mg/kg	<45	500	nc	nc	580	170	340	140	160	120	<10	230	160	140	160	320	420	360	230	290	310
MTBE																						
MTBE	ug/kg	<5	nc	nc	nc																	
TOC																						
Total Organic Carbon Note 1	%	<0.02	3	5	6	2.2	1.3	2.3	4.4	2.7	1.4	0.49	2	3.2	1.6	2.4	2.6	2.1	2.6	1.4	3.1	7.9
Heavy Metal Leachates																						
Antimony	mg/kg	<0.02	0.06	0.7	5	0.058	0.031	0.043	0.11	0.093	0.064	<0.010	0.044	0.023	0.025	0.03	0.15	0.016	0.011	<0.010	<0.010	0.03
Arsenic	mg/kg	<0.025	0.5	2	25	0.11	0.08	0.078	0.078	0.059	0.062	<0.050	0.081	0.059	0.064	0.054	0.055	0.084	<0.050	<0.050	0.059	<0.050
Barium	mg/kg	<0.03	20	100	300	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium	mg/kg	<0.005	0.04	1	5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.018	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium	mg/kg	<0.015	0.5	10	70	0.24	0.22	0.24	0.27	0.22	0.22	0.22	0.25	0.2	0.26	0.29	0.33	0.29	0.27	0.26	0.21	0.21
Copper	mg/kg	<0.07	2	50	100	<0.050	<0.050	<0.050	0.067	<0.050	<0.050	<0.050	0.095	<0.050	<0.050	0.055	0.053	<0.050	<0.050	<0.050	<0.050	<0.050
Mercury	mg/kg	<0.0001	0.01	0.2	2	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Molybdenum	mg/kg	<0.02	0.5	10	30	0.14	0.093	0.13	0.14	0.092	0.13	0.077	0.13	0.14	0.063	0.14	0.1	0.066	0.051	<0.050	<0.050	0.085
Nickel	mg/kg	<0.02	0.4	10	40	0.49	0.43	0.38	0.25	0.21	0.19	0.19	0.18	0.15	0.21	0.2	0.097	0.092	0.12	0.13	0.12	0.13
Lead	mg/kg	<0.05	0.5	10	50	<0.010	<0.010	<0.010	0.03	<0.010	0.073	<0.010	0.018	<0.010	<0.010	<0.010	0.021	<0.010	0.014	<0.010	0.014	<0.010
Selenium	mg/kg	<0.03	0.1	0.5	7	<0.010	<0.010	0.021	0.015	<0.010	0.01	<0.010	0.029	0.011	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc	mg/kg	<0.03	4	50	200	<0.50	<0.50	1.2	<0.50	<0.50	<0.50	0.62	<0.50	<0.50	<0.50	2.2	0.6	<0.50	<0.50	<0.50	<0.50	<0.50
Other Leachates																						
Chloride	mg/kg	<3	800	15000	25000	60	13	28	13	28	270	110	45	43	40	35	120	23	48	<10	<10	15
Fluoride	mg/kg	<3	10	150	500	3.2	3.4	1.9	14	4.4	7.3	3.7	2.7	3.9	3.5	1.7	1.8	1.1	1.3	1.4	4.3	32
Sulphate as SO4	mg/kg	<0.5	1000	20000	50000	710	1100	7800	740	4000	350	5600	740	1600	250	17000	4500	320	440	140	130	1100
Total Dissolved Solids	mg/kg	<100	4000	60000	100000	2100	2700	7800	1900	4500	1200	6300	2000	2700	850	14000	5300	1600	1200	490	510	1900
Phenol	mg/kg	<0.1	1	-	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Dissolved Organic Carbon	mg/kg	<20	500	800	1000	91	6.2	<50	94	68	110	57	120	120	<50	82	140	65	56	<50	71	54

MDL = Laboratory Method Detection Limit
nc = No Criteria
- = Not Analysed
TPH CWG = Total Petroleum Hydrocarbons Criteria Working Group
NAD = No Asbestos Detected

Waste Acceptance Criteria based on EU Council Decision 2003/33/EC

Category A - Inert	Reported concentrations less than inert waste guidelines, which are based on waste acceptance criteria set out by the adopted EU Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of directive 1999/31/EC (2002). * All results are considered Category A - Inert unless otherwise specified.
Category C1 - Stable Non Reactive	Reported concentrations greater than Category A and B but not in exceedance of the non-hazardous waste limit criteria as set out in EU Council Decision 2003/33/EC/ BS EN 12457-2
Catgeory C2 - Non-Hazardous	As in Category C1 but containing <0.001% w/w asbestos fibres
Catgeory C3 - Non-Hazardous	As in Category C1 but containing <0.1% w/w asbestos fibres
Category D - Hazardous	Reported concentrations greater than Category C3 but not in exceedance of the hazardous waste limit criteria as set out in EU Council Decision 2003/33/EC

EU Council Decision 2003/33/EC Notes:

Note 1: If this TOC value for hazardous waste is not achieved, a higher limit value may be admitted by the competent authority, provided that the Dissolved Organic Carbon (DOC) vlaue of 1,000mg/kg is achieved at L/S = 10 l/kg, either at the material's own pH or at a pH value between 7.5 and 8.0.

Note 2: If the waste exceeds the sulphate criterion for inert waste, it may still be considered as complying with the acceptance criteria if the leaching does not exceed either of the following values: 1500 mg/kg as C0 at L/S = 0.1 l/kg and 6000mg/kg at L/S = 10 l/kg. It will be necessary to use a percolation test to determine the limit value at L/S = 0.1 l/kg under initial equilibrium conditions, whereas the value at L/S = 10 l/kg may be determined either by a batch leaching test or by a percolation test under conditions approaching local equilibrium.

Note 3: The values for TDS (Total Dissolved Solids) for inert waste can be used alternatively to the values for Sulphate and Chloride.

9.0 AIR QUALITY & CLIMATE

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts, if any, associated with the proposed development. A full description of the development can be found in Chapter 2.0 of this EIAR.

9.2 METHODOLOGY

9.2.1 Criteria for Rating of Impacts

9.2.1.1 Ambient Air Quality Standards

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 Table 9.1 and Appendix 9.1).

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 a number of pollutants. The limit values for NO_2, PM_{10}, $PM_{2.5}$, benzene and CO are relevant to this assessment as these are traffic related pollutants (see Table 9.1). 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 (see Appendix 9.1).

Table 9.1 Ambient Air Quality Standards

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide	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	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

9.2.1.2 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 9.1 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) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(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 (DOEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

9.2.1.3 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), 65 kt 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 $PM_{2.5}$.

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD), 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 (DEHLG, 2004; 2007). The data available from the EPA in 2019 (EPA, 2019a) indicated that Ireland complied with the emissions ceilings for SO_2 and NH_3 but failed to comply with the ceiling for NO_X and NMVOCs. 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 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). In relation to 2030, Ireland's emission targets are 85% below 2005 levels for SO_2, 69% reduction for NO_x, 32% reduction for VOCs, 5% reduction for NH_3 and 41% reduction for $PM_{2.5}$.

9.2.1.4 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 (UNFCCC, 1997; UNFCCC, 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Doha Amendment to the Kyoto Protocol, in December 2012, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 20% below the 2005 level over the period 2013 to 2020 (UNFCCC, 2012).

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 (COP25) took place in Madrid, Spain from the 2nd to the 13th December 2019 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 is currently ratified by 187 nations and 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, in October 2014, agreed the “2030 Climate and Energy Policy Framework”(EU 2014). 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 ETS and non-ETS sectors 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.

The Climate Action and Low Carbon Development Act 2015 (Government of Ireland, 2015) was developed to provide for the approval of plans by the government in relation to climate change and to enable achievement of the national transition objective of achieving decarbonisation by 2050. Under this Act the National Mitigation Plan (DCCAE, 2017) and the National Adaptation Framework (DCCAE, 2018) were established. The National Mitigation Plan sets out objectives for achieving a reduction in GHG emissions and transitioning the four key sectors (power generation, built environment, transport and agriculture) to decarbonisation, while the National Adaptation Framework aims to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. With the implementation of the Climate Action and Low Carbon Development Act 2015 Ireland has implemented a number of strategies to reduce GHG emissions in future years, with a number of other strategies currently being proposed.

9.2.2 Construction Phase

The Institute of Air Quality Management in the UK (IAQM) guidelines (2014) outline an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale & nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely magnitude of the dust impacts in the absence of mitigation measures.

9.2.3 Operational Phase

9.2.3.1 Local Air Quality

The air quality assessment has been carried out following procedures described in the publications by the EPA (2015; 2017) and using the methodology outlined in the guidance documents published by the UK Highways Agency (2019) and UK Department of Environment Food and Rural Affairs (DEFRA) (2016; 2018). Transport Infrastructure Ireland

(TII) reference the use of the UK Highways Agency and DEFRA guidance and methodology in their document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011). This approach is considered best practice in the absence of Irish guidance and can be applied to any development that causes a change in traffic.

In 2019 the UK Highways Agency DMRB air quality guidance was revised with *LA 105 Air Quality* replacing a number of key pieces of guidance (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). This revised document outlines a number of changes for air quality assessments in relation to road schemes, but can be applied to any development that causes a change in traffic. Previously the DMRB air quality spreadsheet was used for the majority of assessments in Ireland with detailed modelling only required if this screening tool indicated compliance issues with the EU air quality standards. Guidance from Transport Infrastructure Ireland (TII, 2011) recommends the use of the UK Highways Agency DMRB spreadsheet tool for assessing the air quality impacts from road schemes. However, the DMRB spreadsheet tool was last revised in 2007 and accounts for modelled years up to 2025. Vehicle emission standards up to Euro V are included but since 2017, Euro 6d standards are applicable for the new fleet. In addition, the model does not account for electric or hybrid vehicle use. Therefore, this a somewhat outdated assessment tool. The LA 105 guidance document states that the DMRB spreadsheet tool may still be used for simple air quality assessments where there is unlikely to be a breach of the air quality standards. Due to its use of a “dirtier” fleet, vehicle emissions would be considered to be higher than more modern models and therefore any results will be conservative in nature and will provide a worst-case assessment.

The 2019 UK Highways Agency DMRB air quality revised guidance *LA 105 Air Quality* states that modelling should be conducted for NO_2 for the base, opening and design years for both the do minimum (do nothing) and do something scenarios. Modelling of PM_{10} is only required for the base year to demonstrate that the air quality limit values in relation to PM_{10} are not breached. Where the air quality modelling indicates exceedances of the PM_{10} air quality limits in the base year then PM_{10} should be included in the air quality model in the do minimum and do something scenarios. Modelling of $PM_{2.5}$ is not required as there are currently no issues with compliance with regard to this pollutant. The modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value as if compliance with the PM_{10} limit is achieved then compliance with the $PM_{2.5}$ limit will also be achieved. Historically modelling of carbon monoxide (CO) and benzene (Bz) was required however, this is no longer needed as concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (EPA, 2019b). The key pollutant reviewed in this assessment is NO_2. Concentrations of PM_{10} and $PM_{2.5}$ have also been modelled to indicate that there are no potential air quality compliance issues associated with the proposed development. Modelling of operational NO_2, PM_{10} and $PM_{2.5}$ concentrations has been conducted for the do nothing and do something scenarios for the opening year (2021) and design year (2036).

The TII guidance (2011) 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 Highways Agency guidance *LA 150* (2019) states the following scoping criteria shall be used to determine whether the air quality impacts of a project can be scoped out or require an assessment based on the changes between the do something traffic (with the project) compared to the do minimum traffic (without the project):

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band;
- A change in carriageway alignment by 5m or greater.

The above scoping criteria has been used in the current assessment to determine the road links required for inclusion in the modelling assessment. Sensitive receptors within 200m of impacted road links are included within the modelling assessment. Pollutant concentrations are calculated at these sensitive receptor locations to determine the impact of the proposed scheme in terms of air quality. The guidance states a proportionate number of representative receptors which are located in areas which will experience the highest concentrations or greatest improvements as a result of the proposed development are to be included in the modelling (UK Highways Agency, 2019). The TII guidance (2011) defines sensitive receptor locations as: residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. There are minimal receptors within the port area, none of which are considered high sensitivity. A total of four receptors (R1 – R4) were included in the modelling assessment and are detailed in Figure 9.1, these are medium to low sensitivity areas in terms of air quality (offices/shop/warehousing).

The following model inputs are required to complete the assessment using the DMRB spreadsheet tool: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles (%HGV), annual average traffic speeds and background concentrations. 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 document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) details a methodology for determining air quality impact significance criteria for road schemes which can be applied to any project that causes a change in traffic. 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 9.2 Table A9.2.1 to Table A9.2.3. The significance criteria are based on NO_2 and PM_{10} 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 annual $PM_{2.5}$ concentrations for the purposes of this assessment.

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 NO_X 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 NOx to NO_2 in "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" (2011). The TII guidelines recommend the use of DEFRAs NOx to NO_2 calculator (2019) which was originally published in 2009 and is currently on version

7.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NOx 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.

Traffic Data Used in Modelling Assessment

Traffic flow information was obtained from CST Group for the purposes of this assessment. Data for the Do Nothing and Do Something scenarios for the opening year 2021 and design year 2036 were provided. The proposed development will not change traffic flows entering the port but will redistribute the traffic within the port. Traffic has been modelled at the speed limit of 50kph. The traffic data is detailed in Table 9.2 with the %HGV shown in parenthesis beside the AADT. Only road links that met the DMRB scoping criteria outlined in Section 9.2.3.1 and that were within 200m of receptors were included in the modelling assessment. Background concentrations have been included as per Section 9.3.3 of this chapter based on available EPA background monitoring data (EPA, 2019b).

This traffic data has also been used in the operational stage climate impact assessment.

Table 9.2 Traffic Data Used in Modelling Assessment

Road Name	Speed (kph)	Do Nothing	Do Something	Do Nothing	Do Something
		2021		2036	
Tolka Quay Rd	50	8,830 (63%)	10,720 (69%)	13,860 (63%)	16,830 (69%)
Bond D. Ext. (S)	50	2,820 (63%)	4,320 (74%)	4,430 (63%)	6,780 (74%)
Bond Dr Ext. (N)	50	4,450 (50%)	5,900 (63%)	7,000 (50%)	9,260 (63%)
Bond Dr Ext. (E)	50	2,200 (52%)	2,900 (63%)	3,500 (52%)	4,550 (63%)
Bond Dr Ext. (W)	50	2,200 (52%)	2,900 (63%)	3,500 (52%)	4,550 (63%)

Figure 9.1 Approximate Location of Receptors used in Local Air Quality Modelling Assessment

9.2.3.2 Air Quality Impact on Ecological Sites

For routes that pass within 2 km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an ecologist (TII, 2011). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed scheme and when significant changes in AADT (>5%) occur. Only sites that are sensitive to nitrogen deposition should be included in the assessment.

Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Scheme*s (2009) and *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities* (DEHLG, 2010) 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 South Dublin Bay and River Tolka SPA (site code 004024) is directly adjacent to the proposed development. However, this site is designated for the protection of various bird species and as such is not sensitive to nitrogen deposition. In addition the UK Highways Agency (2019) states that a detailed assessment does not need to be conducted for areas that have been designated for geological features or watercourses. Therefore, a detailed NO_X assessment has been screened out based on this criteria.

9.2.3.3 Climate Assessment

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency 2019). The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project during the operational stage:

- During operation, will roads meet or exceed any of the following criteria?
  a) a change of more than 10% in AADT;
  b) a change of more than 10% to the number of heavy duty vehicles; and
  c) a change in daily average speed of more than 20 km/hr.

If the answer to any of the above criteria is ‘yes’ then further assessment is required. There are several road links that will experience an increase of 10% or more in the AADT and a change in HGV of 10% or greater. These road links have been included in the detailed climate assessment (see Table 9.2).

The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland (2011) and the methodology provided in Annex D in the UK Design Manual for Roads and Bridges (UK Highways Agency, 2007). The assessment focused on determining the resulting change in emissions of 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 project that causes a change in traffic. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds (see Table 9.2).

9.3 RECEIVING ENVIRONMENT

9.3.1 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). 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 Dublin Airport, which is located approximately 8 km north of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.1). For data collated during five representative years (2015 – 2019) the predominant wind direction is westerly to south-westerly with a mean wind speed of 5.3 m/s over the period 2005 – 2019 (Met Eireann, 2020).

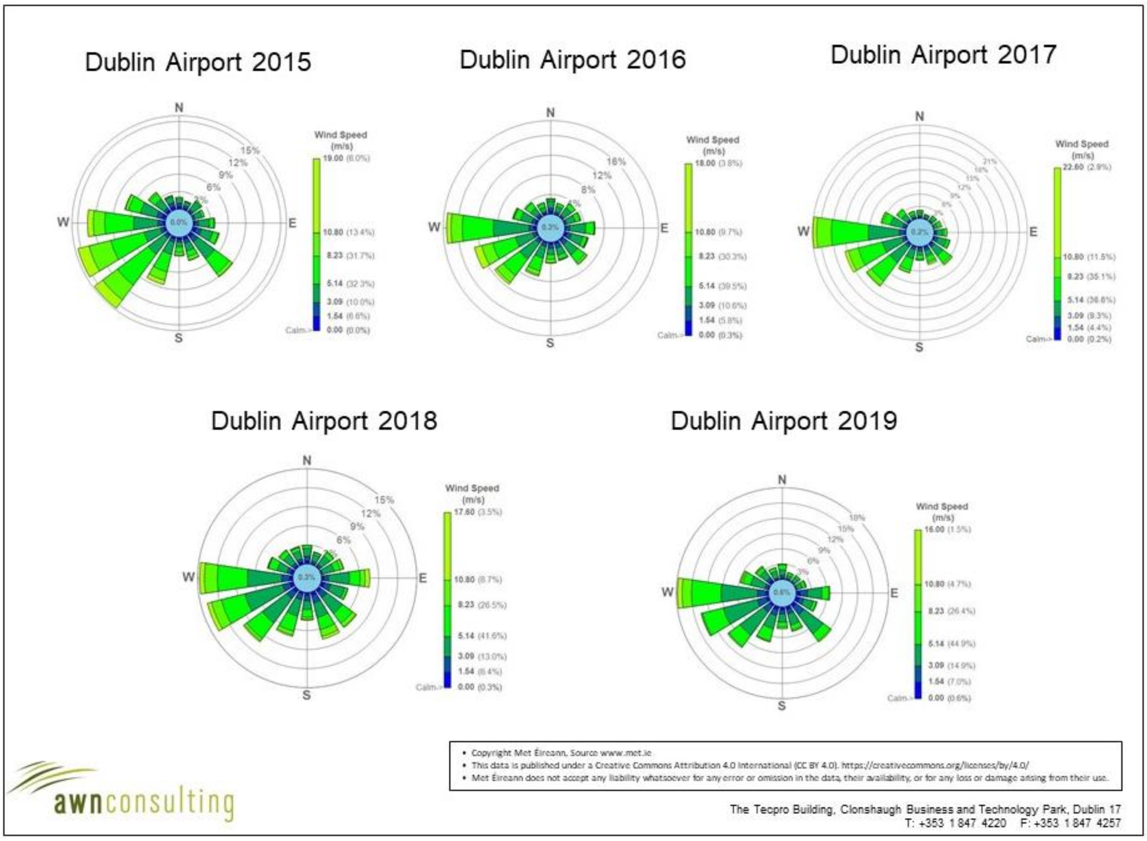

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Figure 9.1 Dublin Airport Windrose 2015 – 2019

9.3.2 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 (WHO, 2006). Thus, residential exposure is determined by the location of sensitive receptors relative to major roads 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 (UK DETR, 1998), 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 (UK DETR, 1998) 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.

9.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2018*" (EPA, 2019b). 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 (EPA, 2019b).

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 (EPA, 2019b). 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 A (EPA, 2019b) . 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.).

Long-term NO_2 monitoring was carried out at the Zone A urban background locations of Rathmines, Dún Laoighaire, Swords and Ballyfermot and the urban traffic location of Ringsend for the period 2014 - 2018 (EPA, 2019b). Long term average concentrations are significantly below the annual average limit of 40 µg/m^3, average results range from 13 – 20 µg/m^3 for the suburban background locations. The NO_2 annual average for this five year period suggests an upper average limit of no more than 18 µg/m^3 (Table 9.3) for the urban background locations. The station at Ringsend is approximately 1.5 km from the proposed development site and would experience similar background concentrations of NO_2 to the proposed development. Based on the above information a conservative estimate of the current background NO_2 concentration for the region of the proposed development is 25 µg/m^3.

Table 9.3 Trends in Zone A Air Quality – Nitrogen Dioxide (NO_2)

Station	Averaging Period	Year				
		2014	2015	2016	2017	2018
Ringsend	Annual Mean NO_2 (µg/m^3)	-	-	-	22	27
	99.8th%ile 1-hr NO_2 (µg/m^3)	-	-	-	-	86.7
Rathmines	Annual Mean NO_2 (µg/m^3)	17	18	20	17	20
	99.8th%ile 1-hr NO_2 (µg/m^3)	105	105	88	86	87
Ballyfermot	Annual Mean NO_2 (µg/m^3)	16	16	17	17	17
	99.8th%ile 1-hr NO_2 (µg/m^3)	93	127	90	112	101
Dun Laoghaire	Annual Mean NO_2 (µg/m^3)	15	16	19	17	19
	99.8th%ile 1-hr NO_2 (µg/m^3)	86	91	105	101	91
Swords	Annual Mean NO_2 (µg/m^3)	14	13	16	14	16
	99.8th%ile 1-hr NO_2 (µg/m^3)	137	93	96	79	85

Continuous PM_{10} monitoring was carried out at five Zone A locations from 2014 - 2018, Winetavern Street, Rathmines, Dún Laoghaire, Tallaght and Phoenix Park. These showed an upper average limit of no more than 15 µg/m^3 (Table 9.4). Levels range from 9 - 15 µg/m^3 over the five year period with at most 2 exceedances (in Rathmines) of the 24-hour limit value of 50 µg/m^3 in 2018 (35 exceedances are permitted per year) (EPA,2019b). Based on the EPA data, a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 20 µg/m^3.

Table 9.4 Trends in Zone A Air Quality – PM_{10}

Station	Averaging Period	Year				
		2014	2015	2016	2017	2018
Ringsend	Annual Mean PM_{10} (µg/m^3)	-	-	-	13	20
	90th %ile 24-hr PM_{10} (µg/m^3)	-	-	-	-	35
Rathmines	Annual Mean PM_{10} (µg/m^3)	14	15	15	13	15
	90th %ile 24-hr PM_{10} (µg/m^3)	25	28	28	24	25
Dún Laoghaire	Annual Mean PM_{10} (µg/m^3)	14	13	13	12	13
	90th %ile 24-hr PM_{10} (µg/m^3)	23	22	22	21	21
Tallaght	Annual Mean PM_{10} (µg/m^3)	15	14	14	12	15
	90th %ile 24-hr PM_{10} (µg/m^3)	26	26	28	22	24
Phoenix Park	Annual Mean PM_{10} (µg/m^3)	12	12	11	9	11
	90th %ile 24-hr PM_{10} (µg/m^3)	20	20	20	16	18
Ballyfermot	Annual Mean PM_{10} (µg/m^3)	11	12	11	12	16
	90th %ile 24-hr PM_{10} (µg/m^3)	20	22	21	21	24

Average $PM_{2.5}$ levels in Rathmines over the period 2014 - 2018 ranged from 9 - 10 µg/m^3, with a $PM_{2.5}/PM_{10}$ ratio ranging from 0.64 – 0.68 (EPA, 2019b). Based on this information, a conservative ratio of 0.7 was used to generate an existing $PM_{2.5}$ concentration in the region of the development of 10.5 µg/m^3.

In terms of benzene, the annual mean concentration in the Zone A monitoring location of Rathmines for 2019 was 0.3 µg/m^3. This is well below the limit value of 5 µg/m^3. Between 2014 - 2018 annual mean concentrations at the Zone A site ranged from 0.3 – 1.01 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 1.0 µg/m^3.

With regard to CO, annual averages at the Zone A, locations of Winetavern Street and Coleraine Street over the 2014 – 2018 period are low, peaking at 0.5 mg/m^3 which is well below the limit value of 10 mg/m^3 (EPA, 2019b). Based on this EPA data, a conservative estimate of the current background CO concentration in the region of the proposed development is 0.5 mg/m^3.

Background concentrations for the Opening Year 2021 and Design Year of 2036 have been calculated for the local air quality assessment. These have used current estimated 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* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

9.3.4 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details emissions up to 2017 (EPA, 2019c). Agriculture was the largest contributor in 2017 at 33.3% of the total, with the transport sector accounting for 19.8% of emissions of CO_2 (EPA, 2019c).

2017 is the fifth year where compliance with the European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC) was assessed. Ireland had total GHG emissions of 60.74 Mt CO_2eq in 2017. This is 2.94 Mt CO_2eq higher than Ireland's annual target for emissions in 2017 (EPA, 2019c). Emissions are predicted to continue to exceed the targets in future years, therefore, reduction measures are required in all sectors.

The EPA 2019 GHG Emissions Projections Report for 2018 – 2040 (EPA 2019d) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018. Implementation of these are classed as a "*With Additional Measures scenario*" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 – 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 10 Mt CO_2eq under the With Existing Measures scenario and 9 Mt CO_2eq under the With Additional Measures scenario (EPA, 2019d).

The Dublin City Council Climate Change Action Plan published in 2019 (Dublin City Council and Codema, 2019) outlines a number of goals and plans to prepare for and adapt to climate change. There are five key action areas within the plan: energy and buildings, transport, flood resilience, nature-based solutions and resource management. Some of the measures promoted within the Action Plan under the 5 key areas involve building retrofits, energy master-planning, development of segregated cycle routes, the promotion of bike share schemes, development of flood resilient designs, promotion of the use of green infrastructure and water conservation initiatives. The implementation of these measures will enable the Dublin City Council area to adapt to climate change and will assist in bringing Ireland closer to achieving its climate related targets in future years. New developments need to be cognisant of the Action Plan and incorporate climate friendly designs and measures where possible.

9.3.5 Sensitivity of the Receiving Environment

In line with the IAQM guidance document (2014) prior to assessing the impact of dust from a proposed development the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are no high sensitivity receptors within 50 metres of the proposed works. There are however, less than 10 medium sensitivity receptors within 50m of the proposed works. Based on the IAQM criteria outlined in Table 9.5, the worst case sensitivity of the area to dust soiling is considered to be **low**.

Table 9.5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	**Number Of Receptors**	**Distance from source (m)**			
		<20	**<50**	**<100**	**<350**
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	**Low**	Low	Low
Low	>1	Low	Low	Low	Low

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is estimated to be 15 µg/m^3 and there are no high sensitivity receptors located within 50m of the proposed works. There are less than 10 medium sensitivity receptors located within 50 m of the proposed works. Based on the IAQM criteria outlined in Table 9.6, the worst case sensitivity of the area to human health impacts is considered to **low**.

Table 9.6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	**Annual Mean PM_{10} Concentration**	**Number Of Receptors**	**Distance from source (m)**			
			<20	**<50**	**<100**	**<200**
High	< 24 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low
		1-10	Low	**Low**	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low

The IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to ecological impacts from dust. The criteria take into consideration whether the receiving environment is classified as a Special Area of Conservation (SAC), a Special Protected Area (SPA), a Natural Heritage Area (NHA) or a proposed Natural Heritage Area (pNHA) as dictated by the EU Habitats Directive or whether the site is a local nature reserve or home to a sensitive plant or animal species. As the construction will occur directly adjacent to South Dublin Bay and River Tolka Estuary SPA and North Dublin Bay pNHA, the worst-case sensitivity of the area to ecological impacts is considered to be **high**.

9.4 CHARACTERISTICS OF THE DEVELOPMENT

The proposed development is described in Chapter 2.0. 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:

- Construction phase, and;
- Operational phase.

9.4.1 Construction Phase

The key elements of construction of the proposed development with potential for air quality and climate impacts are:

- Potential fugitive dust emissions from general site preparation and construction activities;
- Potential fugitive dust emissions from trucks associated with construction;
- Engine emissions from construction vehicles and machinery.

The construction phase impacts will be short-term in duration.

9.4.2 Operational Phase

The key elements of operation of the proposed development with potential for air quality and climate impacts are:

- A change in traffic flows on road links nearby the proposed development.

The potential sources of air and climatic emissions during the operational phase of the proposed development are deemed long-term.

9.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

9.5.1 Do Nothing Scenario

The Do Nothing scenario includes retention of the current site without the proposed development works. 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).

The Do Nothing Scenario for the operational stage is assessed within Section 9.5.3.1.

9.5.2 Construction Phase

9.5.2.1 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. While construction dust tends to be deposited within 200 m of a construction site, the majority of the deposition occurs within the first 50 m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

It is important to note that the potential impacts associated with the construction phase of the proposed development are short-term in nature. When the dust minimisation measures detailed in Appendix 9.3 of this report are implemented, fugitive emissions of dust from the site will not be significant and will pose no nuisance at nearby receptors.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 9.3.5). The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (on wheels of heavy vehicles).

Demolition

Demolition will primarily involve the removal of buildings or structures currently on the site in a potentially dusty manner. This may also involve dust generation at heights. Dust emission magnitude from demolition can be classified as small, medium and large and are described below.

- **Large**: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- **Medium**: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- **Small**: Total building volume less than 20,000 m^3.

There are minimal demolition works required for the proposed development. Therefore, the demolition works can be classified as small. As the overall sensitivity of the area to dust soiling and human health impacts is low, there is a negligible risk associated with the proposed demolition activities according to IAQM guidance (2014) (see Table 9.6). As the overall sensitivity of the area to ecological impacts is high, there is an overall medium risk of ecological impacts as a result of the proposed demolition activities (see Table 9.7).

Table 9.7 Risk of Dust Impacts - Demolition

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Earthworks

Earthworks typically involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. Dust emission magnitude from earthworks can be classified as small, medium and large and are described below.

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes; and
- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The total site area is approximately 5.4 hectares , therefore, under the IAQM guidance (2014) the proposed earthworks can be classified as medium. This results in an overall low risk of temporary dust soiling and temporary human health impacts as a result of earthworks activities (see Table 9.8). As the overall sensitivity of the area to ecological impacts is high there is an overall medium risk of ecological impacts as a result of the proposed earthworks activities (see Table 9.8).

Table 9.8 Risk of Dust Impacts - Earthworks

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;
- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching;
- **Small:** Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude from construction associated with the proposed development works can be classified as small as a worst-case according to the IAQM guidance (2014) as the total building volume will be less than 25,000 m^3. Therefore, there is an overall negligible risk of temporary dust soiling and human health impacts as a result of the proposed construction activities (Table 9.9). As the overall sensitivity of the area to ecological impacts is high there is an overall low risk of ecological impacts as a result of the proposed construction activities (see Table 9.9).

Table 9.9 Risk of Dust Impacts – Construction

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

Factors which determine the dust emission magnitude associated with trackout are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** > 50 HGV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium:** 10 - 50 HGV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;
- **Small:** < 10 HGV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

Dust emission magnitude from trackout can be classified as medium under IAQM guidance as there are likely to be less than 50 outward HGV movements per day. This results in an overall low risk of temporary dust soiling impacts and temporary human health impacts as a result of the proposed trackout activities. As the overall sensitivity of the area to ecological impacts is high there is an overall medium risk of ecological impacts as a result of the proposed trackout (see Table 9.10).

Table 9.10 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Summary of Dust Emission Risk

The risk of dust impacts as a result of the proposed development are summarised in Table 9.11 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

Overall, in order to ensure that no dust nuisance occurs during the demolition, earthworks, construction and trackout activities, a range of dust mitigation measures associated with a **medium risk** of dust impacts must be implemented. When the dust mitigation measures detailed in Appendix 9.3 are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors. In addition all works will be phased which will further reduce the potential for significant dust emissions and dust related impacts.

Table 9.11 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Negligible	Low Risk	Negligible	Low Risk
Human Health	Negligible	Low Risk	Negligible	Low Risk
Ecological Impacts	Medium Risk	Medium Risk	Low Risk	Medium Risk

9.5.2.2 Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. However, based on the scale and nature of construction for the proposed development and the short-term nature of the construction phase, the impact on the climate is considered to be short-term, negative and imperceptible.

9.5.2.3 Human Health

Best practice mitigation measures associated with a low risk of temporary human health impacts are proposed for the construction phase of the proposed development. These will focus on the pro-active control of dust and other air pollutants to minimise generation of fugitive 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. Construction stage traffic is below the criteria requiring a detailed air quality assessment and it can be determined that emissions to air from construction traffic are imperceptible. Therefore, the impact of construction of the proposed development is likely to be short-term, negative and imperceptible with respect to human health.

9.5.3 Operational Phase

9.5.3.1 Air Quality

The impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. Traffic accessing the port will remain unchanged, the only change is the distribution of traffic within the port itself. Therefore the only impacted road links are the internal port roads. The impact of NO_2, PM_{10} and $PM_{2.5}$ for the opening and design 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 impacts, to be determined.

Transport Infrastructure Ireland's document *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (2011) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any development that causes a change in traffic. 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 year 2021 and design year 2036 are shown in Table 9.12. The annual average concentration is in compliance with the limit value at all worst-case receptors in 2021 and 2036. Concentrations of NO_2 are at most 81% of the annual limit value in 2021 and at most 89% in 2036. The hourly limit value for NO_2 is 200 $\mu g/m^3$ and is expressed as a 99.8th 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 in any modelled year (Table 9.13).

The impact of the proposed development on annual mean NO_2 concentrations can be assessed relative to "Do Nothing (DN)" levels. Relative to baseline levels, there are predicted to be some small to large increases in NO_2 concentrations at receptors R1 – R4. Concentrations will increase by at most 11% of the relevant limit value in 2036 at receptor R1. Using the assessment criteria outlined in Appendix 9.2, Table A9.2.1 and Table A9.2.2 the impact of the proposed development in terms of NO_2 is considered negligible to slight adverse. Therefore, the overall impact of NO_2 concentrations as a result of the proposed scheme is long-term, slight and negative.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} in the opening year 2021 and design year 2036 are shown in Table 9.14. Predicted annual average concentrations at the worst-case receptor in the region of the development are at most 52% of the limit value in 2021 and 53% in 2036. The 24-hour mean limit value of 50 $\mu g/m^3$ is expressed as a 90.4th percentile (i.e. it must not be exceeded more than 35 times per year). It is predicted that receptor R1 will experience at most 5 days of exceedance with the proposed development in place. This is an increase of one day when compared with the do nothing scenario. All other receptors will experience at most 4 days of exceedance either with or without the proposed development in place.

Relative to do nothing levels, some imperceptible increases in PM_{10} levels are predicted at receptors R2, R3 and R4. Receptor R1 will experience a small increase in PM_{10} concentrations. Concentrations will increase by at most 1.3% of the relevant limit value in 2036 at receptor R1. Thus, the magnitude of the changes in air quality are negligible at all receptors based on the criteria outlined in Appendix 9.2 Tables A9.2.1 – A9.2.3. Therefore, the overall impact of PM_{10} concentrations as a result of the proposed development is long-term, negative and imperceptible.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ are shown in Table 9.15. Predicted annual average concentrations in the region of the proposed development are at most 58% of the limit value in 2021 and 59% in 2036 at the worst-case receptor.

Relative to do nothing levels it is predicted that there will be some imperceptible to small increases in $PM_{2.5}$ levels at the worst-case receptors assessed. Concentrations will increase by at most 1.4% of the relevant limit value in 2036 at receptor R1. Using the assessment criteria in Appendix 9.2 Table A9.2.1 and Table A9.2.2 the impact of the proposed development in terms of $PM_{2.5}$ is considered negligible. Therefore, the overall impact of the proposed development on $PM_{2.5}$ concentrations is predicted to be long-term, negative and imperceptible.

Summary of Local Air Quality Modelling Assessment

Levels of traffic-derived air pollutants from the proposed 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 9.2 Tables A9.2.1 – A9.2.3, the impact of the development in terms of PM_{10} and $PM_{2.5}$ is long-term, localised and imperceptible. The impact in terms of NO_2, is considered long-term and slight negative. However, it should be noted that all receptors assessed are of medium to low sensitivity in terms of air quality and there is already a relatively high background level of pollutants within the port area due to its nature. Air quality impacts as a result of the proposed development are not considered significant.

A nitrogen deposition assessment for the nearby ecological site South Dublin Bay and River Tolka SPA has been scoped out based on the criteria in Section 9.3.2.2. Therefore the impact can be considered imperceptible.

9.5.3.2 Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development. The predicted concentrations of CO_2 for the future years of 2021 and 2036 are detailed in Table 9.16. These are significantly less than the 2020 and 2030 targets set out under EU legislation. It is predicted that in 2021 the proposed development will increase CO_2 emissions by 0.0010% of the EU 2020 target. In 2036 CO_2 emissions will increase by 0.0018% of the 2030 target. Therefore, the climate impact of the proposed development is considered negative, long-term and imperceptible.

9.5.3.3 Human Health

Traffic related air emissions have the potential to impact air quality which can affect human health. However, air dispersion modelling of traffic emissions has shown that levels of all pollutants are below the ambient air quality standards set for the protection of human health. It can be determined that the impact to human health during the operational stage is long-term, negative and imperceptible.

Table 9.12 Annual Mean NO_2 Concentrations (µg/m^3)

Receptor	Opening Year 2021					Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	29.3	32.4	3.16	Medium	Slight Adverse Increase	31.3	35.8	4.51	Large	Slight Adverse Increase
R2	27.9	29.6	1.74	Small	Negligible Increase	29.3	31.8	2.52	Medium	Slight Adverse Increase
R3	26.5	27.3	0.82	Small	Negligible Increase	27.2	28.4	1.17	Small	Negligible Increase
R4	26.6	27.8	1.25	Small	Negligible Increase	27.4	29.2	1.80	Small	Negligible Increase

Table 9.13 99.8th percentile of daily maximum 1-hour NO_2 concentrations (µg/m^3)

Receptor	Opening Year 2021		Design Year 2036	
	DN	DS	DN	DS
R1	102.4	113.5	109.4	125.2
R2	97.5	103.6	102.4	111.2
R3	92.7	95.6	95.3	99.4
R4	93.0	96.0	95.7	100.0

Table 9.14 Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor	Opening Year 2021					Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	20.4	20.8	0.32	Imperceptible	Negligible Increase	20.7	21.2	0.51	Small	Negligible Increase
R2	20.3	20.5	0.17	Imperceptible	Negligible Increase	20.5	20.8	0.27	Imperceptible	Negligible Increase
R3	20.2	20.2	0.08	Imperceptible	Negligible Increase	20.3	20.4	0.12	Imperceptible	Negligible Increase
R4	20.2	20.3	0.08	Imperceptible	Negligible Increase	20.3	20.4	0.13	Imperceptible	Negligible Increase

Table 9.15 Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	Opening Year 2021					Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	14.3	14.5	0.22	Imperceptible	Negligible Increase	14.5	14.8	0.35	Small	Negligible Increase
R2	14.2	14.3	0.12	Imperceptible	Negligible Increase	14.3	14.5	0.19	Imperceptible	Negligible Increase
R3	14.1	14.2	0.06	Imperceptible	Negligible Increase	14.2	14.3	0.09	Imperceptible	Negligible Increase
R4	14.1	14.2	0.06	Imperceptible	Negligible Increase	14.2	14.3	0.09	Imperceptible	Negligible Increase

Table 9.16 Climate Impact Assessment

Year	**Scenario**	**CO_2** **(tonnes/annum)**
2021	Do Nothing	914
	Do Something	1,285
2036	Do Nothing	1,444
	Do Something	2,025
Increment in 2021		370.5 Tonnes
Increment in 2036		581.0 Tonnes
Emission Ceiling (kilo Tonnes) 2020		**37,943** **Note 1**
Emission Ceiling (kilo Tonnes) 2030		**32,860** **Note 2**
Impact in 2021 (%)		0.0010 %
Impact in 2036 (%)		0.0018 %

Note 1 Target under *European Commission Decision 2017/1471 of 10th August 2017 and amending decision 2013/162/EU to revise Member States' annual emissions allocations for the period from 2017 to 2020*

Note 2 Target under *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013*

9.6 REMEDIAL AND MITIGATION MEASURES

9.6.1 Construction Phase

9.6.1.1 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 9.3, these will be incorporated into the overall Construction Environmental Management Plan (CEMP) for the site.

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures 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.

9.6.1.2 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 nature of these works, the impact on climate will be imperceptible.

Nevertheless, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are minimised. 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.

9.6.2 Operational Phase

Trucks must be prevented from leaving engines idling while on site in order to reduce unnecessary emissions.

No additional mitigation measures are required as the operational phase of the proposed development as it is predicted to have an insignificant impact on ambient air quality and climate.

9.7 PREDICTED IMPACTS OF THE DEVELOPMENT

9.7.1 Construction Phase

Once the dust minimisation measures outlined in Section 9.6.1.1 and Appendix 9.3 are implemented, the impact of the proposed development in terms of dust soiling or particulate matter emissions will be short-term and not significant at nearby receptors.

Impacts to climate are considered imperceptible during the construction stage of the proposed development.

9.7.2 Operational Phase

The results of the air dispersion modelling indicate that the impact of the proposed development on air quality and climate is considered long-term and insignificant.

9.8 RESIDUAL IMPACTS

Impacts to air quality during the construction phase are considered short-term and not significant once the mitigation measures outlined in Appendix 9.3 and Section 9.6.1.1 are implemented. Impacts to climate during the construction phase are considered imperceptible.

The results of the air dispersion modelling indicate that the impact of the proposed development on air quality and climate is considered long-term and insignificant.

9.9 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (including other Brexit related developments at nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 9.9.1 and 9.9.2 below.

9.9.1 Construction Phase

During the construction phase there is the potential for cumulative dust impacts with other construction works within 350 m of the development site (IAQM, 2014). The dust mitigation measures outlined in Appendix 9.3 should be applied throughout the construction phase of the proposed development which will avoid the potential for significant cumulative dust impacts to nearby sensitive receptors. 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.

9.9.2 Operational Phase

Cumulative impacts have been incorporated into the traffic data supplied for the operational stage air and climate modelling assessments. The results of the modelling assessment (section 9.5.2) show that there is an insignificant impact to air quality and an imperceptible impact to climate during the operational stage.

If additional medium to large scale 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. Future projects of a large scale would need to conduct an EIAR to ensure that no significant impacts on air quality will occur as a result of those developments.

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APPENDIX 9.1

AMBIENT AIR QUALITY STANDARDS

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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 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/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 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3). Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/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 µg/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:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km 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.

APPENDIX 9.2

TRANSPORT INFRASTRUCTURE IRELAND ASSESSMENT CRITERIA

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Table A9.2.1 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 A9.2.2 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 A9.2.3 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**		
	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

APPENDIX 9.3

DUST MINIMISATION PLAN

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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 (IAQM (2014), BRE (2003), The Scottish Office (1996), UK ODPM (2002)) and the USA (USEPA, 1997).

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 Figure 9.1 for the windrose for Dublin Airport). As the prevailing wind is predominantly south-westerly to south-easterly, 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 (IAQM, 2014; UK ODPM, 2002). 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 (USEPA, 1986). 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 were 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.

Demolition

- Prior to demolition blocks should be soft striped inside buildings (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- During the demolition process, water suppression should be used, preferably with a hand-held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays/local extraction should be used.
- Drop heights from conveyors, loading shovels, hoppers and other loading equipment should be minimised, if necessary fine water sprays should be employed.

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% (UK ODPM, 2002).

- 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% (USEPA, 1997). 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 (UK ODPM, 2002).
- 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.

10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

This chapter of the EIAR assesses the potential noise and vibration impacts associated with the proposed development.

The chapter has been prepared in accordance with relevant guidance as outlined in the following Environmental Protection Agency (EPA) publications:

- Environmental Protection Agency (EPA) Draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (2017);
- European Commission 'Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report' 2017, and;
- EPA Draft 'Advice Notes for preparing Environmental Impact Statements' (2015).

This chapter of the EIAR should be read in conjunction with Chapter 2 – Description of Proposed Development. Appendix 10.1 presents a glossary of the acoustic terminology used in this section.

10.2 METHODOLOGY

This Assessment has been undertaken using the following methodology:

- Review of relevant guidance to identify appropriate noise criteria for the development;
- Review of baseline noise data available in the vicinity of the site, to identify existing levels of noise in the receiving environment.
- Predict noise emissions at the nearest noise sensitive locations for the operational phase. Prediction calculations for building services noise have been conducted generally in accordance with ISO 9613 (1996): Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
- Assess the predicted noise levels against the appropriate criteria and existing noise levels and outline mitigation measures, where required.

10.3 RECEIVING ENVIRONMENT

The subject sites are c. 5.4 hectares in extent and are located at Dublin Port, Dublin 3 (See Figure 1.1 in Chapter 1 Introduction).

The proposed development sites are located at Bond Drive Extension and Yard 3, Bond Drive Extension and Yard 4, Promenade Road, Dublin Port, Dublin 3 which currently comprises warehouse buildings, existing hardstanding areas, and truck and car parking areas. The site will primarily be built on existing hardstand/gravel surfaces, but some upgrade works will be undertaken for site entrance, roadways etc.

Figures 10.1 and 10.2 present the road traffic noise levels across the site as reported in the Dublin Agglomeration Noise Action Plan 2018 – 2023.

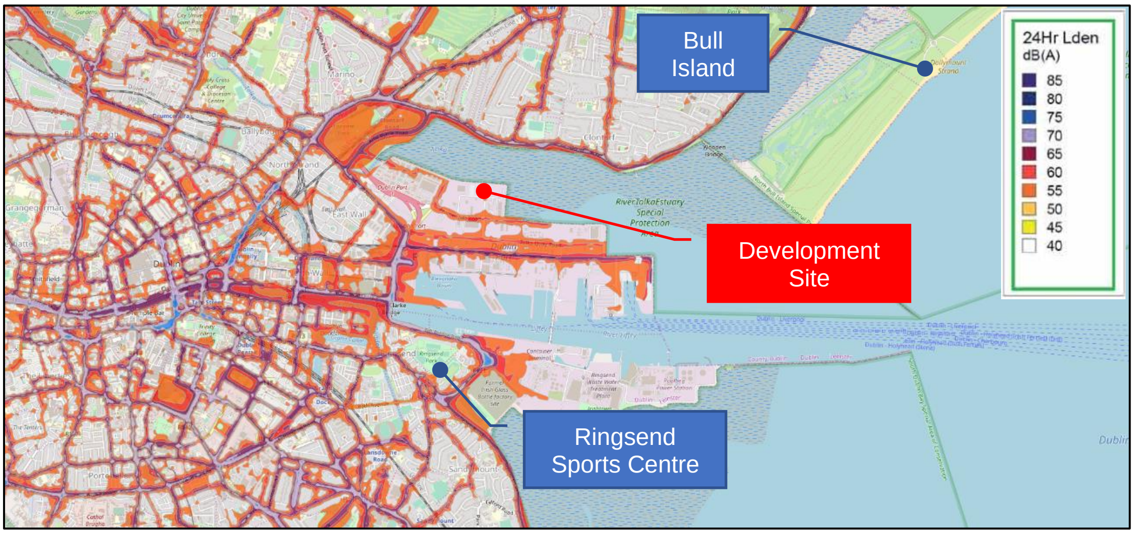

Figure 10.1 Existing L_{den} Traffic Noise Level (Source: https://gis.epa.ie/EPAMaps/)

Figure 10.2 Existing L_{night} Traffic Noise Level (Source: https://gis.epa.ie/EPAMaps/)

In addition to the EPA noise maps, reference has also been made to the noise monitoring network operated by Dublin City Council. Figure 10.3 presents the average hourly noise levels measured at the two nearest monitoring stations to the development site over the 2 week period 15th to 29th October 2019. These locations are Bull Island and Ringsend Sports Centre as indicated previously on Figures 10.1 and 10.2.

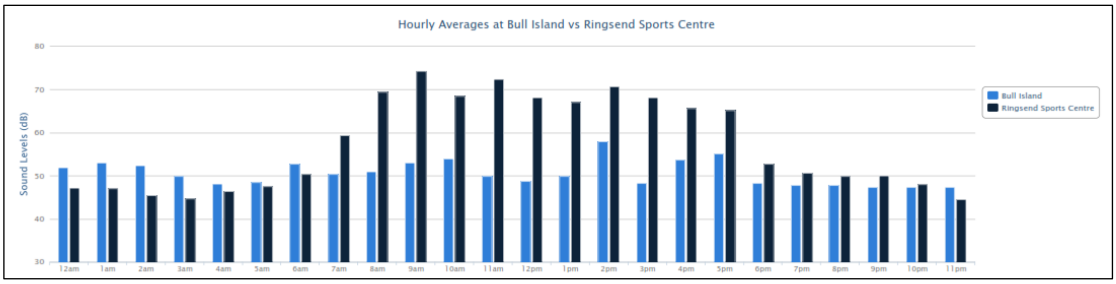

Figure 10.3 Measured Hourly Noise Level (Source: http://dublincitynoise.sonitussystems.com/)

10.4 CHARACTERISTICS OF THE DEVELOPMENT

A detailed description of the development has been outlined in Chapter 2 – Description of Proposed Development. In relation to noise and vibration, the following key characteristics are considered in this assessment.

10.4.1 Construction Phase

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, piling rigs, lifting equipment, dumper trucks, compressors and generators.

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays.

10.4.2 Operational Phase

The primary sources of noise that are expected in the operational context are discussed below:

- Building services plant; and
- HGV and light vehicle activity on site.

These elements are assessed in the following sections.

10.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

When assessing the potential impacts of the development the nearest noise sensitive receptors will be considered. Figure 10.4 identifies the nearest noise sensitive receptors to the development site.

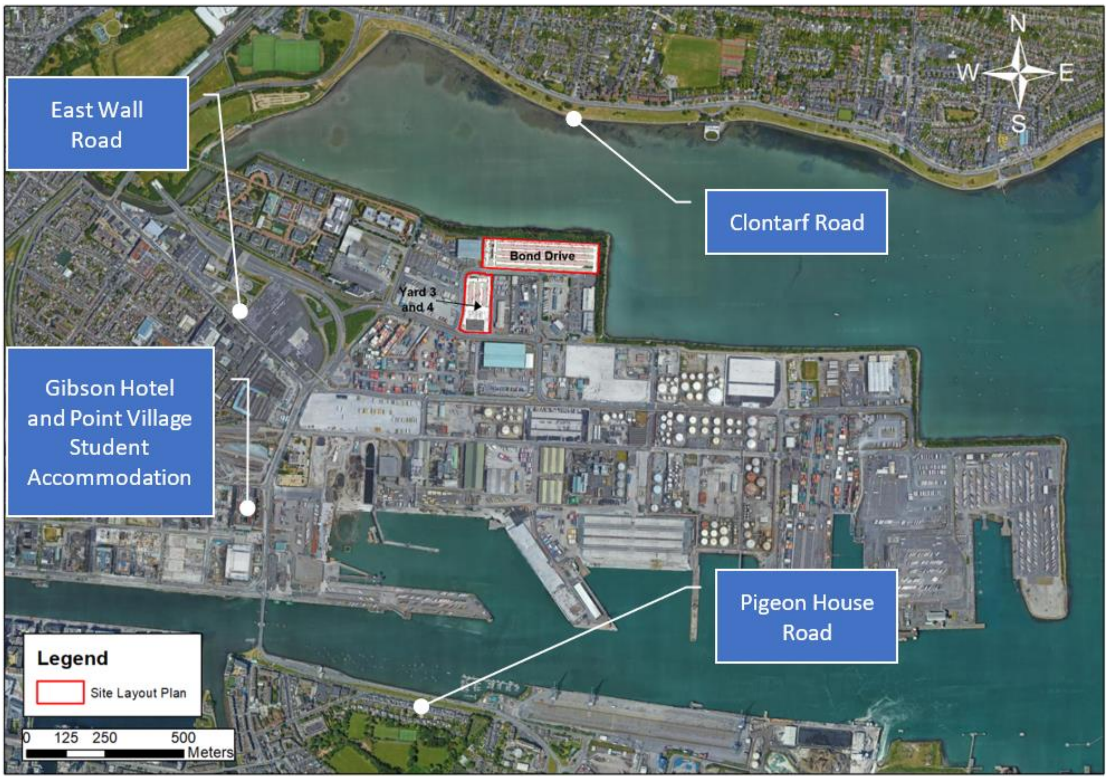

Figure 10.4 Nearest Noise Sensitive Receptors

10.5.1 Significance of Impacts

Relevant Guidance

The significance of noise and vibration impacts has been assessed in accordance with the Environmental Protection Agency (EPA) Draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (2017) see Tables 10.1 to 10.3 below. As these guidelines do not quantify the impacts in decibel terms further reference has been made to the draft '*Guidelines for Noise Impact Assessment*' produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party.

With regard to the quality of the impact, ratings may have positive, neutral or negative applications where:

Table 10.1 Quality of Potential Effects

Quality of Impact	Definition
Negative	A change which reduces the quality of the environment (e.g. by causing a nuisance).
Neutral	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Positive	A change that improves the quality of the environment (e.g. by removing a nuisance).

The significance of an impact on the receiving environment are described as follows:

Table 10.2 Significance of Effects

Significance of Impact on the Receiving Environment	Description of Potential Impact
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.

The duration of impacts as described in the EPA Guidelines are:

Table 10.3 Duration of Effects

Duration of Impact	Definition
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting one year or less
Short-term	Effects lasting one to seven years
Medium-term	Effects lasting seven to fifteen years
Long-term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years
Reversible	Effects that can be undone, for example through remediation or restoration

Assessment of Significance

The draft '*Guidelines for Noise Impact Assessment*' produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party have been referenced in relation to the potential impact of changes in the ambient noise levels during the construction and the operational phases of the proposed development.

The findings of the Working Party are draft at present although they are of some assistance in this assessment. The draft guidelines state that for any assessment, the noise level threshold and significance should be determined by the assessor, based upon the specific evidence and likely subjective response to noise.

The draft 'Guidelines for Noise Impact Assessment' impact scale adopted in this assessment is shown in Table 10.4 below. The corresponding significance of impact presented in the Draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (2017) is also presented.

Table 10.4 Noise Impact Scale

Noise Level Change dB(A)	Subjective Response	Impact Guidelines for Noise Impact Assessment Significance (IoA)	Impact Guidelines on the Information to be contained in EIAR's (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	Profound

The significance table reflect the key benchmarks that relate to human perception of sound. A change of 3dB(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.

It is considered that the ratings specified in the above table provide a good indication as to the likely significance of changes on noise levels in this case and have been used to assess the impact of operational noise.

10.5.2 Relevant Criteria

<u>Construction Phase – Noise Criteria</u>

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. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. However, there are several publications commonly used in Ireland to set appropriate construction noise criteria. Each of these is discussed in the following paragraphs.

TII Guidelines

Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) publication *Guidelines for the Treatment of Noise and Vibration in National Road*

Schemes contains information on the permissible construction noise levels for various hours of operation. The noise level limits are outlined in Table 10.5.

Table 10.5 Maximum Allowable Construction Noise Levels at Dwellings

Period	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

BS-5228

Potential noise impacts during the construction phase of a project are often assessed in accordance with British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.

BS5228-1:2009+A1 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states:

> "*Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut*."

Paragraph E.2 goes on to state:

> "*Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*
>
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
>
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas*".

For residential properties it is considered appropriate to adopt the 70 dB(A) criterion for construction noise.

Construction Phase – Vibration Criteria

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS 7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993); and
- BS 5228 – *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2009+A1:2014).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more buildings with any structural weakness or protected structures.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004) also contains information on the permissible construction vibration levels during the construction phase as shown in Table 10.6.

Table 10.6 Construction Vibration Maximum Allowable Levels

Property Type	Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive building to the source of vibration, at a frequency of		
	Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
Commercial, Industrial or similar	8 mm/s	12.5 mm/s	20 mm/s

Following review of the guidance documents set out above the values in Table 10.6 are considered appropriate for this assessment.

Operational Phase – Noise Criteria

Due consideration will be given to the nature of the primary noise sources when setting criteria. In this instance, there are two primary sources of noise associated with the development, noise from fixed mechanical plant and noise from HGV movements and activity on site.

Criteria for noise from these sources shall be set in terms of the $L_{Aeq,T}$ parameter.

Appropriate guidance for acceptable ambient noise levels is contained within BS8233: 2014: *Sound Insulation and Noise Reduction for Buildings*. This standard provides indoor ambient noise levels for dwellings as follows:

Table 10.6 Indoor ambient noise levels for dwellings from BS8233: 2014

Activity	Location	Day 07:00 to 23:00hrs dB $L_{Aeq,16hour}$	Night 23:00 to 07:00hrs dB
Resting	Living room	35	–
Dining	Dining room/area	40	–
Sleeping (daytime resting)	Bedroom	35	30 ($L_{Aeq,8hour}$) 45 (L_{Amax})*

*Note The document comments that the internal $L_{AFmax,}$ noise level may be exceeded up to 10 times per night without a significant impact occurring.

BS8233 notes the following pertinent information in relation to the guideline values outlined in *Table 4* of the Standard (Table 10.6 above):

> "…*NOTE 2 The levels shown in Table 4 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4…*
>
> *…NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."*

With respect to noise sources containing distinguishable characteristics Section 7.7.1 of BS8233 states:

> "*Occupants are usually more tolerant of noise without a specific character than, for example, that from a neighbour which can trigger a complex emotional reaction. For simplicity, only noise without character is considered in Table 4. For dwellings the main considerations are:*
>
> *a) For bedrooms, the acoustic effect on sleep; and*
>
> *b) For other rooms, the acoustics effect on resting, listening and communicating.*
>
> *NOTE Noise has a specific character feature such as distinguishable discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

For the purposes of this study, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window. This is nominally deemed to fall in the range of 15dB.

In summary, the following operational noise criteria should be adopted at residential properties nearest the development:

- Daytime (07:00 to 23:00 hours) 55dB $L_{Aeq,1hour}$
- Night-time (23:00 to 07:00 hours) 45dB $L_{Aeq,15minute}$

There should be no audible tonal or impulsive noises from the development at any Noise Sensitive Location during night time hours (23:00hrs to 07:00hrs).

The design criteria outlined above are considered robust and appropriate for the environment under consideration.

Operational Phase – Vibration Criteria

It is considered that the proposed development will not give rise to any significant or perceptible levels of vibration in the receiving environment. Vibration criteria are therefore not deemed to be necessary for the operational phase of this development.

10.5.3 Construction Phase Noise Impacts

Given that works during the construction phase will be transient in nature and will involve the use of several different plant items at any one time, it is difficult at this stage of the assessment to state accurately what items of plant will be in use and what levels of noise will be experienced during construction works.

The construction works associated with the removal of hardstanding and resurfacing the new carpark will likely involve the use of mobile breaker tracked excavator dumper trucks and HGV's, other site activities including piling rigs and from smaller lifting equipment, mobile plant, compressors, generators etc. will also be in use.

For the purpose of preparing construction noise calculations relating to the development, an overall sound power level of 115dB $L_{W(A)}$ for this work has been used. This level is equivalent to 5 items of construction plant operating simultaneously with a sound pressure level of 80dB L_{Aeq} each at a distance of 10 metres. Given the range of activities during any one phase, this is considered to provide a good approximation of noise from the site.

The closest noise sensitive buildings to the proposed development are more than 400 metres beyond the site boundary.

Indicative worst-case construction noise levels based on the above assumptions are calculated at 55dB L_{Aeq} at the closest noise sensitive locations. The calculated noise levels are within the recommended construction noise limits of 70dB L_{Aeq} outlined in Section 10.5.2.

The contractor for the works will continue to ensure that all best practice measures relating to the control and minimisation of noise and vibration are employed during all phases of work. Further details are set out in Section 10.6 of this document.

10.5.4 Construction Phase Vibration Impacts

Given the distance to the nearest noise sensitive location and the expected levels of vibration associated with the proposed activities, there are no significant vibration impacts expected during the construction phase of the development. Vibration levels are expected to be below a level that would cause disturbance to building occupants.

10.5.5 Operational Phase Noise Impacts

The primary sources of noise that are expected in the operational context are discussed below:

- Building services plant; and
- HGV activity on site.

Each of these operational scenarios are addressed in the following sections.

Building Services Noise

There are several plant items associated with the operation of the proposed development. Most of this plant can generate noise to some degree. Noisy plant items located externally will potentially have the greatest impact on the receiving environment. At this stage of the development, specific details of the type and number of plant items required for the development are not available. In this instance, it is best practice to set appropriate emission limits relating to plant items which will be used during the detailed design stage.

Making reference to the adopted noise limits as described in Section 10.5.2, the cumulative noise levels associated with building services plant items at the façade of the nearest noise sensitive receptors to the development site will be designed to not exceed the following level:

- Daytime - 55dB $L_{Aeq,1hr}$, and;
- Night-time - 45dB $L_{Aeq,15 minutes}$.

These limits have been set in order to preserve the existing noise environment. Section 10.6.2 will outline typical mitigation measures that will be employed to achieve these limits.

Noise from HGV and Light Vehicle Activity

When operational there will be vehicle movements to and from the facility as well as vehicles manoeuvring within the facility itself.

The noise impact of vehicle movements to and from the facility using the local road network is assessed in the context of the increase in traffic noise as a result of these movements. The development will not increase the traffic volumes on the road network surrounding Dublin Port and instead only results in a redistribution of traffic within the port itself, hence noise levels will not increase due to traffic on the local road network outside the port.

With regards to vehicle activity on site the noise emissions here will be as a result of engine noise, reverse beacons and refrigerated units in operation. In this instance the significant distance (>500 metres) between the site and the nearest noise sensitive receptor will ensure that any noise emissions are attenuated by a significant degree before reaching the receptor.

To assess the potential noise impact of vehicle movements on each area of the development the development traffic, as outlined in Chapter 13, has been used for each of the following periods:

- Night-time – based on the AM peak hour of 05:30 to 06:30 which coincides with the arrival of ferry services, and;
- Daytime – based on the PM peak of 16:45 to 17:45.

The Bond Drive Extension facility is the largest and also the site located closest to the nearest noise sensitive locations along the Clontarf Road approximately 530m to the north. Traffic flows to the Bond Drive Extension facility are,

- Night-time – 120 HGV movements, and;
- Daytime – 82 HGV movements.

The assessment methodology adopted was to calculate the resultant noise level at the nearest noise sensitive location based on the number of HGV movements and using a source sound power level of 104 dB(A) L_w for a HGV travelling at speed <20km/h (source reference level European Imagine Project[1]).

Taking the number of HGV movements, the distance of 530m to Clontarf Rd and an assessment time of 1hr for daytime and 15 minutes for night-time, the resultant noise level is calculated as follows:

- Night-time – 27dB $L_{Aeq,15min}$ (note this assumes that 25% of the hourly flow occurs over each 15 minute period), and;
- Daytime – 25dB $L_{Aeq,1hr}$.

It is possible that some HGV's may operate refrigeration units when parked on site. Refrigeration units typically have relatively high noise levels associated with their operation. AWN has a database of noise measurements of refrigeration trailers, the noise emissions used for this assessment is that the refrigeration unit has a sound power level of 94dB(A) L_w.

The numbers of HGV's that will operate refrigeration units when on site is unknown at this time, however predicted noise levels have been calculated for making a worst-case assumption that the 16 parking bays on the northern boundary of the Bond Drive Extension facility are occupied by refrigerated units operating continuously for the entire assessment period, i.e. 1hr during the day and 15 minutes at night. The resultant noise level is calculated as 44dB $L_{Aeq,T}$. Therefore, the cumulative noise impact of both HGV movements and this assumed quantity of refrigerated units is as follows:

- Night-time – 44dB $L_{Aeq,15min}$, and;
- Daytime – 44dB L_{Aeq},1hr.

Finally, most HGV's will have reversing alarms that will sound on site. Reverse alarms will sound intermittently and will have a negligible contribution the overall operational noise emissions for the development, however, the distinguishable character associated with the alarms may cause an adverse reaction in some instances.

The other facilities at Yards 3 & 4 are located at a greater distance from the noise sensitive locations and have fewer traffic movements associated with them and therefore the cumulative impact of all sites is no greater than that predicted for Bond Drive Extension facility above.

10.5.6 Operational Phase Vibration Impacts

There are no significant sources of vibration expected from the operational phase of the development.

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[1] IMAGINE – Improved Methods for the Assessment of the Generic Impact of Noise in the Environment European Commission.

10.6 REMEDIAL AND MITIGATION MEASURES

10.6.1 Construction Phase

The assessment of construction phase impacts has found that significant noise and vibration impacts are not expected. Notwithstanding this, best practice noise and vibration control measures will be employed by the contractor during the construction phase in order to avoid significant impacts at the nearest sensitive buildings. The best practice measures set out in BS 5228 (2009 +A1 2014) Parts 1 and 2 will be adopted. This includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- Selection of quiet plant;
- Noise control at source;
- Screening, and;
- Liaison with the public.

10.6.2 Operational Phase

The impact assessment has found that predicted noise levels associated with the day to day operations of the site will be well within the proposed criteria applicable to a site of this nature.

It is acknowledged that the detail design of the facility may result in alterations to the plant selection and the associated sound output from the operational plant items. It is possible therefore for the operational noise criteria to be achieved by alternative means including selection of plant items with alternative noise output or with the inclusion of at source attenuation, plant screening etc.

Any alterations to the noise source data, building and plant layouts associated with operational phase of the development will be designed such that the operational noise criteria outlined in this report are achieved and associated noise impacts are in line with those discussed in Section 10.5.3.

It is critical that personnel on site behave in a manner that which minimises noise potential noise disturbance, the following ‘good practice’ mitigation measures are advised for the site:

- Vehicle engines shall not be left idling once on site.
- On-board refrigeration units (if any) shall also be turned off where possible when on site or connected to main power if possible.
- Refrigerated units that must remain running when on site should be directed to parking bays located away from the northern boundary which is closest to the nearest noise sensitive locations.
- Drivers should minimise impact sounds whilst working about their vehicles. This includes dropping tailgates and moving cages and pallets.
- All radios and amplified sound from the truck cab shall be turned off prior to the doors being opened.
- There should be no unnecessary shouting or communicating in raised voices whilst on site.
- There should be no unnecessary sounding of horns or alarms whilst on site.

Once the site is operational a review of on-site activities should be undertaken to identify practicable noise control measures and develop a specific Noise Control Policy for the site to minimise potential noise impacts.

10.7 PREDICTED IMPACTS OF THE DEVELOPMENT

10.7.1 Construction Phase

During the construction phase of the project there is the potential for temporary noise impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum as far as practicable.

The probability of noise effects from the construction phase of the developments are likely and a description of effects are summarised in Table 10.7.

Table 10.7 Significance of Noise Effects – Construction Phase

Quality	Significance	Duration
Negative	Slight to Moderate	Short-term

The probability of vibration effects from the construction phase of the development is not likely and a description of effects are summarised in Table 10.8

Table 10.8 Significance of Vibration Effects – Construction Phase

Quality	Significance	Duration
Neutral	Negligible	Short-term

10.7.2 Operational Phase

The impact assessment has found that predicted noise levels associated with the day to day operations of the site will be well with the proposed criteria applicable to a site of this nature.

The probability of effects from the operational phase of the developments are likely and a description of effects are summarised in Table 10.9.

Table 10.9 Significance of Effects – Operational Phase

Quality	Significance	Duration
Neutral	Not Significant	Long-term

10.8 CUMULATIVE IMPACTS

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments including Brexit related developments at the nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 10.8.1 and 10.8.2 below.

10.8.1 Construction Phase

There is the potential for temporary noise impacts on nearby noise sensitive properties due to noise emissions from site activities during construction. In this instance the distance between the development site and nearby sensitive locations is such that once standard mitigation is in place (as outlined in Section 10.6) for management of construction noise, the effect due to construction in this area is considered to be a ***negative*** on quality and a ***slight to moderate*** in significance. Contractors for the proposed development will be contractually required to operate in compliance with a CEMP which will include the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect the environment from noise and vibration.

Furthermore, once the distance between the proposed development and other permitted developments is taken into account, there will be no significant cumulative noise and vibration impact. This conclusion has been reached by reviewing the EIAR chapters on Noise & Vibration for the Alexander Basin and MP2 developments. In both instances the predicted noise level during construction are more than 10dB below the predicted noise impacts during construction of this development. No major infrastructural work is required at T7, T9, T10 and Yard 2 and the proposed minor works will not result in significant noise emissions to the environment. As a result there will be no significant cumulative impact and the cumulative impact is therefore also considered to be ***negative*** *and* ***slight to moderate***.

10.8.2 Operational Phase

Overall there will be no significant change in the noise environment at the nearest noise sensitive locations due to the proposed and planned developments. The operation of the proposed development is concluded to have a ***long-term, not significant*** significance *with a* ***neutral*** impact on noise and vibration.

On review of the noise and vibration assessments carried out for the Alexander Basin and MP2 projects as well as the screening report carried out for the other Brexit developments and Dublin Port Greenway it is confirmed that operational impacts for all of these developments and the other Brexit developments will not generate any significant cumulative noise or vibration impact when considered in combination with the current proposed development. This is due to the relative distances between the various developments and nearby sensitive locations and also in some instances due to the fact that the operation of the proposed developments, e.g. MP2 and Greenway, are not expected to result in any operational noise or vibration impact.

Therefore the cumulative impact of noise and vibration on the surrounding environment is also considered to have a ***long-term, not significant*** significance *with a* ***neutral*** impact*.*

10.9 INTERACTIONS

The potential interaction between Noise and Vibration and other Chapters in the EIAR is primarily limited to Chapter 5 - Population & Human Health.

10.10 REFERENCES

- Environmental Protection Agency (EPA) Draft ‘Guidelines on the Information to be Contained in Environmental Impact Assessment Reports’ (2017);
- European Commission *‘Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report’* 2017
- EPA Draft ‘Advice Notes for preparing Environmental Impact Statements’ (2015);
- *Calculation of Road Traffic Noise (CRTN)* issued by the Department of Transport in 1988.
- Draft ‘*Guidelines for Noise Impact Assessment*’ produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party.
- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*.
- BS 4142:2014: *Methods for rating and assessing industrial and commercial sound.*
- British Standard *BS 6472 (1992): Guide to Evaluation of human exposure to vibration in buildings (1Hz to 80Hz).*
- ISO 9613 (1996): *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.*
- Alexandra Basin Redevelopment EIAR, 2014 – Chapter 7
- MP2 Project EIAR, 2019 – Chapter 11
- Dublin Port Road Improvement Project – Environmental Impact Assessment Screening Report, May 2016

APPENDIX 10.1

Acoustic Terminology

ambient noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
background noise	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).
broadband	Sounds that contain energy distributed across a wide range of frequencies.
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB L_{pA}	An ‘A-weighted decibel’ - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. ‘A’–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hertz (Hz)	The unit of sound frequency in cycles per second.
impulsive noise	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AFN}	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the “Fast” time weighting.
$L_{Ar,T}$	The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the “Fast” time weighting.
L_{AT}(DW)	equivalent continuous downwind sound pressure level.
L_{fT}(DW)	equivalent continuous downwind octave-band sound pressure level.

L_{day}	L_{day} is the average noise level during the day time period of 07:00hrs to 19:00hrs
L_{night}	L_{night} is the average noise level during the night-time period of 23:00hrs to 07:00hrs.
low frequency noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
noise	Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.
noise sensitive location	NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
rating level	See $L_{Ar,T}$.
sound power level	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m^2 where: $Lw = 10 Log \frac{P}{P_0}$ dB Where: p is the rms value of sound power in pascals; and P_0 is 1 pW.
sound pressure level	The sound pressure level at a point is defined as: $Lp = 20 Log \frac{P}{P_0}$ dB
specific noise level	A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ($L_{Aeq, T}$)'.
tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

$^{1}/_{3}$ octave analysis	Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

11.0 LANDSCAPE AND VISUAL IMPACT

11.1 INTRODUCTION

This chapter of the EIA Report assesses the potential landscape and visual impacts (and resulting effects) likely to occur as a result of the Brexit Infrastructure development at Dublin Port.

Full details of the proposed development can be found in Chapter 2 - Description of Proposed Development.

The section should be read in conjunction with the photomontages prepared for the scheme included in Appendix 11.1 of EIA Report.

The following aspects are particularly relevant to the landscape and visual assessment:

Design

- Form and massing of the proposed development;
- Façade on all above ground structures; and
- Cognisance of how design elements impact on views of the proposed development and any effects on the receiving environment, including landscape character.

Operation

- Views of the proposed development and any effects on the receiving environment, including landscape character.

Construction

- Views of the proposed development and any effects on the receiving environment, including landscape character; and
- Loss or change of existing features that contribute to the receiving environment.

11.2 STUDY METHODOLOGY

11.2.1 General

The landscape assessment has considered the likely significant effects of the proposed development on the landscape as an environmental resource and the visual assessment has considered the effect of visual change on relevant receptors. Landscape and visual effects have been considered for the construction and operation of the proposed development.

To support the assessment, a series of photomontages, illustrating the physical and visual appearance of the proposed development, has been prepared from a range of publicly accessible locations that are representative of views in the surrounding environment. The Photomontage views are included in Appendix 11.1.

The following guidelines were considered and consulted for the purposes of the report:

- Dublin City Development Plan 2016 - 2022
- Environmental Protection Agency, (2017) Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports.
- Environmental Protection Agency, (2015) Draft Advice Notes for preparing Environmental Impact Statements.

- Landscape Institute (UK) and Institute for Environmental Management & Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition.
- European Commission (2017) Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report; and
- Government of Ireland (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).

The methodology used for the landscape assessment entailed:

- Desktop studies of the site in relation to its overall context locally, regionally and nationally; and
- Visiting the site and its environs in between November 2019 and March 2020 to assess the following:
  - Quality and type of views in the area;
  - The extent of the visual envelope, i.e. the potential area of visibility of the site in the surrounding landscape; and,
  - The character and quality of the surrounding landscape in relation to the position of the proposed development.

11.2.2 Nature of Impacts

Impacts on landscape/townscape arise in two distinct but closely related aspects. The first is impact on the character of the landscape/townscape arising from the insertion of new development or the alteration of elements within an existing context. The second aspect is visual impact, which arises as a result of changes or insertions within a view. The impact on the view depends on the degree and nature of the change and such changes may rise from either 'visual intrusion' (i.e. alteration without appreciable blocking) or 'visual obstruction' (i.e. alteration with a notable extent or full blocking).

It is recognised that as with all landscape/townscape and visual considerations, impacts will be influenced and informed, to some degree, by subjective perceptions of how the overall change(s) matter to any given individual.

The assessment of landscape/townscape and visual impacts includes:

- Direct impacts upon specific landscape/townscape elements within and adjacent to the site;
- Effects on the overall pattern of the landscape/townscape elements which give rise to the character of the site and its surroundings;
- Impacts upon any special interests in and around the site;
- Direct impacts of the scheme upon views, and
- Overall impact on townscape character and visual amenity.

11.2.3 Categorisation of the Baseline Environment

The landscape and visual assessment involved visiting the site and its environs between November 2019 and March 2020, to review the nature and scale of existing development surrounding the site, to identify landscape features, local character and land uses, to identify key views to and from the proposed development, and to note receptor sensitivity.

This site based assessment was augmented by reviewing aerial photography, publications and reports and project information included within the planning application and in this EIA Report.

11.2.4 Impact Assessment Methodology

The landscape and visual impact assessment for the proposed development takes account of the character and nature of the existing site and its surrounds, the location of sensitive landscapes and visual receptors, the sensitivity and significance of the site, and its vulnerability to change.

Classification of significance of effects or impacts are based on *Figure 3.5 of the EPA Draft EIA Report Guidelines 2017*, as copied below in Figure 11.1, and on the professional experience of the author in carrying out landscape and visual assessments for over 25 years.

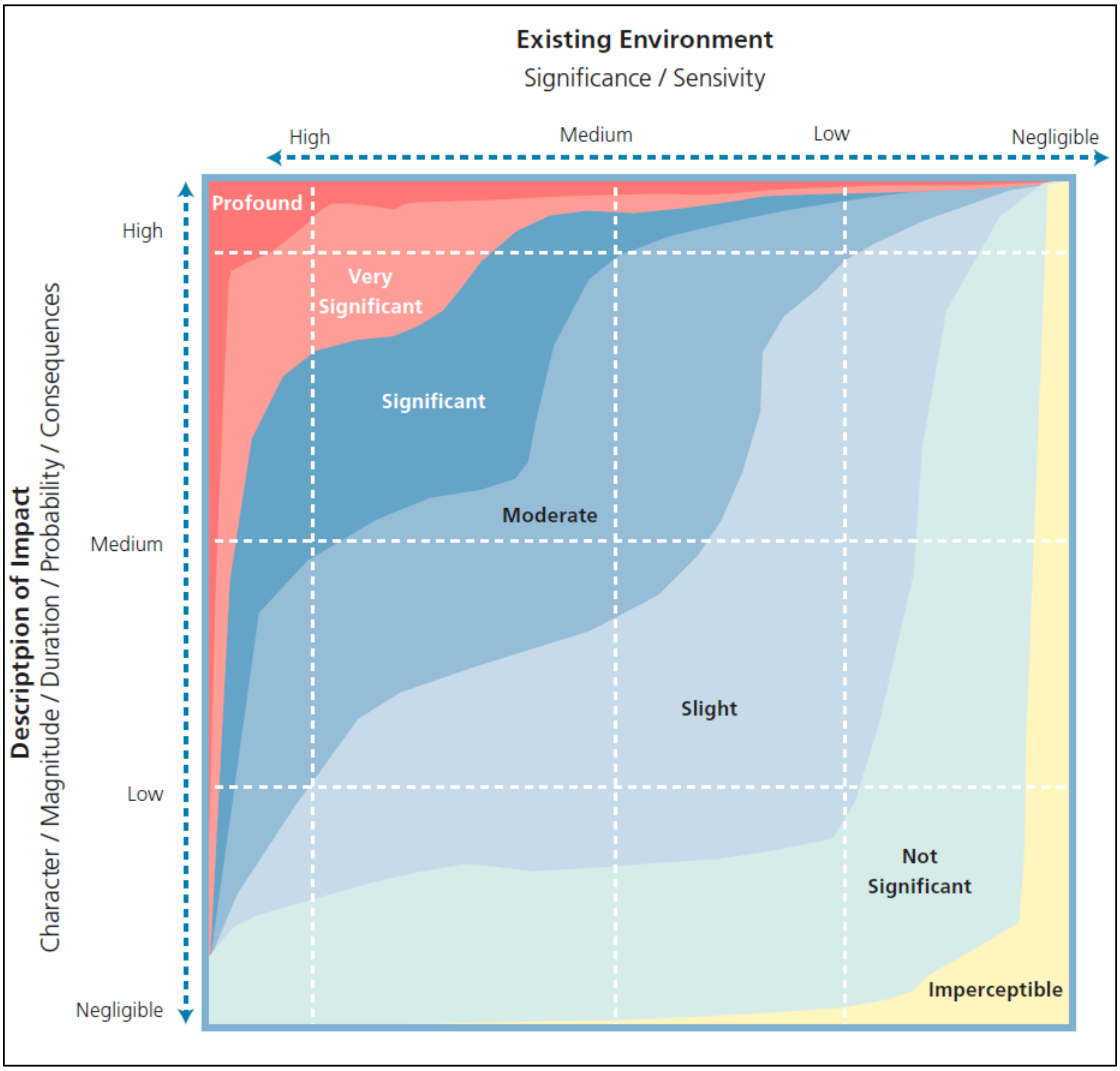

Figure 11.1 Significance of Effects [extract] Figure 3.5, EPA Draft EIA Report Guidelines 2017

The significance of effects, which in nature may be positive, neutral or negative/adverse, are described as follows:

- Imperceptible: An effect capable of measurement but without significant consequences.
- Not significant: An effect which causes noticeable changes in the character of the environment but without significant consequences.
- Slight: An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

- Moderate: An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
- Significant: An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
- Very Significant: An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
- Profound: An effect which obliterates sensitive characteristics.

In terms of duration, effects are considered as follows:

- Momentary: lasting seconds to minutes.
- Brief: lasting up to one day.
- Temporary: lasting up to one year.
- Short-term: lasting one to seven years.
- Medium-term: lasting seven to fifteen years.
- Long-term: lasting fifteen to sixty years.
- Permanent: lasting over sixty years.

Further aspects of effects including their magnitude (i.e. extent, frequency, and context); probability (i.e. likely, indeterminable, ‘worse-case’); and type (i.e. cumulative, interaction (synergistic), residual, indirect, etc.) are also considered in the assessment, where appropriate in accordance with those descriptions outlined in the EPA guidance[1].

There were no particular limitations or constraints in carrying out the assessment.

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[1] See Section 11.2.1 above

11.3 RECEIVING ENVIRONMENT

11.3.1 Site Description and Context

The proposed development site is within the northern part of the established Dublin Port. Dublin Port is located at the eastern edge of Dublin City. The northern port occupies lands east of East Wall Road, and between the River Liffey and Dublin Harbour (Tolka Estuary). The southern part occupies part of the Poolbeg Peninsula to the south of the River Liffey.

Dublin Port is the largest port in Ireland providing both passenger and freight services to the city and country, extending to over 200 hectares and almost 60 hectares north and south of the River Liffey respectively.

Figure 11.2 Site Location and Context

11.3.2 Wider Landscape Setting

Dublin Port is located centrally within the harbour and bay area, and directly east of the city centre. It is an established and busy port and industrial landscape that has evolved in parallel with the city.

The wider context of Dublin Port includes the North Lotts, IFSC and city centre to the west; the established residential areas of East Wall, Fairview and Clontarf to the northwest and north with the Tolka Estuary typically providing 400-500m separation between the northern edge of Dublin Port and the Clontarf Road and Promenade; the North Bull Island to the northeast, and the Poolbeg Peninsula to the south of the River Liffey.

The Dublin Port Estate includes parts of the Poolbeg Peninsula where similar port activity takes place along the River Liffey. The estate also includes the North Bull Wall and the Great South Wall that enclose Dublin Harbour and define the entry point from the Irish Sea. Both are also popular amenity facilities for walking, fishing and bathing.

The Poolbeg Peninsula also includes the Pigeon House Power Station, with its iconic chimneys rising to over 200m in height at the mouth of the harbour, as well as the

Dublin Waste Water Treatment Plant, the Covanta Waste to Energy facility, Irishtown Nature Reserve, and the Seán Moore Park adjacent to the residential area of Ringsend.

11.3.3 Dublin Port North

Dublin Port is of low-lying, flat and industrial landscape character, developed over time on successive areas of land reclaimed from the harbour area, and now extends to over 200 hectares. The port area is substantially a built environment, comprising large expanses of hard standing, accessed via a network of purpose built roadways.

The southern edge along the River Liffey frontage, comprises a range of berthing areas and piers for large cargo and passenger ships. The water's edge includes a range of large scale mobile gantries and roll-on/roll-off ramps for loading and unloading container traffic. There are extensive marshalling areas for container storage and handling, and also for HGV and passenger traffic. There are also a number of oil storage tanks with associated pipe-racks, a ferry terminal building, and occasional large scale industrial warehouse type buildings.

The central spine of port area generally comprises large scale warehouse and tanker storage facilities, together with container storage and handling facilities. While built elements are generally large in scale and extensive in number, there are perceived as part of the overall low lying industrial landscape of the port. There are some notable exceptions, including the North Wall Power Station with its power generation halls and two tall chimneys, and also the Odlums facility comprising clustered arrays of tall silos that present as tall industrial buildings.

The northern section comprises a mix of warehousing, logistics, and marshalling and container storage areas. While there are occasional larger scale warehouse structure, most buildings are relatively modest or small in scale, and none are considered tall. At the western edge of the Dublin Port area, land use transitions to commercial use, with East Point Business Park comprising large floor plate commercial buildings that are typically three to five storeys in height, but with some closer to the port area rising up to seven storeys.

The northern edge of Dublin Port, where it adjoins the Tolka Estuary, features a continuous landscape berm, of varying width and height, planted with trees and shrubs, and providing a softer edge and an element of visual screening from the Clontarf area that is typically 400-500m across the estuary.

11.3.4 Development Site

The proposed Brexit Infrastructure at Dublin Port development will extend to two distinct but proximate areas towards the northern part of Dublin Port.

Bond Drive Extension Site

The Bond Drive Extension site is along the northern edge of Dublin Port, between Bond Drive Extension and Dublin Harbour (Tolka Estuary). The site area currently comprises eight individual logistics, transport and storage compounds, with a combined area of c. 3.75 hectares. The perimeters of the individual compounds are secured by 2.6m high palisade fences, and the compounds are accessed from Bond Drive Ext. via individual gateways within the southern perimeter fencing. All of the compounds are hard surfaced with tarmac, concrete or compacted gravel, and some include small porta cabin or container type offices.

There are continuous tree and shrub planted landscape berms outside the northern and eastern sides of the overall area that form a buffer and visual screen to Dublin Harbour. It is noted that the Dublin Port Masterplan anticipates the construction of a 4km cycle and pedestrian Greenway along the northern shoreline to terminate at a two-tier linear park at the Eastern Terminal Area. This facility will run along the landscape berm along the northern and eastern site boundary referenced above.

To the immediate west of the Bond Road site, the State Warehouse occupies a high-security compound of c. 2.0 hectares, surrounded by high masonry walls with electrified security fencing on top. The compound incorporates extensive marshalling and vehicle storage areas as well as a warehouse of c. 4,500m^2 and c.15.0m in height.

The southern side of Bond Drive Extension is similar in character to the northern side. Compounds are generally larger, and most incorporate permanent purpose built warehouses of varying sizes.

Yards 3 & 4

Yards 3 & 4 are on the southern side of Bond Drive Extension, and extend to Promenade Road further south. The combined sites extent to c. 1.65 hectares, and have frontage onto three sides defined by 2.6m high palisade fencing, while the eastern boundary is shared with another compound. Yards 3 and 4 include warehouses of c. 717 m^2 and 1193 m^2 respectively, and 8-9m high.

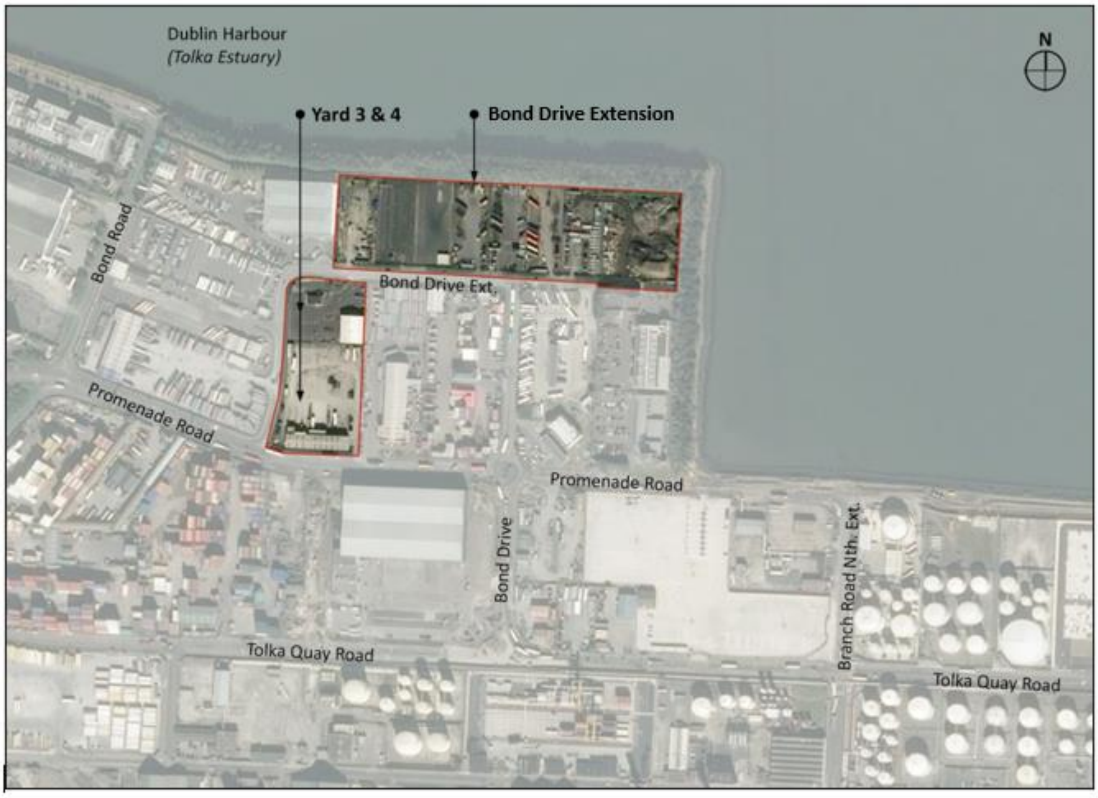

Figure 11.3 Proposed Dublin Port Brexit Infrastructure Development Site Areas

11.4 LANDSCAPE PLANNING AND LAND USE ZONING

There are no national landscape or visual designations pertaining to the site for the proposed Dublin Port Brexit Infrastructure development. In the local context, Dublin Bay has been awarded Biosphere Designation by UNESCO in recognition of its unique ecological and cultural status. The Core Zone of the designation includes the northern area of Dublin Bay and its coastal edges. The entire Dublin Port area north of the River Liffey is considered Transition Zone (Refer to Figure 11.4).

Dublin Bay and the tidal section of the River Liffey are both identified as ‘Waters of National Tourism Significance’ (Fáilte Ireland, 2009).

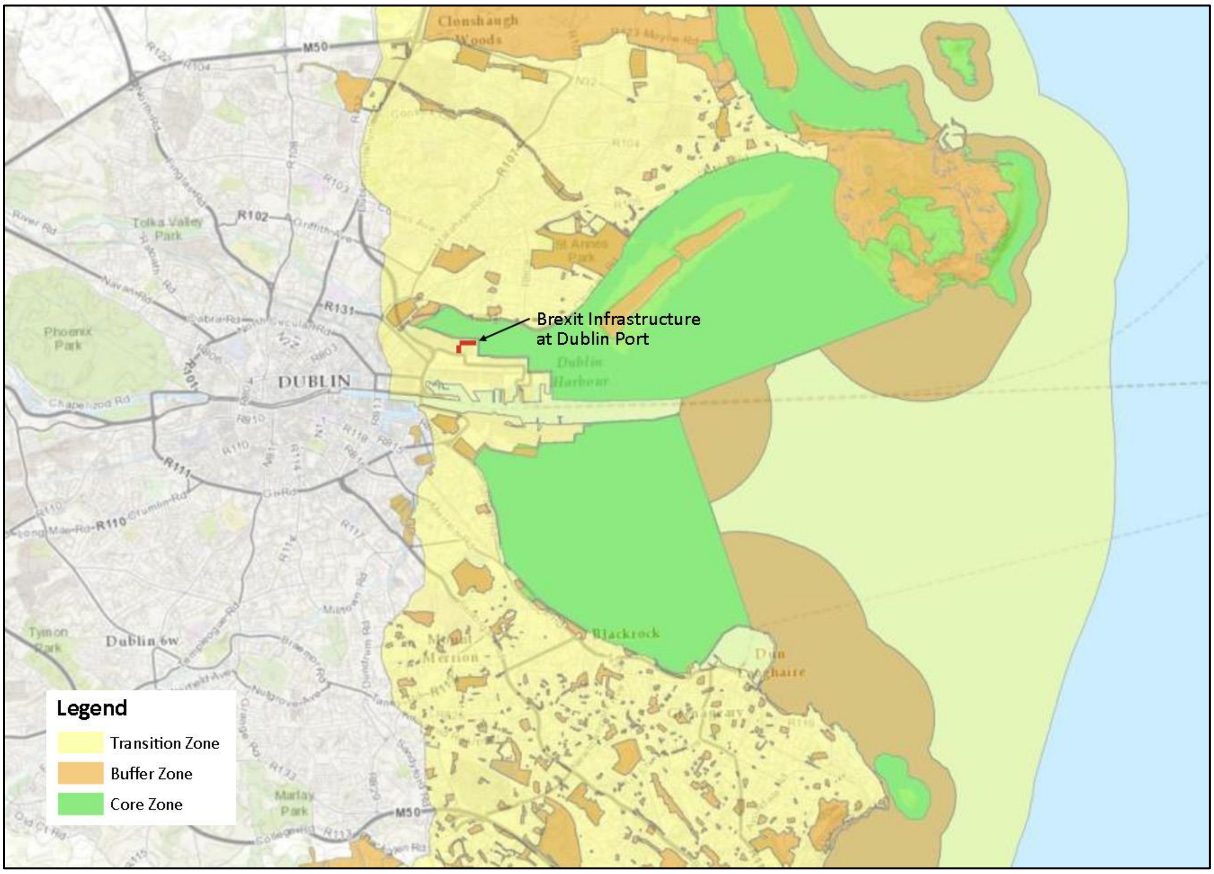

Figure 11.4 (Extract) Zonation map of Dublin Bay Biosphere

11.4.1 Dublin City Development Plan 2016-2022

This site is located within the wider context of Dublin Port - where the Dublin City Development Plan 2016-2022 provides the statutory planning framework. The Dublin Port Company Masterplan 2040, Reviewed 2018, is also of relevance within the area.

The following principal landscape and visual references from the Dublin City Development Plan (the Plan) are noted below.

Chapter 4 Shape and Structure of the City, sub-section 4.5.1.1 'Approach to the Inner City' notes the policy of Dublin City Council:

"SC7: To protect and enhance important views and view corridors into, out of and within the city, and to protect existing landmarks and their prominence."

Figure 3 of the Plan identifies the Key Spaces and Connections in the city, none of which extend further east than the Tom Clarke Bridge.

Figure 4 of the Plan identifies the Key Views and Prospects in the city, none of which pertain to Dublin Port.

Chapter 10 Green Infrastructure, Open Space and Recreation, Section 10.2 'Achievements' notes that:

"Recently, Dublin City Council initiated a partnership and successfully completed an application for a new Dublin Bay UNESCO Biosphere designation, www.unesco.org"

This UNESCO Biosphere designation has subsequently been awarded to Dublin Bay as discussed above.

Figure 14 of the Plan identifies the Strategic Green Network, including the Core Green Areas, Hub Areas and Blue / Green Corridors. A green corridor is identified leading from Fairview Park along the southern side of the Tolka Estuary, or northern shoreline of Dublin Port, to the easternmost extent of Dublin Port. The Dublin Port Company

Masterplan 2040, Figure 6, Indicative internal road, cycle and pedestrian networks at Dublin Port, provides further details the provision of a 4km long cycle and pedestrian greenway along the northern shoreline of Dublin Port, and along the northern boundary of the Bond Road site.

Related policies (GI1, GI3) and objectives (GIO1, GIO2) seek to develop the green infrastructure network of the city providing for improved links and opportunity through new developments.

At sub-section 10.5.2 Landscape**,** the Plan notes that:

"Dublin's setting on the River liffey, with the Dublin mountains to the south, Howth peninsula to the north, and also the amenities and wildlife of Dublin Bay, is a unique one, and it is critical to retain existing key landscapes and open spaces which offer so much to the city in terms of amenity and character."

Under sub-section 10.5.3 Parks and Open Spaces the Plan notes that it is a policy of Dublin City Council:

"GI10: To continue to manage and protect and/or enhance public open spaces to meet the social, recreational, conservation and ecological needs of the city and to consider the development of appropriate complementary facilities which do not detract from the amenities of spaces."

At sub-section 10.5.4 Rivers, Canals and the Coastline, the Plan notes that it is the policy of Dublin City Council:

"GI17: To develop sustainable coastal, estuarine, canal and riverine recreational amenities to enhance appreciation of coastal natural assets in a manner that ensures that any adverse environmental effects are avoided, remedied or mitigated."

"GI18: To liaise with relevant State agencies responsible for the city's waterways, including Waterways Ireland, Inland Fisheries ireland, the Environmental Protection Agency and Dublin Port Company"

It is also an Objective of Dublin City Council:

"GIO17: To seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the city and to protect the ecology and wildlife of Dublin Bay."

"GIO18: To protect and improve the natural character of watercourses, including the Dodder, and to promote access, walkways, cycleways and other compatible recreational uses along them, having regard to environmental sensitivities.

At sub-section 10.5.5 Dublin Bay the Plan notes that:

"Dublin Bay is a major resource for the city deserving of appropriate management. It contains three internationally recognised bio-diversity designations. Dublin Bay has recently been awarded a UNESCO Biosphere designation. The new Biosphere provides Dublin with an important national special amenity area for recreation and a conservation area of national and international importance."

It is the policy of Dublin City Council:

"GI20: To ensure a co-ordinated approach to the management of Dublin Bay with other State and semi-State agencies through the Dublin Bay Biosphere Partnership to develop a Biosphere Strategy for the sustainable development of Dublin Bay. "

At sub-section 10.5.7 Trees the Plan notes that it is the Policy of Dublin City Council:

"GI30: To encourage and promote tree planting in the planning and development of urban spaces, streets, roads and infrastructure projects."

In Chapter 14 Land Use Zoning, under sub-section 14.8.7 Employment (Heavy) – Zone Z7.

"Land-Use Zoning Objective Z7: To provide for the protection and creation of industrial uses, and facilitate opportunities for employment creation including Port Related Activities."

"The majority of these lands are located in the Port area (see Chapter 4 – Shape and Structure of the City, and also Chapter 16 – Development Standards, Section 16.21: Dublin Port). The primary uses in these areas are those that can result in a standard of amenity that would not be acceptable in other areas. They can sometimes lead to disamenities which would need to be managed through the planning process to safeguard residential amenity when necessary. Activities include industry, other than light industry; manufacturing repairs, open storage, waste material treatment, and transport operation services.

11.4.2 Landscape/Townscape Significance and Sensitivity

Dublin Port is an important element within Dublin Bay and within the physical and visual structure of the wider city. While the northern and southern port areas are separated by the River Liffey, the perception of the port from the wider city, north and south, is of the overall port area at the centre of the harbour, and including the balance of the Poolbeg Peninsula. The totality is a significant landscape and visual feature that lies centrally within Dublin Bay, distinctive for the tall red and white banded stacks of the ESB Poolbeg Power Station, and characterised by the overarching industrial/utility character comprising gantry cranes, storage tanks, industrial buildings and chimneys, stacked containers, and the transient presence of container and passenger ships.

The site areas for the proposed Dublin Port Brexit Infrastructure development are industrial in nature and are visually consistent with the prevailing industrial and port-related character of their surrounds. They are of low landscape and visual sensitivity, and have no specific landscape or visual-related designations.

Nevertheless, the wider landscape of Dublin Harbour is recognised as an important amenity and recreational resource. In particular, the Clontarf Promenade, leading along the northern side of the Tolka Estuary to the north of Dublin Port, is recognised as a highly sensitive landscape. Occupants of residential properties along the Clontarf Road, and users of the promenade, are highly sensitive visual receptors.

11.5 CHARACTERISTICS OF THE DEVELOPMENT

A detailed description of the development has been outlined in Chapter 2 – Description of Proposed Development.

The proposed Brexit Infrastructure development comprises two distinct but related areas referred to above in Section 11.3.4 as Bond Drive Extension and Yards 3 & 4.

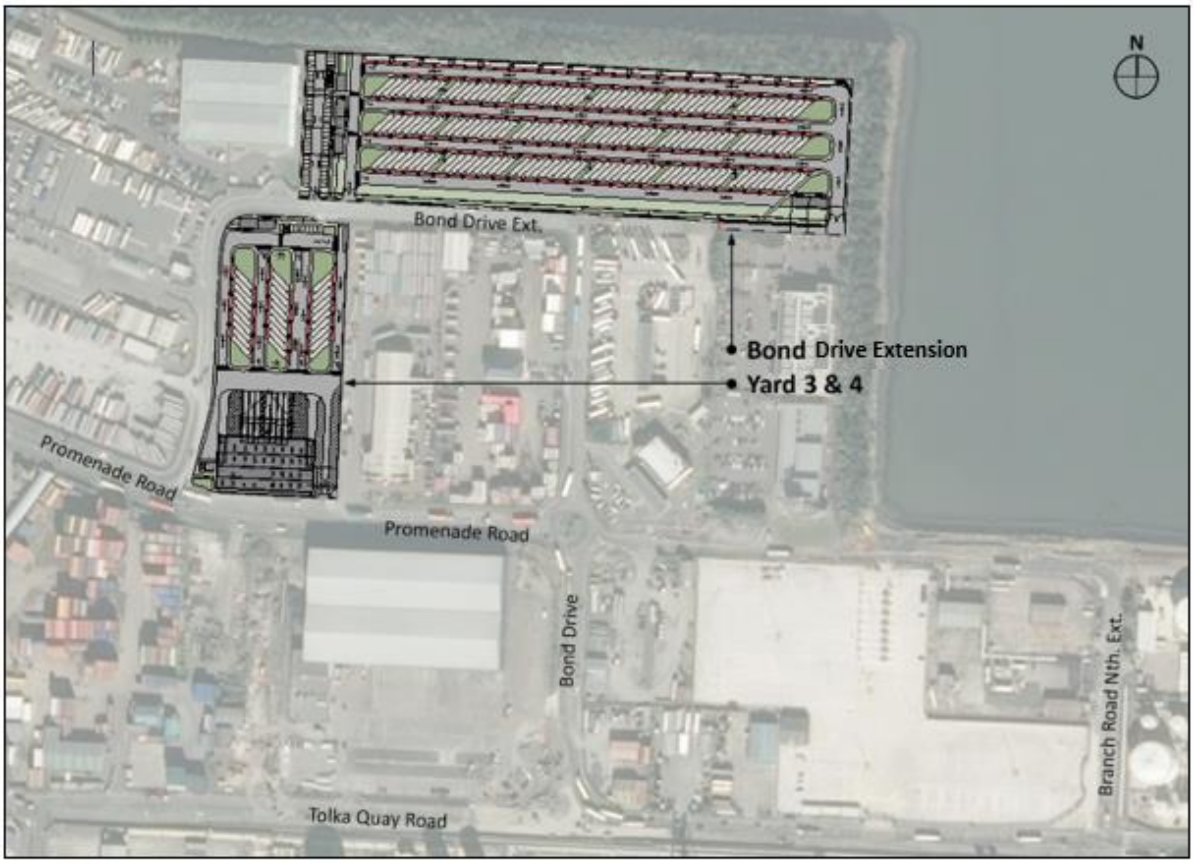

Figure 11.5 Proposed Brexit Infrastructure Development

Bond Drive Extension Site

Establishment of a single compound measuring c. 368 m x 100m, to provide parking facilities for 175 HGVs, together with associated internal access roads and a staff parking facility. Additional accommodation on site will include five single storey porta cabin structures, of 75 m^2 each, for use as a Facilities Management office, two Import Offices, and two Driver Welfare facilities. The existing site boundary palisade fences will be renewed with continuous 3.0m high paladin fencing, and new access and egress gateways. Site lighting will include 6 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways.

Yards 3 & 4

The smaller of the two existing warehouses on site will be demolished, and the larger warehouse along the southern boundary will be refurbished and extended to provide c. 2953m^2 for use as an EHS & Revenue Building. Yards 3 & 4 will incorporate loading bays and dock levellers along the northern side of the EHS & Revenue Building, together with 30 HGV parking spaces and associated internal access roads. Two single storey porta cabins, 75 m^2 each, will be installed at the northern side boundary for use as Export Offices. Site lighting will include 2 No. 20m high primary lighting poles each comprising an array of high cut-off luminaires, together with conventional 10m high street lighting around the perimeter access roadways. Landscaping will include ground cover planting in the end bays of the HGV parking aisles and at the south western corner of the side along Promenade Road.

11.6 POTENTIAL IMPACTS OF THE DEVELOPMENT

The proposed development is similar in character and operation to the existing and established uses on the development lands.

The Bond Drive Extension compounds will be combined to form a single larger compound, but will for the most part incorporate orderly HGV parking facility with a number of modest porta cabin structures to accommodate various administrative and welfare facilities. The boundary to Bond Drive Extension, comprising palisade fencing with a multiple access gateways, will be replaced with a new and continuous 3.0m high paladin fence incorporating newly defined access and egress gateways for the new facility. New landscape areas will be located along the southern site boundary inside the perimeter fence, at the ends of the HGV parking aisles, and locally around the new porta cabin facilities.

Yards 3 & 4 site will be combined to form a single compound. The northernmost warehouse will be demolished, and the southern warehouse will be refurbished and extended to accommodate an EHS & Revenue Building. The northern part of the compound will incorporate orderly HGV parking bays and two porta cabin facilities. Areas of new landscaping will be incorporated to enhance site presentation.

11.6.1 Do-Nothing Scenario

Should the proposed development not be granted, the existing compounds are likely to remain as they are currently, or until such time as an alternative development is permitted and implemented.

11.6.2 Construction Stage

During the construction phase, landscape/townscape and visual impacts are related to the visual and physical disruption arising from temporary works.

Given the industrial nature of the existing and adjoining sites, and the substantially civil nature of the proposed works, potential construction impacts will be similar in nature to day-to-day activities in the area, and including:

- Establishment of site enclosures, and site clearance;
- General construction activity, including mostly civil and ground works, extension of the warehouse building at Yards 3 & 4, installation of porta cabin facilities, and refurbishment and replacement of perimeter site fencing and gateways;
- Import and export of materials using HGVs, low-loaders and other construction vehicles. It is noted that the site areas will not be operation during construction, and that the normal day-to-day volume of haulage traffic will consequently reduce;
- Craning activities, site lighting, etc; and,
- Ancillary site development works, including finishing of parking areas, landscaping, lighting and signage.

Potential construction stage impacts will be temporary, slight and neutral as they will be consistent with the heavy industrial character of the Dublin Port environs.

11.6.3 Operational Phase

The proposed development includes two separate but related areas along the northern part of the established north Dublin Port facility. The Dublin Port Brexit Infrastructure facility will be similar in character and function to that of many of the established haulage and logistics compounds in this part of Dublin Port. The Bond Drive Extension will host HGV traffic in an orderly manner within the new HGV parking areas, and will process import and export documentation in the porta cabin offices before allowing vehicles the leave the port. Yards 3&4 will operate in a similar manner, but with a larger EHS and Revenue Building and an array of loading bay and dock-levellers to facilitate detailed inspection of cargo.

The physical appearance of the facilities will be similar to other stablished compounds at Dublin Port, except that the sites will have a more ordered and managed appearance, and will incorporate elements of landscaping where appropriate so as to enhance the general presentation of the site.

The profile of truck movements in and out of the facility will be different to that of the existing facilities, and there may be an intensification of HGV traffic movements in the vicinity of the proposed development and adjoining areas within the port. This is dealt with in Chapter 13 - Traffic and Transportation

11.7 REMEDIAL AND MITIGATION MEASURES

Primary mitigation includes locating the proposed facilities in areas where the new and existing facilities will be compatible in presentation and operation, and also by design to establish better presented and more ordered facilities that typically exist within the port, with high quality perimeter fencing and new landscaping where none currently exists.

New 20m high primary lighting poles will be located in Yards 3&4 and Bond Drive Extension will incorporate high cut-off luminaires to minimise light spill. Internal roadways will have more conventional 10m street lights with high cut-off luminaries.

11.8 PREDICTED IMPACTS OF THE DEVELOPMENT

11.8.1 Visual Impact

The assessment of visual impact is made with cognisance of the nature of the proposed development, both physically and operationally, being broadly similar to many of the established haulage and logistics facilities at Dublin Port. Within the port area, the proposed will be consistent with existing and established facilities. The nature of the proposed development is such that HGVs are processed in an orderly manner, and the site layouts have been developed to streamline throughput and to ensure a sense of order. In this regard, the proposed development will have a more ordered and high quality presentation that some of the general haulage and logistics yards, and will improve the visual quality of the immediate environment.

The assessment also makes use of a series of Photomontages (see Appendix 11.1) focussing on the high amenity area along the Clontarf Road and Promenade on the northern side of the Tolka Estuary, and the North Bull Wall.

Views from the Clontarf Road and Promenade are characterised by expansive views over the Tolka Estuary in the foreground, leading to more distant built and natural features at Dublin Port, Poolbeg Peninsula, areas of Dublin City, and beyond to the Dublin Mountains. From the western end of Clontarf Promenade, and moving eastwards towards the Clontarf Baths, the established landscape berm and tree planting along the northern port boundary prominent, and provides effective screening of many of the small to medium sized structures and facilities located south of the berm within the port area. Moving further east, towards the slipway opposite the Dublin Bus depot, and further again onto the North Bull Wall, the landscape berms and screening become less prominent with distance, and also as storage tanks, gantries, chimneys and ships become increasingly visible. The location of the proposed development is such that the Bond Drive Extension and Yards 3&4 sites will be substantially behind the landscape berms and tree screening.

Visual impacts will be slight and neutral.

Night-time Impact

The existing Dublin Port includes a broad range of street lighting, area lighting, lighting beacons on taller gantries and chimneys, and operational lighting on building and cargo and passenger vessels. Lighting is part of the inherent character of any port development, as both cargo and passengers come and go throughout the day and night. Lighting is continually changing, depending on operational activities, and is also reflected in the water of the Tolka Estuary which can be calm or rough, yielding different reflective qualities and character.

Some of the taller lighting poles will be intermittently visible behind the landscape berms and tree planting, however, with high cut-off luminaires, the visual effect will be moderate and neutral, as it will be consistent with the overarching lighting infrastructure at the port.

11.8.2 Landscape Impact

The nature of the established haulage and logistics compounds at Dublin Port, and the nature of the proposed development, is such that there will be no adverse effects on landscape arising from the proposed development. There are currently no landscape features on any of the proposed site areas, and the proposed development will introduce hedging, trees, low level ground cover and grass areas to enhance the presentation, amenity and biodiversity value of the sites where possible.

Landscape effects will be slight, and positive.

11.8.3 Photomontages

A series of 4No. Photomontages of the proposed development have been prepared and provided in the accompanying Appendix 11.1. Vantage points are representative of the range of views from the Clontarf Road and Promenade extending along the Tolka Estuary north of Dublin Port.

Each view is presented *As Existing* and *As Proposed*.

View 1 is from the Clontarf Promenade close to the Clontarf Baths, looking southwest. Figure 1.2.2 As Proposed, illustrates that none of the proposed structures will be visible beyond the perimeter planting, and includes a red outline to illustrate the relative size and location of the structures. The tops of the 20m high lighting poles at the Bond Road site will be intermittently visible between the tree canopies, and at a similar level to the tops of those trees and other gantry structures in the view. Landscape and visual effects are considered slight and neutral.

View 2 is from the Clontarf Promenade opposite St. Anthony's Church, looking southeast. Figure 1.1.2 As Proposed, illustrates that none of the proposed structures at the Bond Drive Extension or Yard 3&4 sites will be visible beyond the perimeter planting, and includes a red outline to illustrate the relative size and location of the structures. The tops of some of the 20m high lighting poles at the Bond Drive Extension site will be intermittently visible between the tree canopies. Landscape and visual effects are considered slight and neutral.

View 3 is from the Clontarf Promenade near the slipway facility opposite the Dublin Bus depot. Figure 1.3.2 As Proposed, illustrates the promenade amenity overlooking the Tolka Estuary and beyond to the industrial character of Dublin Port. The landscape berm and tree planting can be seen beyond the bend in the promenade, and at c. 1.2km distance. The proposed development will be either screened behind the trees, or imperceptible against the backdrop of the larger port related structures. Landscape and visual effects are considered slight and neutral.

View 4 is from the North Bull Wall looking west, and at a distance of c. 2.5km. The low-lying nature of the landscape and seascape, including Dublin Port is readily visible. Figure 1.4.2 As the proposed development includes an outline of the proposed structures that will either screened or imperceptible against the backdrop of the larger port related structures. Landscape and visual effects are considered slight and neutral.

11.8.4 Impact on Landscape / Townscape Planning Context

It is considered that the proposed development is to be developed on established port-related site areas that are of low landscape and visual sensitivity, and have no specific landscape or visual-related designations. The development will be contained to the footprints of the established site areas, and will not impact directly on any adjoining landscape features, such as the landscape berm with tree and shrub planting along the northern shoreline of Dublin Port.

11.9 RESIDUAL IMPACTS

The proposed development of the Brexit Infrastructure at Dublin Port represents a new use at Dublin Port, however, one that is physically, visually and operationally consistent with many of the haulage and logistics facilities already in operation at Dublin Port, and including those on the selected site areas.

As such, the proposed development will give rise to limited physical or visual change within the Dublin Port facility, with only localised alterations, and generally improvements, to the presentation and functionality of the selected site areas.

Within the Dublin port environs, residual landscape and visual impacts of the proposed development will be slight and neutral or positive.

Within the wider setting, including in particular, the Clontarf Road and Promenade area to the north, residual landscape and visual impacts will be slight and neutral, and the scale of the proposed strictures are generally small and will not be readily visible or distinguishable from the general port-related infrastructure and facility at Dublin Port.

11.10 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact of the proposed development with including other Brexit related developments at the nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 11.10.1 and 11.10.2 below.

11.10.1 Construction Phase

The potential for landscape and visual impacts during construction primarily arises from construction activity such as site clearance, import and export of materials, groundworks, and construction of new facilities. The Alexandra Basin project and the MP2 project are both substantial projects within Dublin Port and mostly focussed towards the southern part of the north Dublin Port lands. By virtue of their expanse and scale, these projects will in themselves give rise to noticeable landscape and visual effects from the wider setting of the port.

The Greenway project, while 4km in length, and running along the northern shoreline of Dublin Port including the northern edge of the Bond Drive Extension site, is nonetheless a modest intervention, and landscape and visual impacts will be localised, moderate and positive.

Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017) .

Construction of the proposed Brexit Infrastructure development, by its nature and scale, and relative to existing similar facilities on the sites, will give rise to slight and neutral landscape and visual effects.

The cumulative impact is considered to be neutral and imperceptible.

11.10.2 Operational Phase

Overall there will be no real change in the land use and operation of the two sites, as they will continue to operate for the reception, parking, storage and discharge of HGV traffic, with modest office, welfare and administrative facilities that are similar to those on the existing site areas, and to those at nearby compounds.

The potential for landscape and visual impacts during operation primarily arises from potential intensification of HGV movements in and out of the facility, and utilising the surrounding road network. The Alexandra Basin project and the MP2 project are both much larger scaled development projects within Dublin Port and with the objective of increasing the capacity and efficiency of the port. By virtue of their expanse and scale, these projects will in themselves give rise to noticeable landscape and visual effects from the wider setting of the port.

The Greenway project, while 4km in length, and running along the northern shoreline of Dublin Port including the northern edge of the Bond Drive Extension site, is a modest intervention, and landscape and visual impacts will be localised, moderate and positive.

Operation of the proposed Brexit Infrastructure development, by its nature and scale, and relative to existing similar facilities on the sites, will give rise to slight and neutral landscape and visual effects.

The cumulative impact is considered to be neutral and imperceptible.

11.11 CONCLUSION

The proposed Brexit Infrastructure development is consistent with the landscape/townscape policy context as set out in the Dublin City Development Plan 2016-2022 which provides the statutory planning framework for development at Dublin Port.

The proposed development is also consistent with the objectives and deliverables of the Dublin Port Company Masterplan 2040, Reviewed 2018, and will not impact on delivery of the MP2 project, the Alexandra Basin project, or the Greenway porject.

APPENDIX 11.1

PHOTOMONTAGES

for

Project No. 6735
Brexit Infrastructure at Dublin Port

for

Client: AWN Consulting Limited

Date: 14 May 2020
Document Number: RP01

Brady Shipman Martin
Canal House
Canal Road
Dublin 6

Tel: +353 (0)1 208 1900
Email: mail@bradyshipmanmartin.com

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

CONTENTS AMENDMENT RECORD

This report has been issued and amended as follows:

REVISION	DESCRIPTION	DATE	PREPARED BY	CHECKED BY
00	View Location Map and 4 no. of Phototmontages	18 February 2020	BP	JK
01	Updated 4 no. of Photomontages	17 April 2020	BP	JK
02	Update to 4 no. of Photomontages	14 May 2020	BP	JK

PHOTOMONTAGE TABLE OF CONTENT

Day:	18	17	14															
Month:	02	04	05															
Year:	20	20	20															
FIGURE NUMBER	**REVISION**																	
1.0	00	01	02															
1.1.1	00	00	00															
1.1.2	00	01	02															
1.2.1	00	00	00															
1.2.2	00	01	02															
1.3.1	00	00	00															
1.3.2	00	01	02															
1.4.1	00	00	00															
1.4.2	00	01	02															

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

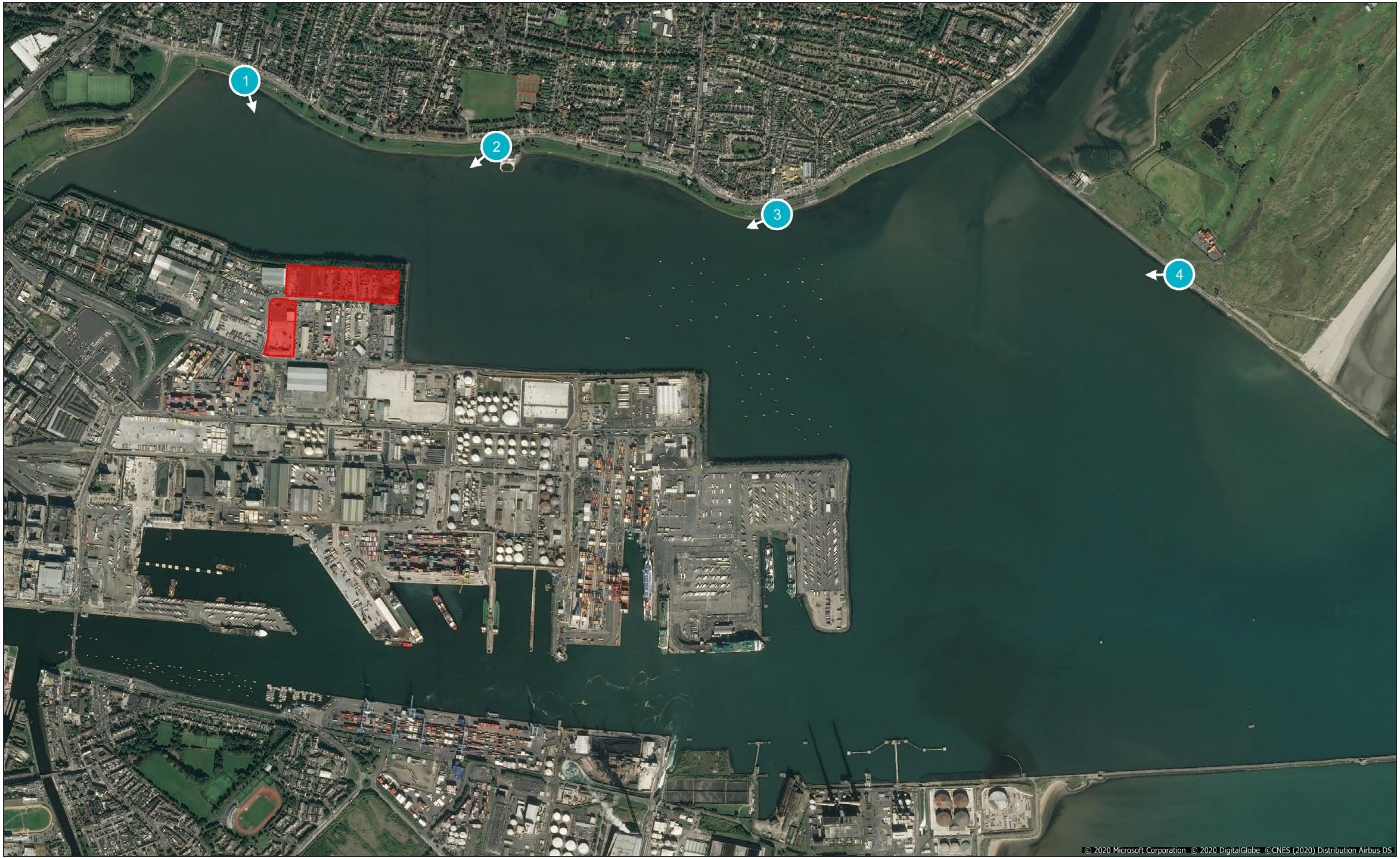

Figure: 1.0

Rev: 02

View Location Map

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm ANGLE OF VISION / LENS FOCAL LENGTH 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.1.1

Rev: 00
View 1
As Exisiting

BSM Est. 1968 **Brady Shipman Martin.** Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

Red outlines represent size and location of proposed structures not visible from this viewpoint.

< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 1.1.2

Rev: 02

View 1

As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 1.2.1

Rev: 00

View 2

As Exisiting

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020


Red outlines represent size and location of proposed structures not visible from this viewpoint.

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm ANGLE OF VISION / LENS FOCAL LENGTH 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.2.2

Rev: 02
View 2
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

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Figure: 1.3.1

Rev: 00
View 3
As Exisiting

BSM Est. 1968
Brady Shipman Martin.
Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

Red outlines represent size and location of proposed structures not visible from this viewpoint.

< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 1.3.2

Rev: 02
View 3
As Proposed

BSM Est. 1968
Brady Shipman Martin.
Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm ANGLE OF VISION / LENS FOCAL LENGTH 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.4.1

Rev: 00

View 4
As Exisiting

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6735	Document Number:	RP01	Revision:	02
Project Name:	Brexit Infrastructure at Dublin Port	Document Title:	PHOTOMONTAGES	Date:	14 April 2020

< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 1.4.2

Rev: 02
View 4
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

12.0 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

12.1 INTRODUCTION

The following chapter assesses the predicted impacts of the proposed development on archaeological, architectural and cultural heritage. The proposed development is located east of Dublin City Centre at the mouth of the River Liffey in an area of reclaimed land known as Tolka Quay (ITM 718857, 735503), see Figure 12.1).

Figure 12.1 Layout of proposed development

12.2 METHODOLOGY

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 RMP was established under the National Monuments (Amendment) Act, 1994. 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 included on the RMP all receive statutory protection under the National Monuments Acts 1930 - 2004. 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 so as to take account of on-going research. The RMP was consulted in the Archives of the Department of Culture, Heritage and the Gaeltacht. There are no recorded archaeological monuments located within the site boundary. There are 13 recorded archaeological monuments within the study area which comprises a distance of c. 1.5km from the proposed development (see Figure 12.2 and Appendix 12.1).

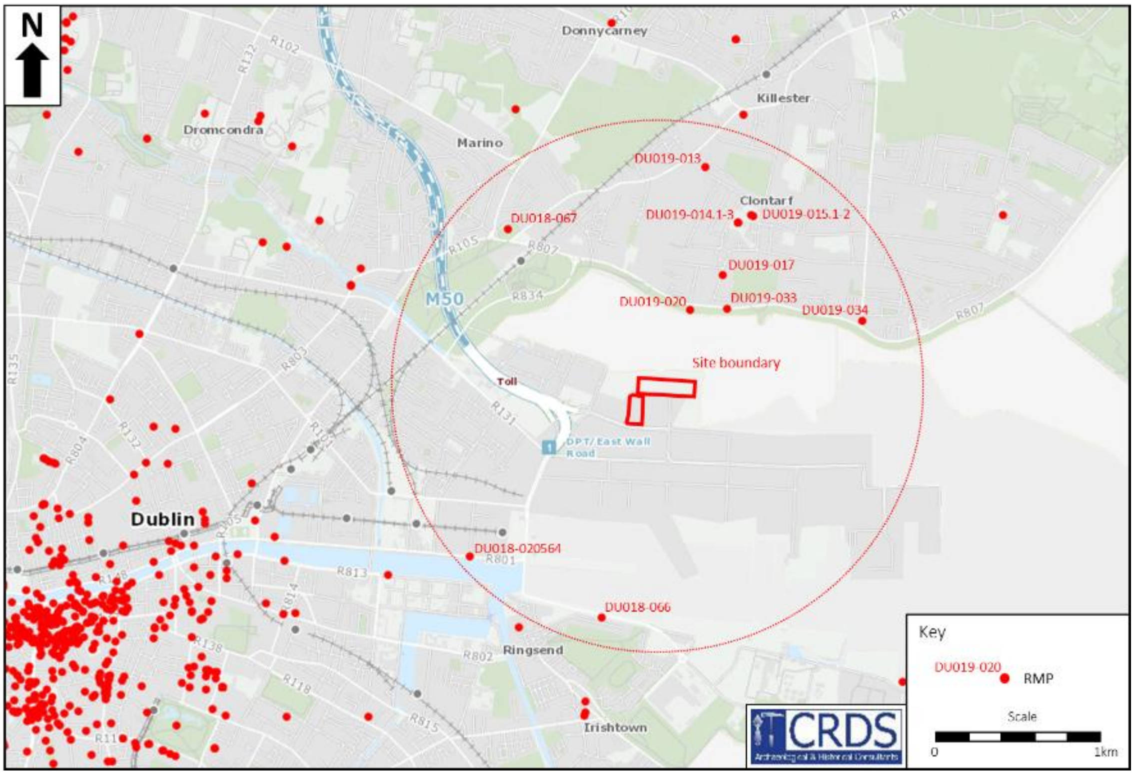

Figure 12.2 Recorded archaeological monuments within c. 1.5km of the proposed development (source: www.archaeology.ie)

The excavation bulletin website (www.excavations.ie) was consulted to identify previous excavations that have been carried out within c. 1.5km of the proposed development. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2019. The database includes twenty archaeological investigations undertaken under license from the National Monuments Service (see Figure 12.3 and Appendix 12.2).

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 Arts, Heritage and the Gaeltacht is currently using the Inventory as the basis for making recommendations for the NIAH. There are no structures included in the NIAH within the site boundary, there is one structure included in the NIAH within the study area which comprises a distance of c. 1km from the proposed development (see Figure 12.4 and Appendix 12.3).

Published catalogues of prehistoric material were also studied: Raftery (1983 - Iron Age antiquities), Eogan (1965; 1993; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers). The townlands within the study area, namely Clontarf, Ringsend and Irishtown were assessed (see Appendix 12.4).

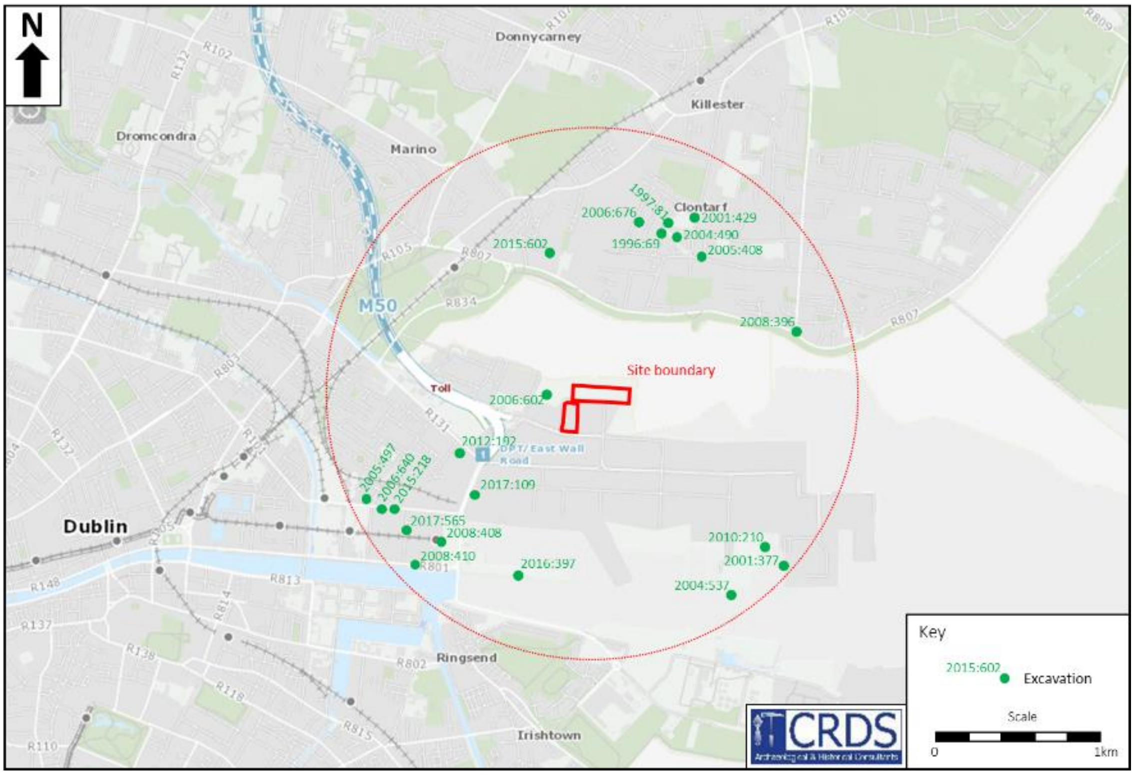

Figure 12.3 Recorded archaeological excavations within c. 1.5km of the proposed development (source: www.excavations.ie)

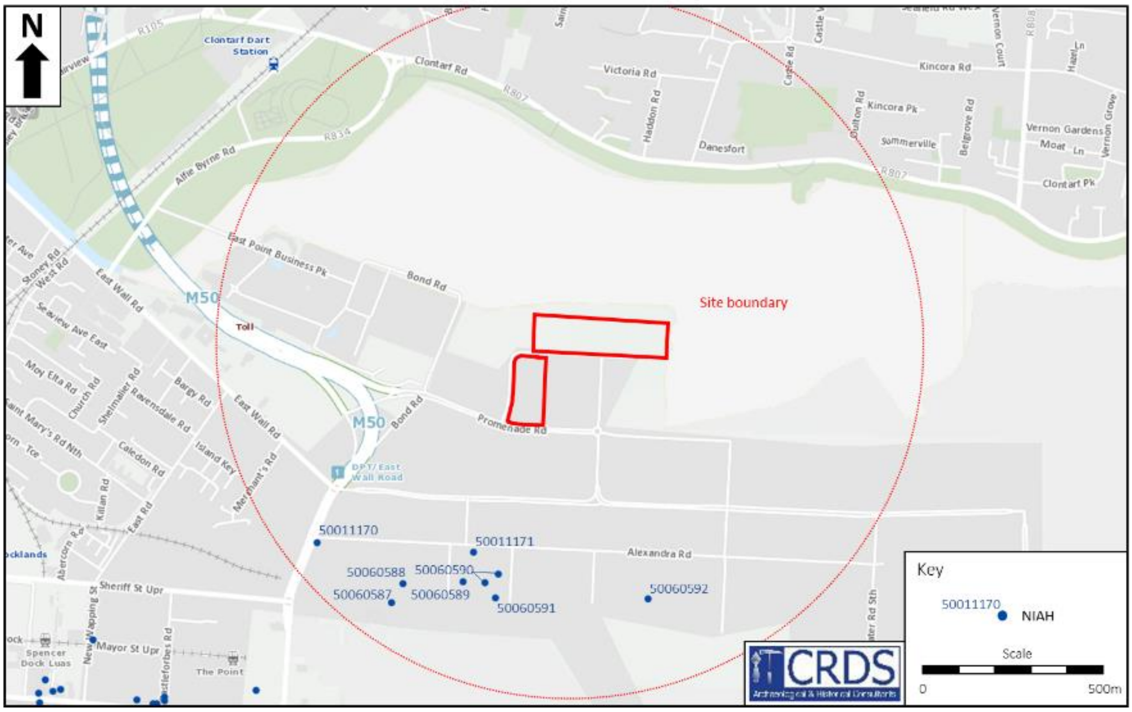

Figure 12.4 NIAH Structures within c. 1km of the proposed development (source: www.archaeology.ie)

The Dublin City Development Plan 2016-2022 was consulted. The plan includes policy objectives for the protection of the City's archaeological, architectural and cultural heritage. The Plan lists the area of the proposed development as 'to provide the protection and creation of industrial uses and facilitate opportunities for employment creation (see Figure 12.5).

Figure 12.5 Extract from the Dublin City Development Plan 2016-2022 (source: https://www.dublincity.ie/sites/default/files/content/Planning/DublinCityDevelopmentPlan/MapsetF.pdf)

The National Monuments Service Wreck Viewer (https://www.archaeology.ie/underwater-archaeology/wreck-viewer) and the published Shipwreck Inventory of Ireland: Louth, Meath, Dublin and Wicklow (Brady 2008) were consulted for shipwrecks from the Sutton area. The Wreck Viewer has been developed to facilitate easy access to the National Monuments Service's Wreck Inventory of Ireland Database (WIID) and to complement the existing Historic Environment Viewer which provides access to the databases of the Sites and Monuments Record (SMR) and the National Inventory of Architectural Heritage (NIAH). It is important to note that the Wreck Viewer displays only wrecks for which there is a recorded location, and these are represented on the map canvas as red dots. The red dot equates with the known approximate centre point of the wreck and is not indicative of its geographic or spatial extent. There are five recorded wrecks within c. 2km of the proposed development ((see Figure 12.6 and Appendix 12.5).

Cartographic sources were used to identify additional potential archaeological and cultural heritage constraints. Primary cartographic sources consulted consisted of the Down Survey 'Barony Map of Newcastle in the County of Dublin 1654-6' (see Figure 12.7), Rocque's Survey of Dublin, 1757 (see Figure 12.8), the Ordnance Survey first edition 6" map (see Figure 12.9), second edition 25" map (see Figure 12.10), and Cassini edition map (see Figure 12.11) (TCD Map Library, www.osi.ie, www.archaeology.ie, http://www.ecis.ie/public-domain-maps-rocques-survey-of-dublin-1757/).

Figure 12.6 Recorded shipwrecks within c. 2km of the proposed development (source: https://www.archaeology.ie/underwater-archaeology/wreck-viewer).

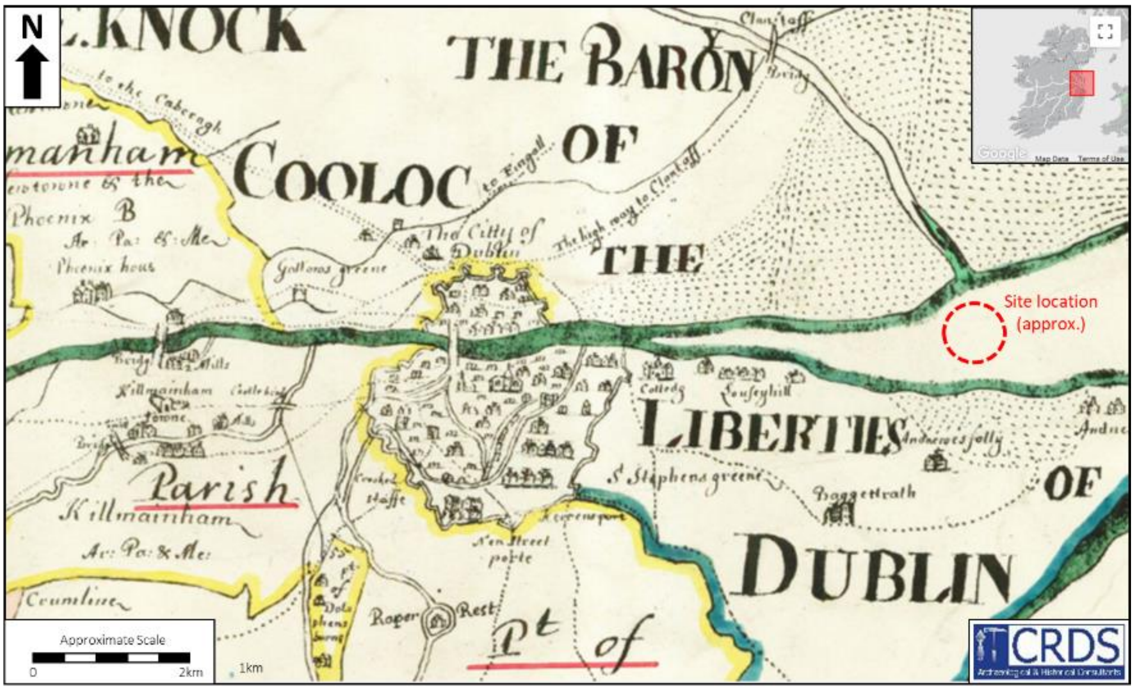

Figure 12.7 Extract from Down Survey 'Barony Map of Newcastle in the County of Dublin 1654-6' (source www.downsurvey.trinity.ie).

Figure 12.8 Extract from Rocque's Survey of Dublin, 1757 (base map source: http://www.ecis.ie/public-domain-maps-rocques-survey-of-dublin-1757/).

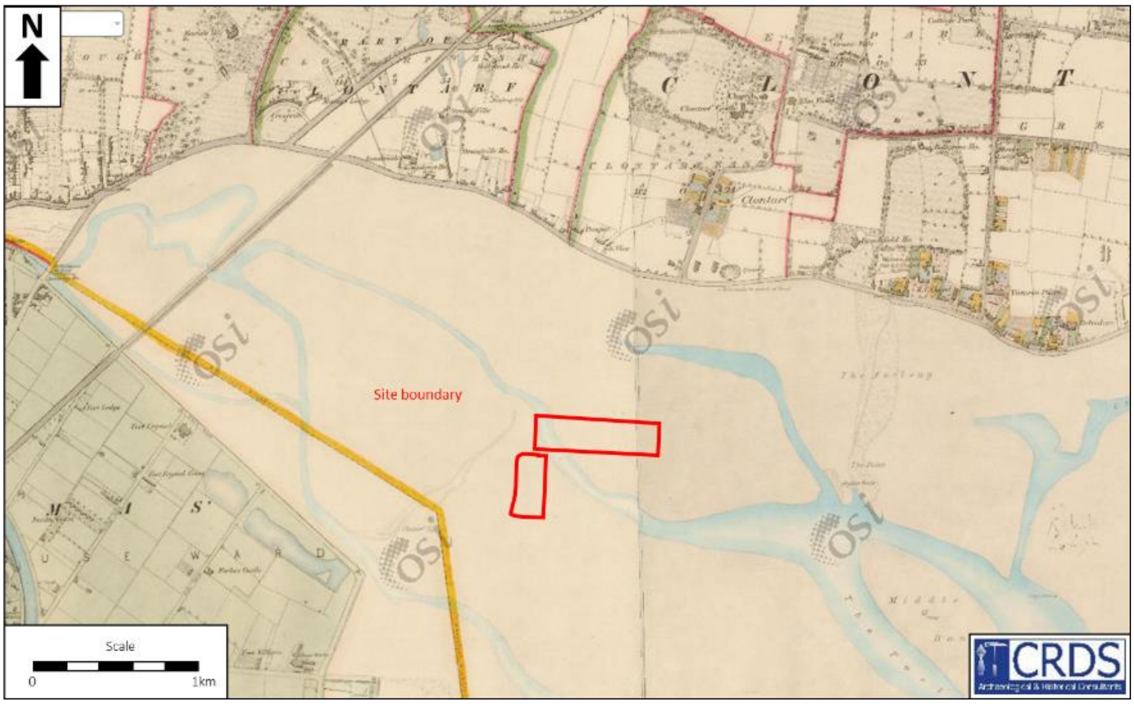

Figure 12.9 Extract from 1st edition Ordnance Survey 6" Map, 1838-1842 (base map source: www.archaeology.ie).

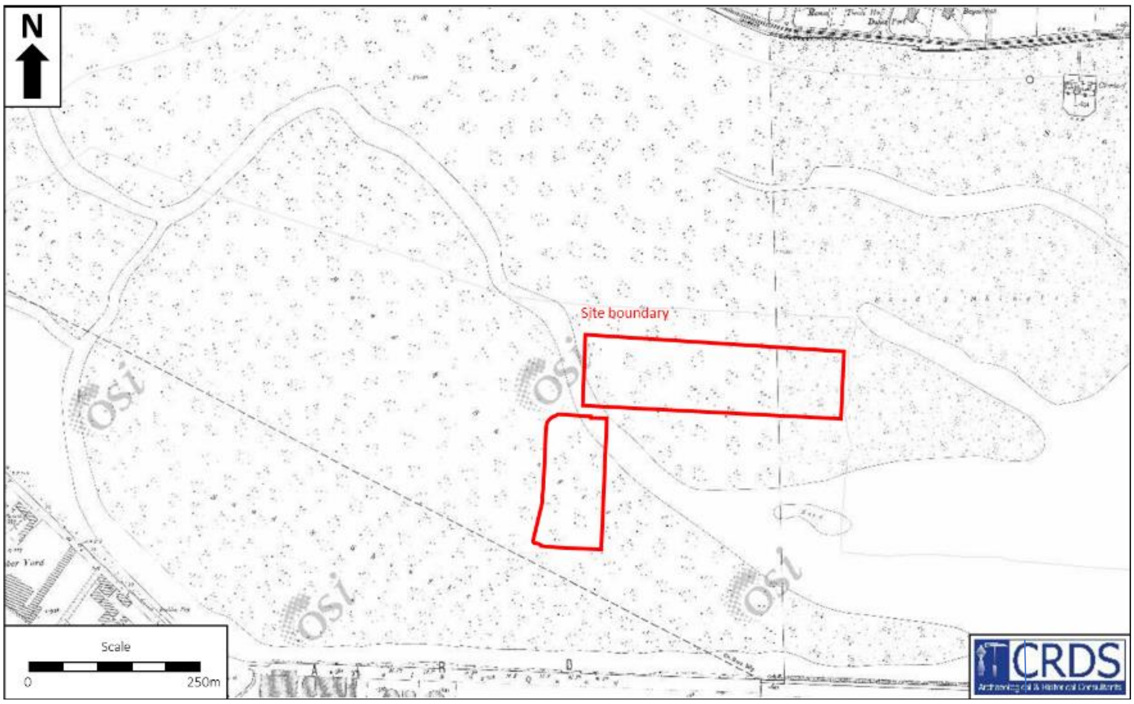

Figure 12.10 Extract from 2nd edition Ordnance Survey 25” Map, 1890-1915 (base map source: www.archaeology.ie).

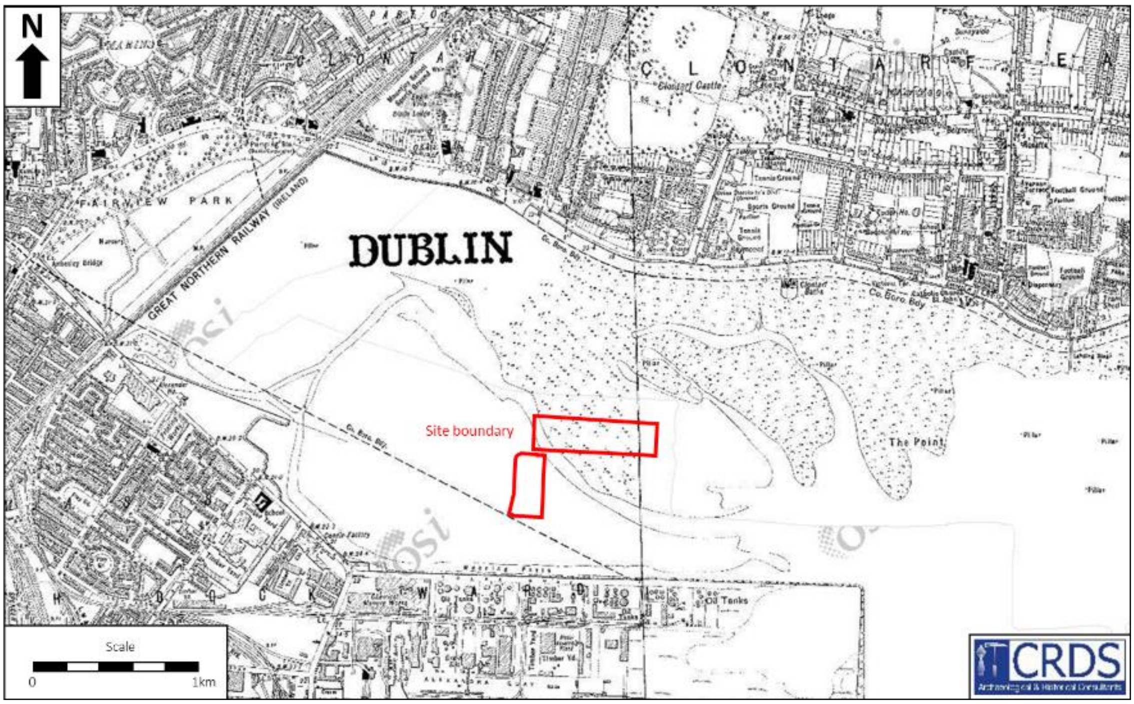

Figure 12.11 Extract from Cassini edition Ordnance Survey 6” Map, c. 1940 (base map source: www.archaeology.ie).

The baseline historical research utilised sources including Lewis’ Topographical Dictionary of Ireland (Lewis 1837), the Proceedings of the Royal Irish Academy and the Journal of the Royal Society of Antiquaries. See Bibliography for full list of references used.

12.3 RECEIVING ENVIRONMENT

12.3.1 Archaeological, Architectural and Cultural Background

Prior to modern land reclamation the area in which the proposed development is located was tidal and formed part of the estuary of the River Liffey (Cox & Gould 1998). While permanent occupation during the prehistoric and medieval periods may have been problematic, the area may have been used on a temporary basis exploiting local resources including fish and wild fowl. Archaeological material associated with this form of exploitation includes fish traps and other fishing structures and dug out boats. Movement through the estuarine landscape would have been assisted by the dumping of brushwood or the construction of hurdle panels or timber trackways (O'Sullivan 2001, 131).

Recent archaeological monitoring at North Wall Quay, to the west of the proposed development, has uncovered archaeological material associated with the use of the estuary during the prehistoric period (McQuade 2005, 6). The monitoring revealed a primary shoreline associated with the River Liffey which descended into silt deposits which had accumulated to a depth of approximately 3m. The remains of at least two fish-traps, constructed of hazel, were revealed between 1.2m and 12m from that shoreline (McQuade 2005, 6). The fish-traps were dated to around 7000 BP placing them in the Mesolithic period (McQuade 2005, 6).

Efforts to reclaim the northern side of the estuary commenced with containment works undertaken by the Ballast Office in 1710 to the west of the proposed development (De Courcy 1996, 268-9). Woven baskets or 'kishes' filled with stones, gravel and shingle were laid along the line of the intended wall by small sailing vessels (University College Dublin School of Architecture 1996, 171). The newly made ground behind the kishes was surveyed and a number of new streets including Sheriff Street, Commons Street, Guild Street and Mayor Street were laid out (Clerkin 2001, 132). The land was divided into 132 allotments, each consisting of two lotts facing either North Wall Quay or one of the new streets. The lotts were subsequently sold by public subscription (De Courcy 1996, 269). The construction of a stone river wall, began soon after. Brooking's map of 1728 depicts the new wall running east to a point opposite the Donneybrook River at Ringsend before turning north. Newly made ground to the north of this is 'Walled in but as yet overflow'd by ye tide'. Brooking's map is augmented by 'A Prospect of the City of Dublin from the North' which clearly shows the area behind the river wall inundated with water. The area had been fully reclaimed by the mid-18th century and is shown on Rocque's map of 1756.

The banks of the Liffey estuary may have been used on a temporary basis for hunting and fishing in the early prehistoric period. Archaeological material associated with this form of exploitation includes fish traps, other fishing structures such as wooden posts and dug out boats. Recent archaeological monitoring undertaken at North Wall Quay, to the northwest of the site, has revealed the remains of five fish-traps dating to the Mesolithic period (6100 – 5720 BC) (McQuade and O'Donnell 2006; O'Sullivan and Breen 2007). The site was located under land reclaimed from the Liffey, but would originally have been on the foreshore of the river.

Archaeological evidence suggests that the earliest permanent settlements in the Dublin region were located on two dry patches of ground, one of which is located nearby the site of the proposed development. The most important settlement was well outside the study area, in the vicinity of Dublin Castle, and the other was situated on the low gravel ridge at Ringsend immediately to the west planning scheme area (De Courcy 1996, 324). The name Ringsend is thought to be a corruption of the Irish An

Rinn, meaning ‘the end of a point of land’ where this community would have been located (Bennett 1994, 172). Besides this small peninsula of land the area was largely riverine marsh until reclamation in the post medieval period.

From the Viking period onwards, Wood Quay to the west of our study area formed the focal point of trade moving along the River Liffey (de Courcy 1996, 128). It is known that in the 16th century vessels unloaded at Merchants Quay and Wood Quay. Prior to the 18th century large ships anchored in Dublin Bay and used lighter craft to move cargo into the city centre (Official Handbook 1927).

After Dutch attacks on British vessels moored in the Thames in 1667, the Admiralty and Government were worried about the safety of Dublin Port. In 1672 Bernard de Gomme was sent to ascertain what works would be necessary to protect Dublin. He produced a survey that was displayed to King Charles II in November 1673 (Haliday 1881, 230). In 1698 the Corporation of Dublin petitioned the House of Commons to allow the establishment of the Ballast Office. The aim of the organisation was to remove ballast from the banks on both sides of the Liffey below Ringsend and thereby free up the river and allow ships to dock and unload (ibid, 245-6). Political arguments prevented the formation of this body. After some political manoeuvring, primarily that the Queen’s consort Prince George of Denmark and Lord High Admiral of England be provided with an annual tribute of “100 yards of the best Holland duck sail cloth, which shall be made in the realm of Ireland”, the Ballast Office was formed in 1708 (ibid, 246-7). The first improvement was to straighten the channel from the city to Ringsend in 1711. This comprised a bank of timber and stones to the north and a masonry quay wall to the south (Purser Griffith 1915, 13-14). By 1717 the reclamation project had gone out as far as East Wall Road (identified as East Quay on Rocque’s 1756 map (McCullough 1989, 39).

In 1725 Gabriel Stokes produced a Survey of Dublin Bay and Harbour. This was followed by a further survey in 1728 by Captain John Perry and Thomas Burgh who went onto to produce a detailed map of the harbour. The beginnings of the breakwater on the south side of the channel are shown on the 1728 map. John Rocque’s map of 1756 shows the section of the Great South Wall running from Ringsend into the centre of the Dublin Bay. A lighthouse was built at the furthest extent of the wall in 1760 (Daly n.d., 5-8). Duncan’s 1821 map showed that the area has developed considerably since 1756. Although the level of detail was not as great as Rocque’s map, it appeared that the area had opened up and a number of compact property boundaries had been removed. However, the area was still annotated as ‘The North Lots’ and a series of small structures which were noted, though not identified, are presumed to have been buildings.

In 1800 Captain William Blythe (former captain of The Bounty) began a survey of Dublin Harbour, which was published in 1803. Blythe suggested the construction of a wall parallel to the Great South Wall on the northern side of the Liffey to improve tidal scour and increase depth. The advice was not followed until 1819, two years after his death, when Bull Wall was built. The wall did increase tidal scour and depth, improving access to the quays for large vessels. By the 1830’s large ships were able to travel up the river to the quays. Some were only able to reach moorings in an area known as Halpin’s pool – a deep area of what is now Alexandra Basin (Daly n.d., 15-16). During the period 1786-1867 a number of improvements were made to the port, including: Construction of quay wall of North Quay, South Quay and East Quay; Dredging of channel; Construction of Great North Wall; Building of Graving Slips 1 and 2; Construction of Graving Dock No.1 (see below for further detail); Beginning of North Wall basin; Construction of timber jetties along North Quay; Building of sheds on North Wall; Transfer of Custom House Dock by Government to Port Board; Deepening of

North Quays begun. In 1835 a gridiron was provided at the end of North Wall for the use of smaller vessels. It consisted of a timber and iron grid approximately 100 foot (30 m) by 35 foot (10 m) laid on the river bed by the quay wall. At low water the gridiron was exposed allowing for hull repairs and painting (Gilligan 1988, 126-7). Between 1867 and 1869 further improvements included: Deepening and widening of river channels; Construction of additional timber jetties; Building of deep water quays on north and south sides of the river; North Quay extension begun; Building of additional lighthouses; Re-building of George's Dock Bridge.

By 1915 the Dublin Port and Docks Board were granted further powers, which allowed additional borrowing and provision made for raising revenue for the maintenance and improvement of the Port by rates on cargos. The powers provided by the 1902 Act included: Further improvement of the port through dredging; Dredging the channel across the Bar; Further deepening of the North Wall Quay; Deepening of City and George's Quay up to Butt Bridge; Eastern breakwater and lighthouse; Alexandra Basin extension and reclaimed lands north of it; Deep water jetty (Alexandra Wharf) north side of the Alexandra Basin; Electrical generating station and electrical equipment of port. (Purser Griffith 1915, 18-19). Developments to Alexandra Basin continued from this period onwards. Improvements made included the extension of the basin and reclamation of new land in 1921, extension to the dockyard in 1928, construction of deep-water berths in 1938, and the construction of an Ocean pier at Alexandra Basin in 1939.

The area was not infilled until the late 1960's. Modern demolition material was used to create a stable surface 3.5m above the high-water level.

12.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The project description is outlined in Chapter 2.

Dublin Port is the main seaport and point of entry for ferry and container traffic into the Republic of Ireland. It is located east of the city centre. It is equipped with a ferry terminal, container terminals and storage facilities, as well as supporting infrastructure, including public roads. The proposed sites for the proposed development are on areas of land within the boundary of Dublin Port.

The proposed Brexit Infrastructure will include the construction of the following new structures:

-
Bond Drive Extension:
  Five single storey porta cabin structures, of 75m^2 each, for use as a Facilities Management office, Import Offices, and Driver Welfare facilities.

Yard 3 & 4:
- Existing warehouse along the southern boundary will be refurbished and extended to provide c. 2,953 m^2 for use as an EHS & Revenue Building
- Two single storey porta cabins, 75m^2 each, will be installed at the northern side boundary for use as Export Offices and sanitary facilities.

The proposed development will also include provision for 205 no. HGV parking spaces, staff car parking, and associated ancillary development.

A site layout plan of the proposed development is provided in Figure 12.1.

12.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

12.5.1 Construction Phase

Potential impacts on archaeological and cultural heritage associated with the proposed development involves ground disturbance associated with the construction of buildings and services. Where ground disturbance associated with the site preparation and excavations exceed the depth of reclaimed backfill and impact on the underlying foreshore sediments, this would potentially remove sub-surface archaeological features, should any survive within the site.

There will be no potential impacts on architectural heritage associated with the proposed development.

12.5.2 Operational Phase

There are no potential impacts on archaeological, architectural and cultural heritage expected as a result of the operational phase of the proposed development.

12.5.3 Do-nothing Scenario

There are no immediate potential impacts on archaeological, architectural and cultural heritage expected in the case of a Do-nothing Scenario. However, as the site is zoned for development there are likely to be similar ground disturbance impacts during any future development.

12.6 REMEDIAL AND MITIGATION MEASURES

12.6.1 Construction Phase

Prior to the commencement of construction works (including enabling works), the following will be required:

A suitably qualified archaeological consultant will be required to oversee the works and undertake the required archaeological monitoring and reporting.

Archaeological monitoring (under license to the National Monuments Service) of groundworks should be undertaken in areas where excavation exceeds the depth of the infill material deposited post 1958. The aims of the monitoring is to see if any features or finds of archaeological significance are located within the area of the proposed works. These features may consist of fish traps, kishes or ships timbers. The existing infill material was deposited post 1958 and sits directly on the old foreshore bed. It is the old foreshore bed that will be monitored once the initial modern infill has been removed. Should any archaeological material be encountered mechanical excavation will cease and the City Archaeologist and National Monuments Service shall be notified. Further work will then only be carried out following consultations with the City Archaeologist and the National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

Financial, logistical and time provision should be made for archaeological excavation, if required, prior to the commencement of the construction phase of the development.

Please note that the recommendations given here are subject to the approval of the National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

12.6.2 Operational Phase

No mitigation measures are required for archaeological, architectural and cultural heritage during the operational phase of the proposed development.

12.7 PREDICTED IMPACT OF THE DEVELOPMENT

12.7.1 Construction Phase

Whilst the construction phase of the proposed development will not impact directly on any sites included in the Record of Monuments and Places, it is possible that ground disturbance will impact on previously unrecorded sub-surface archaeological features or finds within the site. However, the implementation of mitigation measures detailed in Section 12.6.1, will ensure that the effect is ***neutral*** and ***imperceptible***.

12.7.2 Operational Phase

The operational phase of the proposed development is not predicted to have any impact on archaeological, architectural and cultural heritage.

12.8 RESIDUAL IMPACTS

Subject to the implementation of appropriate archaeological mitigation measures, no residual impacts on archaeological, architectural and cultural heritage are predicted.

The cumulative impact assessment is addressed in Section 12.9 below.

Interactions are addressed in Chapter 16 of this EIA Report.

12.9 CUMULATIVE IMPACT ASSESSMENT

The cumulative impacts of the proposed development (as described in Chapter 1) are described in section 12.9.1 and 12.9.2.

12.9.1 Construction Phase

Whilst the construction phase of the proposed development will not impact directly on any sites included in the Record of Monuments and Places, and archaeological testing and monitoring of recent past developments in the vicinity of the current site have not uncovered sub-surface archaeological remains, it is possible that sub-surface archaeological features or finds (for example, fish traps, kishes or ships timbers) occur within the development site, which will be impacted on during construction. However, given the sub-surface nature of potential archaeology, the ability to excavate this site through the construction phase will provide data to the archaeological community from the potential subsurface sites. The potential to gain knowledge outweighs the negative impact. Furthermore, the implementation of mitigation measures detailed in Section 12.6.1 for the proposed development will ensure that the cumulative effect is neutral and not significant.

12.9.2 Operational Phase

The operational phase of the proposed development will not require any subsurface disturbance and as such is not predicted to have any impact on archaeological, architectural and cultural heritage, and therefore no potential for cumulative impact.

12.10 REFERENCES

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APPENDIX 12.1

RECORDED ARCHAEOLOGICAL MONUMENTS

PREPARED BY CRDS LTD.

Recorded Archaeological Monuments located within c. 1.5km of the proposed development are listed below (source Sites and Monuments Record for Co. Dublin, www.archaeology.ie).

RMP NO: DU018-066----
Class: Building
Townland: Dublin South City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The Archaeological Survey of Ireland (ASI) is in the process of providing information on all monuments on The Historic Environment Viewer (HEV). Currently the information for this record has not been uploaded. To access available information for research purposes please make an appointment in advance with the Archive Unit (open Fridays 10.00 am – 5.00 pm), Department of Culture, Heritage and the Gaeltacht, The Custom House, Dublin 1 D01W6XO or email nmarchive@chg.gov.ie.

RMP NO: DU018-067----
Class: Burial
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The Archaeological Survey of Ireland (ASI) is in the process of providing information on all monuments on The Historic Environment Viewer (HEV). Currently the information for this record has not been uploaded. To access available information for research purposes please make an appointment in advance with the Archive Unit (open Fridays 10.00 am – 5.00 pm), Department of Culture, Heritage and the Gaeltacht, The Custom House, Dublin 1 D01W6XO or email nmarchive@chg.gov.ie.

RMP NO: DU018-020564-
Class: Quay
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The Archaeological Survey of Ireland (ASI) is in the process of providing information on all monuments on The Historic Environment Viewer (HEV). Currently the information for this record has not been uploaded. To access available information for research purposes please make an appointment in advance with the Archive Unit (open Fridays 10.00 am – 5.00 pm), Department of Culture, Heritage and the Gaeltacht, The Custom House, Dublin 1 D01W6XO or email nmarchive@chg.gov.ie.

RMP NO: DU019-013----
Class: Ritual site - holy well
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The site of this well is situated in the front of No. 35 Stiles Road. This was formerly part of a demesne NW of Clontarf Castle (Dillon Cosgrave 1977, 120; Ó Danachair 1958, 79). Stiles Lane has since been developed with housing estates. A tarmaced area at No. 35 Stiles Road is identified locally as the site of the well.

RMP NO: DU019-014001-
Class: Castle - Anglo-Norman masonry castle
Townland: CLONTARF EAST
Scheduled for inclusion in the next revision of the RMP: Yes

Description: Situated on a slight rise overlooking Dublin Bay just SW of a Church (DU019-015001-) and graveyard (DU019-015002-). The present castle is a Tudor-Revival House (1837) with a mock Norman keep attached, designed by Willliam Vitruvius Morrison. It occupies the site of a former castle associated in the 12th-century with Adam de Phephoe and later the Knights Hospitallers (Bence-Jones 1987, 87; Dawson 1976, 124-5, O'Donovan 1997, 17-18)). During the late 17th century the property passed to John Vernon, a quartermaster of Cromwell's army in 1650. The Civil survey (1654-6) describes a castle with a stone house adjoining a stone bawn at Clontarf (Simington 1945, 176). Rocque's map (1760) shows a large rectangular bawn with circular bastions at the NW and NE angles, which was demolished in 1837. Excavations in 1996 revealed little evidence for the original castle except for a section of wall (W 2.6m) orientated N-S, which extends under the existing building (O'Donovan 1997, 17-18).

RMP NO: DU019-014002-
Class: House - 16th/17th century
Townland: CLONTARF EAST
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The Civil survey (1654-6) describes a stone house with the castle (DU019014001-) adjoining a stone bawn at Clontarf (DU019-014003-, see Simington 1945, 176). Not visible at ground level.
Compiled by Geraldine Stout

RMP NO: DU019-014003-
Class: Bawn
Townland: CLONTARF EAST
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The Civil survey (1654-6) describes a castle with a stone house adjoining a stone bawn at Clontarf (Simington 1945, 176). Rocque's map (1760) shows a large rectangular bawn with circular bastions at the NW and NE angles, which was demolished in 1837.

RMP NO: DU019-015001-
Class: Church
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Located in a graveyard (DU019-015002-) situated at the NE boundary of Clontarf Castle Demesne. It may be on an earlier church site associated with St. Comgall. This is a plain rectangular building of undivided nave and chancel type (int. dims. L 21m, Wth 5.8m) with a tall single bellcote over the W gable and a residential tower attached. There was a N aisle originally entered through two arched openings in the N wall of the chancel (now blocked). Sometime after 1609 a N wing was attached. The nave is entered through a round-headed doorway on the S side. The interior is lit by tall plain round-headed, brick-faced windows. The residential tower in the W gable is entered through a semi-circular headed S doorway with chamfered sandstone jambs. The upper storey is offset and lit by a lunate window (Dillon Cosgrave 1977, 120-121).

RMP NO: DU019-015002-
Class: Graveyard
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Situated along the NE boundary of Clontarf Castle Demesne (Dillon Cosgrave 1977, 120-121). This relatively large walled in graveyard encloses the

remains of a medieval church (DU019-015001-). It contains 18th to 20th century memorials. It is still in use.

RMP NO: DU019-017----
Class: Well
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Located along Castle Avenue. At the site is a very decorative doorway with an inscription ' Brian Boroimhe's well' with a water dispenser inserted. This is the well where according to local tradition the Irish chiefs are said to have refreshed themselves during the Battle of Clontarf (Ryan 1938, 40-1; O'Gorman 1879, 80, 169).
Compiled by: Geraldine Stout
Date of upload: 23 November 2011

RMP NO: DU019-020----
Class: Battlefield
Townland: CLONTARF EAST,CLONTARF WEST,KILLESTER SOUTH
Scheduled for inclusion in the next revision of the RMP: No
Description: Battle of Clontarf (Cath Chluain Tarbh) – 1014
Note on location
The ITM coordinates provided for this battle must only be considered as indicative of its general location and have been purposefully positioned on the seafront at present-day Clontarf. It has not been possible to identify with any certainty where the battle took place other than to state that it occurred in the general area of the present suburb of Clontarf, roughly corresponding with the townlands of Clontarf West and Clontarf East and the intervening portion of Killester South. This would appear to be part of the small plain referred to in Irish sources as Mag n-Ealta (see map in Duffy 2013, 203). The coastline in this area has changed significantly and now extends some considerable distance into what were undoubtedly tidal sands or open water during the Viking period. At the time of the battle this area was bounded on the north-east by a wood and to the south-west by the Tolka River flowing into the sea. It would appear that the battle was contested in the immediate environs of a weir or possible fish trap whose exact location is unknown. It is referred to in one of the primary sources for the battle, the ‘Cogadh Gaedhel re Gallaibh: War of the Gaedhil with the Gaill’ (Cog. Gaedhel) which records that it was at the weir that Brian Boru’s grandson, Tairdelbach, died having pursued the retreating Vikings into the sea. The significance with which the battle was viewed by contemporary chroniclers is evinced by the references to it not just in Irish sources but also those of Welsh, French, Norse and Icelandic origin. These, however, must be interpreted within the context of their time and purpose and reflect the incremental, literary, political and historiographical requirements that successive generations brought to the event and the texts which recorded it. The battle has been the subject of numerous scholarly studies since the mid-nineteenth century and, in consequence, it is possible to identify the key events that happened on that fateful day, Good Friday, 23rd April 1014 (for recent commentaries see Duffy 2013, McGettigan 2013).
Background
The battle has its origins in the warrior culture of medieval Ireland, in those complex inter-dynastic struggles within the small elite nexus of high status individuals who, through whatever means at their disposal – marriage, alliance, patronage, protection, hostage or force – set out to put in place an extended power base that would bring them to the top of the ruling social pyramid. It is a testament to the tenacious capacity of the ruler of a small dynasty, the Dál Cais, in the south-east corner of what is now Co. Clare, that saw him rise to power and establish himself as king of Munster in the year 978: his name – one that resonates with every Irish school boy and girl – is Brian mac Cennétig otherwise known as Brian Bóraime (anglicised Brian Boru). He

managed events to the extent that he was able to wrestle power from rival political dynasties and after a successful battle at Glenn Máma in 999 extend his control over both Dublin and Leinster. In the following decade he further consolidated his power base northwards so that by time of the battle of Clontarf in 1014 he had ensured an acknowledgement of his overlordship not only among the native Irish but also among the Norse settlers and communities further afield on either side of the Irish Sea. This led him to being described in the contemporary Irish annals – allowing for an element of hyperbole – as 'high king of the Irish of Ireland and of the Foreigners and of the Britons.' (AU, s.a. 1014) But this power base was under constant threat and in 1013, the Viking king of Dublin, Sitriuc Silkenbeard, made incursions into Meath and further north. In this he was assisted by the king of Leinster, Máelmórda mac Murchada, who had fought with him against Brian in the battle of Glenn Máma. Brian marched north not only to face down the rebellion but possibly also to take Dublin and having spent three months in the field returned to Munster at the close of the year without achieving any notable success. It is evident that both Brian and the Dubliners then spent the following months securing allies that would support them in the expected renewal of hostilities. Sitriuc sought assistance from his Viking allies from as far afield as the Orkney Islands and down along the west coast of Scotland to the Isle of Man. Chief among his supporters were Sigurd, the jarl (earl) of Orkney and the Isles, and Bródar, the jarl of the Isle of Man. His other main allay was, as noted above, Máelmórda who commanded the Leinster army. In addition to his own followers among the Dál Cais, Brian sought hostings from his Munster allies, his other dynastic connections in Connacht and also from the 'men of Mide' (Meath) whose territory had been ravaged by the Viking and Leinster armies. Brian had also sought assistance from his own contacts across the Irish Sea and his force was supplemented by ten 'mormaír' (sea-stewards) supported by rival Vikings.

Brian commenced his campaign in March 1014 and his forces raided and plundered the lands of Kildare, south Dublin and Fingal. It is not entirely clear from the sources how both armies came to face each other at Clontarf but it seems probable that the Viking-Leinster army assembled in Dublin and marched out to respond to the harrying of the land in Fingal. It was possibly at this point that Brian moved his army to confront it. Assuming that there were at least 5,000 involved in the battle (see below) the logistics of coordinating the respective gatherings into defined formations as suggested by the sources make it difficult to reconcile the accounts of the battle. On the morning of 23 April 1014 the overseas Viking contingent, who must already have been in the bay of Dublin, probably drew up their ships at Clontarf in the area currently known as Fairview strand. It was here that they linked up with the Viking-Leinster army from Dublin who must have come to this area having crossed the Tolka river via Dubgall's Bridge. It has not been possible to identify with certainty where this was located though it may be suggested that it straddled the river at Ballybough, possibly somewhere in the vicinity of the present Luke Kelly Bridge. This bridge was to figure during the battle proper (below). Brian's army must already have been in the general area of Clontarf and, as may be inferred from the ensuing events of the battle, was probably drawn up in its various groupings facing towards the shore.

The battle

According to the sources the 'Foreigners' came out to fight in the morning when the tide was full: this would have enabled the Vikings beach their boats with relative ease at Clontarf. Sitriuc Silkenbeard does not appear to have taken part in the battle and he remained within the fortress at Dublin. The Cogadh records that the Viking-Leinster army was drawn up with the foreign troops in the van, the Dublin army next in line with the Leinster men in the rear. As noted above, Brian's forces at the battle comprised the contingents from his homeland, Dál Cais, together with other supporters from Munster, Connacht and the 'men of Mide' (Meath), though there is some debate about the involvement of the Meathmen in the battle proper. While Brian probably exercised strategic control over the battle plan there is little doubt, given his advancing years –

he was then in his early seventies –, that on the day of the battle he delegated immediate command to his son and heir apparent, Murchad, who led the Dál Cais contingent: these forces were positioned in the van. Behind them were the various other hosts from Munster and Connacht while Brian, together with a number of retainers, retired to the rear behind the main battle lines. His non-Irish allies were grouped together. Not fully trusting the loyalty of this force, the Meath men had requested that these 'Foreigners', though fighting on Brian's side, be positioned so that there was a ditch between the two contingents: clearly, there was some enmity between them.

In keeping with literary tradition the sources record that the battle commenced with a single combat bout between two champions on either side which ended in the death of both men. When the battle proper commenced the Connacht force took on those of Dublin and a wholesale slaughter ensued that resulted in the annihilation of the majority of the latter: it is recorded that the last of these was killed at 'Dubgall's bridge' possibly attempting to effect escape back to Dublin. This suggests that the battle lines were drawn up in groups under their respective commanders rather than in long lines as suggested by the Cogadh. This is confirmed by reference to the use of 'meirge' ('battle standard' or banners) during the conflict as these would have served as both rallying points and a means of identifying specific important commanders.

The sources are at one in confirming that the battle was fiercely fought on both sides and there seems little reason to doubt the account of the fighting recorded in the various Irish sources and sagas which provide horrific details of the slaughter that took place around the banners of the principal commanders on both sides. The death of the jarl of Orkney seems to have been a major event in the battle as he is recorded as the principal commander on the day. Eventually, Brian's army gained the upper hand as fighting progressed throughout the day. Indeed, it is recorded that the battle continued all day until the tide turned again that evening. This rising tide was a significant factor in determining the ultimate outcome of the battle for it is credited with carrying away the Viking ships. It also blocked off a potential escape route to the south-west across present-day Fairview Strand which would have led to Dubgall's Bridge on the Tolka. In addition, it probably inundated the area to the north-east prohibiting access to the wood. In the ensuing melee and flight there is little doubt but small numbers of Vikings tried to effect escape and it was one such band, under the leadership of one of the key commanders, Bródar, from the Isle of Man, that stumbled upon Brian's tent and killed him and some of his retainers: in the fight the Vikings were also slain. The majority of the remaining Viking-Leinster force was effectively trapped along the shoreline and those that did try to escape were cut down or drowned in the sea under the weight of their armour while attempting to reach their vessels.

It is impossible to give an accurate figure of the casualties inflicted on the two armies that day. Various estimates have been made over the years of the numbers who fought and died at Clontarf and while the combined strength of both armies added together has been postulated at c. 5,000 men (Hayes-McCoy 1990, 16), the sources record the presence of 1,000 'luirech' (breastplates or coats of mail) of the foreigners from outside Ireland and a like number from Dublin. And these numbers do not include the men from Máelmórda's Leinster force. Even allowing for an element of exageration in the above record it is evident from all the sources that there was a substantial number of combatants involved. It seems likely that the force at Brian's disposal was at least comparable in size given the scale of the victory on the day of the battle: indeed, it may even have been larger given the fact that it had to overcome a host of foreign well-armed Vikings who were seasoned campaigners.

Aftermath

After the battle the Cogadh claims that those bodies that could be identified as Brian's followers among the numerous dead on his side were gathered together and buried, presumably in a mass grave. The bodies of the Irish nobles were taken for burial to their own ancestral churches around Ireland. Brian's body was first taken to the

monastery at Swords and from there to Armagh, the ecclesiastical capital of Ireland, where he was interred. Given the losses suffered by Brian’s army, especially among the leading families including his heir apparent Murchad and his grandson, the battle of Clontarf could be considered as something of a pyrrhic victory for as the ensuing historical events demonstrate, the latent rivalries of the many, small, separate dynasties and kingdoms across Ireland that had been dormant and subservient to Brian during his reign reemerged into a fractious and fragmented political landscape. That said, the battle of Clontarf was hugely significant not only in terms of its effect on many of the leading Irish families involved but because, as noted in the Annals of Ulster, of the ‘slaughter of the Foreigners of the Western World’: in the eyes of the contemporary chroniclers and their successors it was a turning point in the history of Ireland and the Irish Sea.
Compiled by: Paul Walsh
Date of upload: 2 April 2014
References:

AU (1983) - The Annals of Ulster to 1311, ed. S. Mac Airt and G. Mac Niocaill (Dublin 1983)
Cogadh Gaedhel re Gallaibh; the war of the Gaedhil with the Gaill. J.H. Todd (ed.). Rolls series. Longmans, Green, Reader and Dyer. London, 1867.
Duffy, S. 2013 Brian Boru and the battle of Clontarf. Gill & Macmillan. Dublin.
McGettigan, D. 2013 The battle of Clontarf. Good Friday, 1014. Four Courts Press. Dublin.

RMP NO: DU019-033----
Class: Mine - lead
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Shown as 'Pump and Site of Old Lead Mine' on the 1837 edition of the OS 6-inch map. A lead mine on the shore of Clontarf was mentioned in a list of mines prepared in 1497 which continued in production for 300 years (De Courcy 1996, 80). When the promenade was built the last surviving shaft was incorporated into the base of a shelter on the city side of the swimming baths.

RMP NO: DU019-034----
Class: Building
Townland: Dublin North City
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Buildings were erected in an area near the present junction of Vernon Avenue and Clontarf Road known as the Sheds in the 17th century for the processing and storage of fish (De Courcy 1996, 81). Not visible at ground level.

APPENDIX 12.2

EXCAVATIONS

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The excavation bulletin website (www.excavations.ie) was consulted to identify previous excavations that have been carried out within c. 1.5km of the proposed development. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2019.

Excavation No.: 1996:069
Site name: Clontarf Castle, Clontarf
SMR No.: SMR 7:00201 Licence number: 96E0212
Author: Edmond O'Donovan for Margaret Gowen and Co. Ltd. Rath House, Ferndale Road, Rathmichael, Co. Dublin.
Site type: Medieval urban
ITM: E 719325m, N 736426m
Lat, Lon: 53.364546, -6.207126

An archaeological assessment was carried out on the site of Clontarf Castle to fulfil a condition of the planning permission for the scheme. The site is also listed in the Dublin Development Plan. The archaeological assessment was carried out in two phases between 26 August and 19 September 1996.

The original Clontarf Castle, erected by the AngloNormans, was the residence of Alan de Phepoe. who granted it to the Knights Templar in 1179. The Templars fell out of favour with the king and were suppressed in 1312, and their possessions subsequently passed to the Knights Hospitaller. Following the acquisition of the castle by the Hospitallers the preceptory was leased out from the fifteenth century. It eventually fell into the hands of John Vernon, a quartermaster of Cromwell's army in Ireland in 16S0. The present castle, a Tudor Revival house designed by William Virruvius Morrison, was built in 1836-7, when the earlier buildings were demolished. It consists of a mock-Tudor building attached to two tall, older 'Norman'-style towers. Prior to Morrison's building, the site is likely to have consisted of elements of the original Templar castle, later medieval alterations, including changes made by the Hospitallers, and the seventeenth-century fortified residence of the Vernons.

The assessment sought to establish whether any remains of the original Clontarf Castle and the additional buildings built up to the seventeenth century survived. The buildings were thought to have been demolished by Virruvius Morrison when he built the present Gothic-style house.

A total of 28 test-pits and trenches were opened across the site in order to establish the nature of any pre-1700 buildings on the site. Trial-trenching revealed that the site had been substantially altered and that little of the original castle remained. No medieval horizons were identified in any of the trenches opened.

The original location of Clontarf Castle can be estimated from Rocque's map, and William Morrison's nineteenth-century building coincides with this location. Since the house is to be incorporated into the new development, the main focus of the early buildings are likely to remain undisturbed, if they survive. However, there is evidence that buildings extended to the north and east of the castle in the eighteenth century (Rocque's map, 1756). A possible bawn wall is also depicted by Rocque, with rounded corner turrets at its northern end. A possible 'ditch' located on Rocque's map crosses the footprint of the new building, but no traces of any defences or ditch were located in the four trenches opened in this area.

Three trenches revealed evidence for walls of post-medieval or later date. These foundations may relate to buildings indicated on Petrie's illustration of the castle in 1834. A large, wide wall uncovered in one trench was assumed to be medieval, although there were no associated medieval layers or structures against it or in nearby trenches. It was orientated north-south and extended under the existing building towards the towers of the Morrison building.

A series of east-west walls and contemporary clays were recorded in one trench. The outbuildings of Morrison s nineteenth-century house were located to the rear (north) and east, and it is possible that these walls may represent the foundations of the outbuildings. No archaeological features were recorded on the west of the building. A seventeenth-century pit located in one trench may have functioned as a cesspit or drain.

One upstanding castle wall survives within the fabric of the original building, measuring 6m in length and surviving to a height of 4.8m above present ground level. It is presently covered with plaster render and pre-dates the structures attached to and on top of it.

Further excavation of the site in the vicinity of the large wall uncovered in one trench and around the standing wall incorporated into the tower will be necessary as they appear to be original to the Templar and Hospitaller houses.

The remains of the original medieval church associated with the site were noted outside the development area. It survives within the fabric of the present eighteenth-century church lying to the east of the development site.

Excavation No.: 1997:089
Site name: CLONTARF CASTLE, CLONTARF
SMR No.: SMR 7:00201
Licence number: 96E0212ext.
Author:Edmond O'Donovan for Margaret Gowen and Co. Ltd. Rath House, Ferndale Road, Rathmichael, Co. Dublin.
Site type: Environs of castle
ITM: E 719354m, N 736450m
Lat, Lon: 53.364755, -6.206682

An archaeological excavation was carried out on the site of Clontarf Castle. The existing 19th-century buildings are listed in the Dublin Development Plan. Archaeological test excavation was carried out on the site prior to the excavation (Excavations 1996, 17-18).

Two separate cuttings were excavated to the rear and north of the main house. Cutting 1 was centred on Trench 26 of the earlier archaeological assessment. The cutting measured 10m north-south and 11m east-west. Cutting 2 was located immediately to the east and was divided into two areas. Area 1 measured 13m north-south and 13m east-west. Area 2 measured 3.5m north-south and 9m east-west. Prior to hand-excavation, c. 0.5-1m of the uppermost deposits of mixed rubble debris were mechanically removed. The distinct lack of datable finds proved problematic in dating the site.

The excavation uncovered a medieval wall extending north-south at the western end of the site. No other structures were identified associated with the wall and no buried soils or deposits were found to be associated with it. The wall is interpreted as an early boundary defining the western extent of the medieval complex.

An early cobbled surface (17th-century) was identified in both Cuttings 1 and 2. These surfaces were dated to the post-medieval period on the basis that the only associated deposits, albeit identified above the cobbling, consisted of post-medieval clays. These included a grey gravelly clay identified in Area 1, a cultivated soil identified in the eastern portion of Cutting 1, and a cultivated soil identified in the western portion of Cutting 2, all dating from the post-medieval period.

The walling recorded in Cutting 2 (Area 1) consisted of a series of post-medieval walls. The cutting was opened to examine the fabric of a large wall recorded in Trench 8 during the archaeological assessment. The wall had been identified as being potentially medieval in date; however, this proved not to be the case. The walls were later than and cut through the earlier 17th-century cobbling. The structures are most likely to be associated with outbuildings that originally formed part of the Tudor Revival mansion dated 1836-7.

The building identified in Cutting 2 (Area 2) was part of the rear range of buildings associated with the mansion. The excavation identified a platform. This formed the foundation on which steps led down and out of the building. The cultivated soils identified north of this strongly suggest that the steps led out into a garden which was likely to have been walled.

Excavation No.: 2001:377
Site name: Berth 51a, Dublin Port
SMR No.: N/ A
Licence number: 01E0288
Author: Edmond O'Donovan for Margaret Gowen and Co. Ltd. Rath House, Ferndale Road, Rathmichael, Co. Dublin.
Site type: Tidal mud and silt banks
ITM: E 719973m, N 734405m
Lat, Lon: 53.346250, -6.198163

Ten test-trenches were excavated on the location of the extension to Berth 51a in Dublin Port. Three layers were identified in the deposit profile established in Trenches 1–9. The depths of the layers varied in the individual trenches and indicated a gently sloping surface in both glacial and post-glacial times; however, the sequence and constituent make-up of the deposits remained constant.

The upper deposits excavated consisted of backfilled material dumped on the old estuary surface in 1970. These deposits were 1–2m deep and were made up of heavy demolished building debris (rubble stone, brick and concrete and fragmentary iron reinforcing). This backfilled material was dumped in the estuary in the 1970s as a solid retaining wall to surround the reclamation scheme for the new ferryport terminal. The building debris lay above the fine estuarine silt that accumulated in the mouth of the Liffey on either side of the old channel leading into the port. The deposits of silt accumulated to a depth of 1–3.8m and overlay glacial gravel at the base of the deposit profile.

Trench 10 was the most southerly trench excavated and recorded the deposits of rubble debris utilised as bund material in the 1970s. The identification of deep deposits of bund material at this location identified the old dredging line associated with the deepening of the port in the late 1960s.

No archaeological deposits or indicators were located in any of the test-trenches. A silt deposit was identified along the area to be dredged, with the exception of Trench 10, where this deposit had been completely removed. The results of the test excavation corroborated the results of earlier geophysical survey.

Excavation No.: 2001:429
Site name: Grange Castle International Business Park, Grange and Kishoge
SMR No.: N/ A
Licence number: 01E0718 ext.
Author: Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.
Site type: Post-medieval
ITM: E 719482m, N 736542m
Lat, Lon: 53.365552, -6.204725

The archaeological assessment carried out in this area during February 2001 (see below, No. 438) recommended that an archaeologist be present to monitor the stripping of topsoil.

The initial recognition of archaeological features was compromised somewhat by the contractor stripping a quantity of topsoil before informing the archaeologist. However, several metalled surfaces, field drains, pits and gullies of post-medieval and modern date were recognised during the stripping when an archaeological presence was maintained.

In Kishoge townland, to the south-west of the area intended for the attenuation lake, the remains of a subrectangular structure, which appears to have burnt down, were detected. This consisted of what appeared to be the remains of slot-trenches cut into natural boulder clay with a fill of oxidised clay and charcoal. The feature measured 5.8m east–west by 4.6m and appeared to have been truncated through intensive ploughing. Access to this area was not available at the time of the assessment owing to dumping and storage of building materials. This area was later excavated by Edmond O'Donovan (see below, No. 438).

Excavation No.: 2004:0490
Site name: CLONTARF CASTLE, CLONTARF
SMR No.: N/ A
Licence number: 03E0832
Author:Claire Walsh, 27 Coulson Avenue, Rathgar, Dublin 6.
Site type: No archaeological significance
ITM: E 719378m, N 736385m
Lat, Lon: 53.364172, -6.206348
Planning permission has been granted for alterations to Clontarf Castle, a protected structure, SMR 19:14(01). The alterations included the addition of six extra surface car-parking spaces along the driveway. The work was undertaken on 14-15 November 2004. No archaeological deposits were present.

Excavation No.: 2004:0537
Site name: BERTH 50A, DUBLIN PORT
SMR No.: N/ A
Licence number: 04E0560
Author:William O. Frazer, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.
Site type: No archaeological significance
ITM: E 719726m, N 734245m
Lat, Lon: 53.344869, -6.201931
Monitoring of dredging for a new berth was undertaken in April-May 2004. The berth is at the south end of Breakwater Road South, adjacent to land reclaimed by the Dublin Port Authority/ Company in the past 37 years, just east of the North Wall and the North Wall (Breakwater) lighthouse and just west of the car ferry terminal. While most of the site lay within the main modern Dublin Harbour channel, and has thus been dredged regularly in recent times, it was near the historical location of Brown's Patch sandbank and Clontarf Pool, in an area infamous for its tortuous, shifting sands, at the confluence of the Liffey and Tolka estuaries. No wrecks are recorded specifically for this area, but the eastern extremity of Brown's Point was sufficiently dangerous to have been successively marked by buoys to prevent breaching by vessels entering either Dublin Port or Clontarf Pool. No archaeology was revealed anywhere on the site, and no further mitigation was recommended.

Excavation No.: 2005:408
Site name: 2 KINCORA ROAD, CLONTARF
SMR No.: N/ A
Licence number: 05E1246
Author: Franc Myles, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.
Site type: No archaeological significance
ITM: E 719525m, N 736278m
Lat, Lon: 53.363172, -6.204184

The site was located to the north-east of Clontarf village uphill from the shoreline, within a residential area developed in the 1940s. It is close to several archaeological sites but did not impact directly on their areas of constraint.

Two Bronze Age bronze axeheads were found at Clontarf (Stout and Stout 1992, 9–10), but there are no further indications of prehistoric settlement in the area.

The site of the Battle of Clontarf seems to have extended from Summerhill towards Fairview and parts of Clontarf. There was, however, no evidence recorded for anything pre-dating the construction of the bungalow that occupied the development site.

Reference

Stout, G. and Stout, M. 1992 Patterns in the past: County Dublin 5000 BC–1000 AD. In F.H.A. Aalen and K. Whelan (eds), Dublin city and county: from prehistory to present. Dublin.

Excavation No.: 2005:477
Site name: SHERIFF STREET/ CHURCH STREET EAST, DUBLIN
SMR No.: N/ A
Licence number: 05E0080
Author: Goorik Dehaene, Glascarn, Ratoath, Co. Meath, and Denise Cronin, for Arch Tech Ltd.
Site type: Post-medieval church remains
ITM: E 717497m, N 734816m
Lat, Lon: 53.350497, -6.235184

The site is located between Sheriff Street, Church Street East and Abercorn Road in east inner-city Dublin. This site was identified by ESBI during site works. The site was inspected by Antoine Giacometti, who noted the presence of architectural remains.

The south-west corner of a large masonry structure was visible, which continues east and north beyond the limits of the excavation (and the site). The exposed structure measured 16.75m north–south by 6.5m and was up to 1m in height. The walls measured 0.7–0.9m in width. Cement repair work along the south-facing portion of the wall was evident. The wall comprised varying-sized limestone blocks and stones bonded with a grey compact lime mortar with small stones and flecks of charcoal. The foundations were cut into a dark-brown organic peaty soil (a probable reclamation deposit). In section this organic layer was c. 0.3m deep, overlying a greyish, silty natural layer. Isolated fragments of late 18th- and 19th-century pottery were noted throughout the deposit.

Subsequent to recording the structure, the removal of a portion of the foundations was monitored. No further archaeological material was identified.

The archaeological investigations of this site have revealed the foundations of a large stone structure. Assessment of available historical and cartographic sources indicates that this structure was a church dating from the late 18th to 19th century. No other archaeological structures or features were identified.

Excavation No.: 2006:602
Site name: Bond Street, Dublin
SMR No.: -
Licence number: 06E0003
Author: Melanie McQuade, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.

Site type: No archaeological significance.
ITM: E 718575m, N 735526m
Lat, Lon: 53.356632, -6.218724
Monitoring was carried out at this site, which lies on the eastern side of Bond Road to the south of the Tolka River. Prior to development, the site was occupied by two warehouses. The depth of excavation was 1m and a series of engineering trial pits were excavated to depths of between 4.5m and 5m. Monitoring revealed that the development site was located on made ground comprising fill dating from the 20th century. Natural ground was identified in the trial pits c. 5m below the present ground level. Nothing of archaeological significance was identified.

Excavation No.: 2006:640
Site name: 117–126 Sheriff Street Upper, Dublin
SMR No.: -
Licence number: 06E0327
Author: Helen Kehoe, 11 Norseman Place, Stoneybatter, Dublin 7.
Site type: Post-medieval
ITM: E 717613m, N 734776m
Lat, Lon: 53.350109, -6.233456
Planning permission was granted to demolish the Liffey Trust building, an ESB sub-station and a house structure and to erect an eight-storey over basement building comprising offices, retail and residential units, and associated services, works and connections.
There was no evidence for any archaeological deposits or structures revealed during excavation for the groundworks. The site lies in an area which was originally laid out in regular plot units without buildings. An 1809 map indicated that the land was still a 'greenfield area'. The OS map of 1876 indicated later industrial development on the lands which incorporated the site.

Excavation No.: 2006:676
Site name: Marino/ Clontarf/ Dollymount/ Raheny/ Kilbarrack
SMR No.: DU019–033, DU019–034, DU019–001, DU015–083
Licence number: 06E1115
Author: Rob Lynch, Irish Archaeological Consultancy Ltd, 9 Albert Terrace, Meath Road, Bray, Co. Wicklow.
Site type: Monitoring
ITM: E 719133m, N 736471m
Lat, Lon: 53.365000, -6.210000
Monitoring work for the North Fringe Water Supply scheme is ongoing, although to date nothing of archaeological significance has been found. A full summary will be made available for the 2007 publication.

Excavation No.: 2008:396
Site name: 76 Clontarf Park, Dublin
SMR No.: N/ A
Licence number: 08E0344
Author: Eoin Corcoran, ADS Ltd, 110 Amiens Street, Dublin 1.
Site type: Testing
ITM: E 720086m, N 735862m
Lat, Lon: 53.359309, -6.195915
The site at 76 Clontarf Road was assessed by means of a desktop study and test-trenching in June 2008. The site is located beside the 'Clontarf Sheds', DU019–034. The development of the site is to involve the demolition of the current structure and the construction of a new building containing two residences. Testing was carried out on the 10 June. This consisted of the mechanical excavation of a single trench across

the site, orientated from north to south. The trench measured c. 12m long and 2m wide.

The stratigraphy consisted of a 0.4–0.6m thick layer of rubble and grey/ brown loam over grey and yellow boulder clay with a varying content of gravel. The trench was excavated to an average depth of 0.7m, though a portion towards the centre of the trench was excavated to a depth of 1.3m to ensure the boulder clay was not redeposited. The gravel content of the clay increased with depth of excavation. The trench filled with water at either end upon excavation, suggesting the presence of springs in the area. No archaeological features or artefacts were revealed during the course of the testing.

Excavation No.: 2008:408
Site name: Luas C1 development, George's Dock/ Mayor Street Upper and Lower, etc.
SMR No.: N/ A
Licence number: 07E0167
Author: Frank Mallon, Callan Lodge, 130 Ballygassoon Road, Co. Armagh BT61 8JU.
Site type: Monitoring
ITM: E 717929m, N 734582m
Lat, Lon: 53.348299, -6.228788

Monitoring took place of groundworks associated with the Luas C1 development from November 2007 to 18 April 2008. The development extends for 1.5km from Connolly Station to the termination at the Point Depot, past George's Dock and along Mayor Street Upper and Lower, and the north side of the Liffey in Dublin City Docklands and will largely be constructed on the road surface.

The alignment is located in areas along the north side of the Liffey that were reclaimed from the 1730s and later. The majority of the land was used extensively in the 18th, 19th and 20th century for heavy industry, rail and shipping use, but evidence for earlier use has been identified. Previous excavations within 150m south of the development uncovered the remains of Mesolithic and Neolithic fishtraps, the earliest dated examples recorded in either Ireland or the UK and therefore of international importance.

No major archaeological finds or features were uncovered. Several sections of wall foundations for buildings that are depicted on the 19th-century editions of the OS maps for the area were located. These were not impacted on and were reburied.

A series of brick-lined sewers dating to the 19th century were also located. These were observed in several locations along the alignment of Mayor Street Upper and Lower. In some cases it was necessary to break through these sewers and reinforce them to prevent collapse.

A 19th-century plank-lined drain was located at the site of the electrical substation at the Spencer Dock stop, along with 42 glazed pottery fragments, and two clay-pipe stems, again all of 19th-century date.

Excavation No.: 2008:410
Site name: Grand Canal Place, Dublin
SMR No.: N/ A
Licence number: 08E0741
Author: Helen Kehoe, 11 Norseman Place, Stoneybatter, Dublin 7.
Site type: Canal basin
ITM: E 717759m, N 734427m
Lat, Lon: 53.346944, -6.231389

The Grand Canal Harbour at Grand Canal Place was the original Dublin terminus of the Grand Canal and was completed in 1785. In 1978 it was infilled and built over. The harbour originally consisted of two rectangular basins; these were later extended by the addition of a semicircular basin to the north.

Initial site investigations have shown that the canal quay walls remain in situ at three locations and, knowing that the harbour was filled in the 1960s/ 70s, it is likely that most of the quay walls remain in place underneath the modern buildings existing on the east and west sides of the canal perimeter. Future site recording is envisaged in light of the importance of the site to the post-medieval industrial landscape.

Excavation No.: 2010:260
Site name: Berth 50, Dublin Port
SMR No.: N/ A
Licence number: 09E0200, 10E0051
Author: David J. O'Connor, CRDS Ltd, Unit 4a, Dundrum Business Park, Dublin 14.
Site type: Urban
ITM: E 719914m, N 734516m
Lat, Lon: 53.347260, -6.199007

At the request of Dublin Port Company, monitoring was undertaken of the enlargement and reintroduction of the foreshore at Berth 50, Dublin Port. The area of Berth 50 was part of Dublin Bay until the 1960s when it was filled in during an expansion of the port area. The possibility of a wreck surviving underneath Berth 50 necessitated monitoring.

The proposed development consisted of the construction of piled new quay walls followed by the removal of the modern infill to create an enlarged Berth 50. The excavation was undertaken by two mechanical tracked excavators on a floating platform.

Monitoring of excavation of the modern infill and original seabed layers underneath took place between 2 February and 28 April 2010. No archaeological features or finds were uncovered during the course of the works.

Excavation No.: 2012:192
Site name: Coolock/ Brookville/ Killester North/ Artaine South/ Donnycarney/ Clontarf West/ Marino/ Drumcondra/ Clonturk/ St Thomas Ward
SMR No.: N/ A
Licence number: 12E295
Author: Fintan Walsh, IAC Ltd, 120b Greenpark Road, Bray, Co. Wicklow.
Site type: Monitoring
ITM: E 718075m, N 735141m
Lat, Lon: 53.353286, -6.226380

A programme of monitoring associated with the Bord Gáis Pipeline Replacement Project between East Wall Road and Coolock is currently ongoing. The pipeline is mainly located within existing road carriageway but will pass through Fairview Park and cross the River Tolka. The pipeline route passes c. 60m from a burial site (DU018-067) identified during construction work at Marino Crescent. A mound (DU015-074) lies c. 100m from the pipeline route in the grounds of the Cadbury Factory. To date no features of archaeological significance have been identified.

Excavation No.: 2015:125
Site name: North City Water Supply Scheme Phase 1, Clontarf, Dublin
SMR No.: n/ a
Licence number: 14E0425
Author: Graham Hull, TVAS (Ireland) Ltd, AHISH, BALLINRUAN, CRUSHEEN, CO. CLARE
Site type: No archaeological significance
ITM: E 718582m, N 736328m
Lat, Lon: 53.363835, -6.218324

Monitoring of water pipe laying took place between August 2014 and August 2015. The part of the scheme that required monitoring was in Clontarf West townland, along

Hollybrook Park, Hollybrook Road and part of Clontarf Road. Trial holes in the grassed area along the seafront south of Clontarf Road and east of Alfie Byrne Road were also monitored. The monitoring did not locate definite archaeological features, deposits or finds, however a single potential archaeological deposit, namely a small burnt feature, was recorded at one location on Hollybrook Road.

Excavation No.: 2015:218
Site name: North Dock Sewerage Scheme, Dublin
SMR No.: n/ a
Licence number: 15E0330
Author: David McIlreavy & Brenda Fuller, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow
Site type: No archaeology found
ITM: E 717709m, N 734768m
Lat, Lon: 53.350017, -6.232014
Monitoring of site investigation pits was carried out along Sherriff Street Upper, Dublin 1, associated with the North Docklands Sewerage Scheme – Advance Utility Diversion Contract. Monitoring was recommended in a desktop assessment undertaken in April 2009 for any open trenching in the Sherriff Street area (Tobin, 2009).
Monitoring was undertaken in November 2015. No archaeological finds or features were identified during this phase of the development.

Excavation No.: 2016:397
Site name: Alexandra Basin Redevelopment Project
SMR No.: None
Licence number: 16E0212; 16E0212 ext
Author: Niall Brady, Archaeological Diving Company Ltd, Beverley Studios, Church Terrace, Bray, Co. Wicklow
Site type: Port
ITM: E 718392m, N 734394m
Lat, Lon: 53.346505, -6.221900
Dublin Port Company is implementing the Alexandra Basin Redevelopment project, and is conducting a series of Site Investigations (SI) to inform the engineering design process. Monitoring has taken place of the SI works, which began on North Wall Quay Extension, continued on Crossberth Quay, and extended to monitoring marine site investigations within the Approach Channel and associated areas. No archaeologically significant material was recovered during this work but a profile of the buried strata is being constructed across the development area based on the SI observations. Monitoring is an ongoing process throughout the project and will continue in 2017.

Excavation No.: 2017:109
Site name: Port Centre Precinct, East Wall Road, Dublin
SMR No.: N/ A
Licence number: 16E0500
Author:Faith Bailey, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow
Site type: No archaeology found
ITM: E 718130m, N 734857m
Lat, Lon: 53.350723, -6.225660

Monitoring of works associated with public realm landscape upgrades to the existing Port Centre Precinct was carried out in 2016 and 2017. Reclamation deposits were identified beneath the tarmac and topsoil that was removed during the works. These varied in composition, which is not unusual as any fill material that could be obtained for reclamation was used. A cut stone surface was identified in one of the trenches, which is likely to relate to the former ship-building yard that was located to the south of the existing precinct structure. No features of archaeological significance were identified during the course of works.

Excavation No.: 2017:565
Site name: North Docklands Sewerage Scheme, Dublin 1
SMR No.: N/ A
Licence number: 17E0058
Author:James Hession, Rubicon Heritage Services Ltd, Office 8, Dominick Court, 41 Dominick St. Lower, Dublin 1
Site type: No archaeology found
ITM: E 717716m, N 734632m
Lat, Lon: 53.348796, -6.231960A programme of monitoring of groundworks was undertaken for works relating to the proposed North Docklands Sewerage Scheme, North Wall, Dublin 1. The proposed archaeological works were carried out from 6 February 2017 to 29 September 2018. The work was undertaken on behalf of Ward and Burke Ltd.

The North Docklands Sewerage Scheme is an €18 million investment that will deliver an upgrade to the wastewater collection network serving the North Docklands area. The North Docklands area has seen significant development over the past two decades and was designated as a Strategic Development Zone in 2014. The existing wastewater collection network serving the area is based mainly on a single pipe combined system, which is in excess of 150 years old. Once completed, the newly upgraded wastewater network in the North Docklands area will be capable of handling the areas fast growing population and will protect and improve water quality in the River Liffey.

Monitoring of the groundworks identified the remnants of two 19th-century masonry structures at the northern extent of the shafts associated with MH3.1 and MH4. A limestone wall representing the remnants of the foundation courses of a structure depicted on the corner of Castleforbes Road and Sheriff Street Upper was identified at MH3.1 at 3.2m below the existing ground level. A second limestone wall associated with a former patent slip structure was identified beneath the northern extent of shaft MH4 within Dublin Port at 4m below the existing ground level.

No features, deposits or finds of archaeologically significance were identified during the course of the monitoring programme. The walls associated with masonry structures identified at MH3.1 and MH4 are of historical significance and were recorded and removed in order to facilitate the works.

No further archaeological work should be required in connection with this development.

APPENDIX 12.3

NATIONAL INVENTORY OF ARCHITECTURAL HERITAGE

PREPARED BY CRDS LTD.

The recorded archaeological sites within c. 1km of the development are listed below, all noted in the National Inventory of Architectural Heritage (NIAH) for Co. Dublin (www.archaeology.ie).

East Wall Road, Alexandra Road, Dublin, Dublin City

Reg. No.	50011170
Date	1880 - 1910
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318208, 234875
Categories of Special Interest	ARCHITECTURAL ARTISTIC TECHNICAL
Rating	Regional
Original Use	electricity substation
Description	Detached corner-sited two-storey electricity substation, built c.1900, with single-bay breakfronted front elevation and three-bay north side elevation, latter fronting onto Alexandra Road. Flat roof hidden behind brick parapet wall with moulded granite coping. Red brick walls laid in Flemish bond with brick plinth course, moulded brick string course between floors, stop-chamfered bowtell mouldings to corners and deep moulded brick cornice to base of parapet. Gauged brick round-headed window openings with granite sills and impost mouldings. Front west elevation has shallow breakfront with paired window openings to the first floor having timber casement windows and hood-mouldings. Gauged brick round-arched door opening to breakfront with further gauged brick arch and hood-moulding springing from pair of brick Doric piers on moulded plinth blocks. Double-leaf vertically-sheeted timber doors and timber over-panel opening onto pavement via granite step. To either side of breakfront is oculus formed in gauged moulded brick with four-pane timber lights. Three-bay north side elevation with bricked up windows except to ground floor having timber-framed overlights, with each bay flanked by full-height brick pilasters. East elevation is blank with cast-iron hopper and downpipe breaking through parapet wall. South elevation obscured by vegetative growth

Appraisal	This brick structure was built as a utilitarian piece of electrical infrastructure in the industrial Docklands area. The decorative brick detailing to the principal facades attests to the attention to aesthetic detail that remained so important into the early twentieth century while forming an attractive element on both streetscapes

Alexandra Road, Dublin, Dublin City

Reg. No.	50011171
Date	1890 - 1910
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318642, 234848
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	electricity substation
In Use As	electricity substation
Description	Attached single-bay single-storey electricity substation, built c.1900. Flat roof hidden behind brick parapet wall with granite coping and central pediment rising above pediment with granite capstones to centre and either side. Red brick walls laid in Flemish bond with brick plinth course, brick pilasters to either end, moulded brick string course and moulded brick cornice to base of parapet. Central square-headed door opening with replacement steel doors and chamfered granite lintel. Open pediment to door opening with applied Dublin City coat of arms to tympanum and dentillated brick detail to raking cornice of pediment.
Appraisal	This diminutive structure was built as a utilitarian piece of infrastructure in an industrial docklands area. The inclusion of a pedimented door surround shows the remarkable attention to aesthetic detail that was employed in all civic projects up to the early twentieth century.

Pump House, Alexandra Road, Dublin 1, Dublin City

Reg. No.	50060587
Date	1900 - 1920
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318411, 234709
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	building misc
In Use As	store/warehouse
Description	Detached gable-ended pump house, northern three-bay double-height half, built c.1910, and southern three-bay two-storey added shortly later, adjacent to southeast corner of now-infilled Graving Dock. Pitched natural slate roof with black clay ridge tiles set behind raised gables having granite coping and moulded granite kneeler stones. Replacement uPVC guttering supported on stepped brick eaves course, with replacement uPVC down-pipes embedded in walls. Buff brick walls laid in English garden wall bond with projecting brick plinth course having chamfered granite trim (to north half only). Earlier part has recessed panels with gauged brick round-headed window openings having multiple-pane iron windows with spoked heads and granite sills. Gauged brick camber-headed window openings to south half with replacement timber windows and granite sills. Gauged brick segmental-headed vehicular opening to north gable with original double-leaf sheeted timber doors. Gauged brick square-headed door opening to south bay having double-leaf sheeted timber doors. Interior is double-height to north end and two-storey to south end. Northern part has timber sheeted roof with iron ties and painted brick walls. Windows flanked by piers openings and supporting rolling steel mechanism. Located in Dublin Port, area comprising modern industrial and maritime buildings,

	interspersed with patches of wasteland. Early twentieth-century dry dock to east.
Appraisal	Although now in use as a store, with little evidence of the associated pump machinery, this early twentieth-century pump house forms part of the rich industrial heritage of Dublin Port. It is notable for its two halves of different dates, with different facade arrangements, though unified by the common use of brick walling and continuous corbelled-out brick eaves work. The earlier, associated Graving Dock appears to have been infilled, and consequently this former pump house remains as one of the few remnants from that era. The varying nature of the facade and its openings, coupled with good eaves details, makes this building visually interesting. Its function gives it technical interest.

Dublin Graving Dock, Alexandra Road, Dublin 1, Dublin City

Reg. No.	50060588
Date	1900 - 1920
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318444, 234760
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	dry dock
In Use As	dry dock
Description	Rectangular-plan poured concrete graving dock, built c.1910. Approximately fifteen metres deep, with steeply-sloping walls, and having flights of concrete steps to both sides. Two sets of large steel sluice gates divide dock in two, with timber walk boards. Some cast-iron mechanisms around perimeter still extant. Coursed and squared rubble limestone walls and square-capped piers to northern site boundary. Located at west end of Dublin Port, area largely comprising modern industrial and maritime buildings, interspersed with patches of wasteland.
Appraisal	A large-scale graving dock built in the early twentieth century and still in use today. The scale is impressive, and the dock is an important part of the industrial heritage of Dublin Port.

R. & H. Hall, Alexandra Road, Dublin 1, Dublin City

Reg. No.	50060589
Date	1910 - 1930
Previous Name	Merchants Warehousing Company Ltd/Odlum's Mills
Townland	
County	Dublin City
Coordinates	318609, 234766
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	National
Original Use	granary
In Use As	granary
Description	Detached nine-bay fifteen- to twenty-storey reinforced concrete grain silo, built 1915-20, with attached steel bin silo added c.1932 to north, and further reinforced concrete silo attached to north 1938. Three six-storey single-bay projections to front elevation. Flat roof and rainwater goods not visible. Reinforced concrete walls arranged in vertical recessed panels, nine to front elevation with five to side elevation. Heavy cornice to older part, with mutules and heavy plat-band to storey below. Above cornice is three- to four-storey attic section with further central head-house floor. Square-headed window openings with wrought-iron multiple-pane windows and splayed concrete sills. Square-headed carriage-arch openings to west and east elevations to allow for loading, with granite wheel-guards and diorite setts to west opening. Located to west end of Dublin Port, area largely comprising modern industrial and maritime buildings, interspersed with patches of wasteland. Dry dock situated to west. Complemented by associated silos to east, of similar period and style.

Appraisal	An enormous and architecturally impressive representative of large-scale early-twentieth-century industrial architecture, this grain silo, designed by Frederick G. Hicks, constitutes the most elaborate in Ireland in terms of both scale and design. The application of a cornice to this symmetrical façade gives the structure a formal aspect not usually found in this building type. When viewed from Ringsend, on the opposite side of the River Liffey, the composition and scale can be well appreciated and stands out as the most monumental structure in the district.

Odlum's Mills, Alexandra Road, Dublin 1, Dublin City

Reg. No.	50060590
Date	1910 - 1930
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318709, 234787
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	granary
Description	Detached eleven-bay six-storey reinforced concrete grain silo, built c.1920, with four-bay short elevations, and with further multi-storey concrete tower and collection of single and two-storey flat-roofed accretions to north. Flat roof not visible, with some visible cast-iron box-profile down-pipes. Reinforced concrete walls arranged in vertical recessed panels, four to north elevation and eleven to west, each framed by giant panelled pilasters. Over-sailing concrete crown cornice below attic storey. Square-headed window openings arranged in pairs to west elevation (window details not visible) blocked up with grey brick to north elevation. Three blind vertical panels to all north, east and south elevations of tower with attic storey having continuous glazing. West elevation has stepped façade with glazed breakfront having continuous vertical glazing. Located at west end of Dublin Port, in area largely comprising modern industrial and maritime buildings, interspersed with patches of wasteland. Complemented by associated silo to west, of similar period and style.
Appraisal	The main block within this group exhibits restrained classical proportions including full-height pilasters and crown cornice.

The building appears to be out of use while the remaining structures are less noteworthy. As an early twentieth-century example of industrial architecture, the main building represents one of a small collection of grain-associated buildings that adds significant architectural interest to Dublin Port.

Odlum's Mills, Alexandra Road, Dublin 1, Dublin City

Reg. No.	50060591
Date	1920 - 1950
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	318701, 234721
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	granary
Description	Detached multiple-bay multi-storey reinforced concrete grain silo, built c.1935, abutted by further two-bay wing and steel grain silo drums to east and west. Flat roof and rainwater goods not visible. Reinforced concrete walls to tower and lower structure. Riveted cylindrical grain silo drums on concrete base. Square-headed window openings with steel casement windows. To north and south elevations of tower is single vertical glazed panel with horizontal windows visible to attic storey. Lower section has steel casement windows. Some silo drums have had aluminium windows inserted. Two-storey block abutting base of south elevation has steel windows and timber loading doors. Located at west end of Dublin Port, in area largely comprising modern industrial and maritime buildings, interspersed with patches of wasteland. Complemented by associated silo to west, of similar period and style.
Appraisal	This composition appears to date from the 1930s, suggested by the vertical emphasis of the tower with its strip glazing. The silo drums are purely utilitarian while the abutting south block appears to have been truncated. Together they form an austere industrial composition with traces of the Art Deco style. As an early twentieth-century example of industrial architecture, the group is one of a small collection of grain associated buildings that add architectural interest to Dublin Port.

Alexandra Road, Branch Road South, Dublin 1, Dublin City

Reg. No.	50060592
Date	1910 - 1930
Previous Name	N/A
Townland	
County	Dublin City
Coordinates	319123, 234719
Categories of Special Interest	ARCHITECTURAL TECHNICAL
Rating	Regional
Original Use	building misc
Description	Detached multiple-bay multi-storey industrial building, built c.1920, with narrow wing to west. Pitched roofs with replacement steel sheeting and raised central section with timber louvres to sides. Redbrick walls laid in stretcher bond on riveted iron frame. Randomly placed tripartite timber framed windows inserted at later date. Located at west end of Dublin Port, in area largely comprising recent industrial and maritime buildings, interspersed with patches of wasteland. Abutted by two-storey red brick building to east.
Appraisal	This industrial building has an early twentieth-century appearance and may be one of the earliest of its type in the port. The exoskeleton design and richly textured red brick give this building a distinct appeal as a good example of early steel-frame construction, contributing to the architectural history of Dublin Port and its rich industrial heritage.

APPENDIX 12.4

ARCHAEOLOGICAL FINDS

PREPARED BY CRDS LTD.

The recorded archaeological finds in the vicinity of the proposed development, are listed below, all noted in published catalogues of prehistoric material: Raftery (1983 - iron age antiquities), Eogan (1965; 1993; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers) and the Irish Stone Axe Project Database. The following townlands were assessed Clontarf, Irishtown and Ringsend.

Townland	Object	Reference	Catalogue No
Clontarf	Bronze Sword	Eogan 1965	151
Clontarf	Early Bronze Age Halberd	Harbison 1969a	133
Clontarf	Early Bronze Age Halberd	Harbison 1969b	876
Clontarf	Early Bronze Age Halberd	Harbison 1969b	877
Clontarf	Early Bronze Age Halberd	Harbison 1969b	878
Clontarf	Early Bronze Age Halberd	Harbison 1969b	879
Clontarf	Early Bronze Age Halberd	Harbison 1969b	1683

APPENDIX 12.5

SHIPWRECKS

PREPARED BY CRDS LTD.

The Wreck Viewer is a new free-to-use digital service provided by the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht (see https://www.archaeology.ie/underwater-archaeology/wreck-viewer). It has been developed to facilitate easy access to the National Monuments Service's Wreck Inventory of Ireland Database (WIID) and to complement the existing Historic Environment Viewer which provides access to the databases of the Sites and Monuments Record (SMR) and the National Inventory of Architectural Heritage (NIAH).

It is important to note that the Wreck Viewer displays only wrecks for which there is a recorded location and these are represented on the map canvas as red dots. The red dot equates with the known approximate centre point of the wreck and is not indicative of its geographic or spatial extent. Wrecks with known locations account for approximately 22% of the total number of records contained in the WIID; there is data held within the WIID on a large number of wrecks for which we have no precise recorded location, co-ordinate or known extent. Of the approximate 18,000 records only 4,000 have precise locations leaving approximately 14,000 wrecks in the database for which a location has yet to be confirmed.

Wreck Name	Unknown
Wreck No.	W01465
Classification	Unknown
Place of Loss	Dublin Port, River Liffey, N Bank, 53 20 53.029N, 06 10 56.67W
Date of Loss	Unknown
Year of Loss	
DD Latitude	53.34806
DD Longitude	-6.18241
Source of co-ordinate	National Monuments Service
Description	Remains of a wooden wreck protrude through the mud.
Record Source	Brady 2008, 278; National Monuments Service.

Wreck Name	Unknown
Wreck No.	W01466
Classification	Unknown
Place of Loss	Dublin, N Bull, S end, in a creek, 53 21 01.599N, 06 10 38.6W PA
Date of Loss	Unknown
Year of Loss	
DD Latitude	53.35044
DD Longitude	-6.17739
Source of co-ordinate	Vernon's estate map of North Bull
Description	One of 10 wrecks marked on John Vernon's estate map of the North Bull. It is located towards the southern end of the North Bull, close to a small creek.

Record Source	Brady, 2008, 279; Vernon's estate map of North Bull.

Wreck Name	Unknown
Wreck No.	W10400
Classification	Unknown
Place of Loss	Unknown
Date of Loss	Unknown
Year of Loss	
DD Latitude	53.34840
DD Longitude	-6.22285
Source of co-ordinate	GSI
Description	We regret that we are unable to supply descriptive details for this record at present.
Record Source	GSI.

Wreck Name	Unknown
Wreck No.	W18539
Classification	Barge
Place of Loss	(Co. Dublin) Royal Canal, 70m SE of the Belfast-Dublin railway line. It lies adjacent to the north bank of the canal alongside Ossory Road.
Date of Loss	Unknown
Year of Loss	
DD Latitude	53.35455
DD Longitude	-6.24133
Source of co-ordinate	National Monuments Service
Description	The remains of a barge is visible on Google Earth imagery (7 December 2013) submerged beneath the water on the north side of the Royal Canal near the Dublin-Belfast railway bridge. The upper strucutre of the barge is gone but at least six bulkheads are visible. It measures approximately 20.6m long and 4.22m wide. It is orientated NW/SE on the canal bed. Its date is unknown.
Record Source	National Monuments Service.

Wreck Name	Unknown
Wreck No.	W18574
Classification	Unknown
Place of Loss	Clontarf Strand
Date of Loss	Unknown

Year of Loss	
DD Latitude	53.35982
DD Longitude	-6.21983
Source of co-ordinate	National Monuments Service
Description	Wreck visible on the mudflats of Clontarf Strand at low tide. The wreck is orientated WNW-ESE with the bow to the ESE. The wreck measures 14.68m long and 3.92m wide.
Record Source	National Monuments Service

13.0 TRAFFIC AND TRANSPORTATION

13.1 INTRODUCTION

The Office of Public Works is developing a number of sites within Dublin Port to provide facilities for the relevant State agencies to enable them to carry out checks and controls on non-EU goods entering the State. The principal location for imports is referred to as the Bond Drive Extension Site located at the Bond Drive Extension. Other key locations within Dublin Port are referred to as:

- Yard 3 –Bond Drive Extension;
- Yard 4 - Promenade Road;
- Terminal 7 – Tolka Quay Road;
- Terminal 9 – Tolka Quay Road;
- Terminal 10 – Tolka Quay Road.

All sites, except Yard 3, will be used for processing freight traffic entering Ireland from non-EU locations. Yard 3 will cater for some export related traffic that requires an intervention at the port. A number of the yards/terminals have been constructed over the recent past. As the various facilities will contribute to the overall traffic and transportation impact of the facility all the various elements will be considered in this chapter. One other smaller yard; Yard 2 also processes incoming vehicles. However, due to the small number of vehicles processed associated traffic is insignificant and is not considered further.

Terminals 7, 9 and 10 have been the subject of previous Ministerial Orders but routing to and from them will be considered in this chapter due to their association with the operation of the Bond Drive Extension Site.

13.2 METHODOLOGY

This chapter has been prepared taking the following documents into account:

- NRA's (now TII) Traffic and Transport Assessment Guidelines (May 2014);
- Dublin City Development Plan (DCDP) 2016 - 2022. Sections from the DCDP have been used to help describe the development location and its local context;
- Road Safety Authority's website www.rsa.ie for statistics on collisions in the study area;
- Proposals in the port complex related to the Alexandra Basin Development and the port company's MP2 developments.

The methodology used to conduct the assessment includes:

- Establishing baseline conditions – The existing conditions will be recorded including existing site location and use, surrounding road network, public transport services;
- Defining the development – This includes size, use, parking, staffing, trip distribution for the operational stages of the development;
- Assess the potential impact of the development on the existing local transport network and its ability to carry the development traffic;
- Mitigation measures will then be proposed to offset any impacts that may result from the development.

The preparation of the junction assessments has been carried out in consultation with DPC and their traffic consultants Roughan O'Donovan, including a meeting held on 24 March 2020 to discuss up to date developments with respect to roads issues and agree a methodology for assessing the proposals.

13.3 RECEIVING ENVIRONMENT

13.3.1 Existing Road Access

The various sites are accessed from the Dublin Port internal road network as shown in Figure 13.1. The internal road network has generally been developed to reflect the predominant use of heavy goods vehicles. The port facility has the following main accesses from the local road network:

- Promenade Road – two by two-lane carriageway with footpaths on either side of the road, accessible from the M50 termination of Dublin Port Tunnel/ R131 East Wall Road. The junction with the main road network is a grade- separated signalised junction;
- Alexandra Road - two by one-lane single carriageway shared with a two-line rail freight railway. The junction with main road R131 East Wall Road is via a signalised junction;
- Terminal 3 Access – two by one-lane single carriageway via left-in left-out at-grade priority junction with the R131 East Wall Road.

The Promenade Road access accommodates the majority of the traffic flow into and out of the port.

The roads system in the vicinity of the sites is currently being improved and altered as part of the Port Roads improvement project including the Greenway scheme (DCC planning reference 3084/16) which include construction of improved junction layouts, widening and construction of roads, road signage, wayfinding and improved cycle and pedestrian facilities, which serve the various parts of the development.

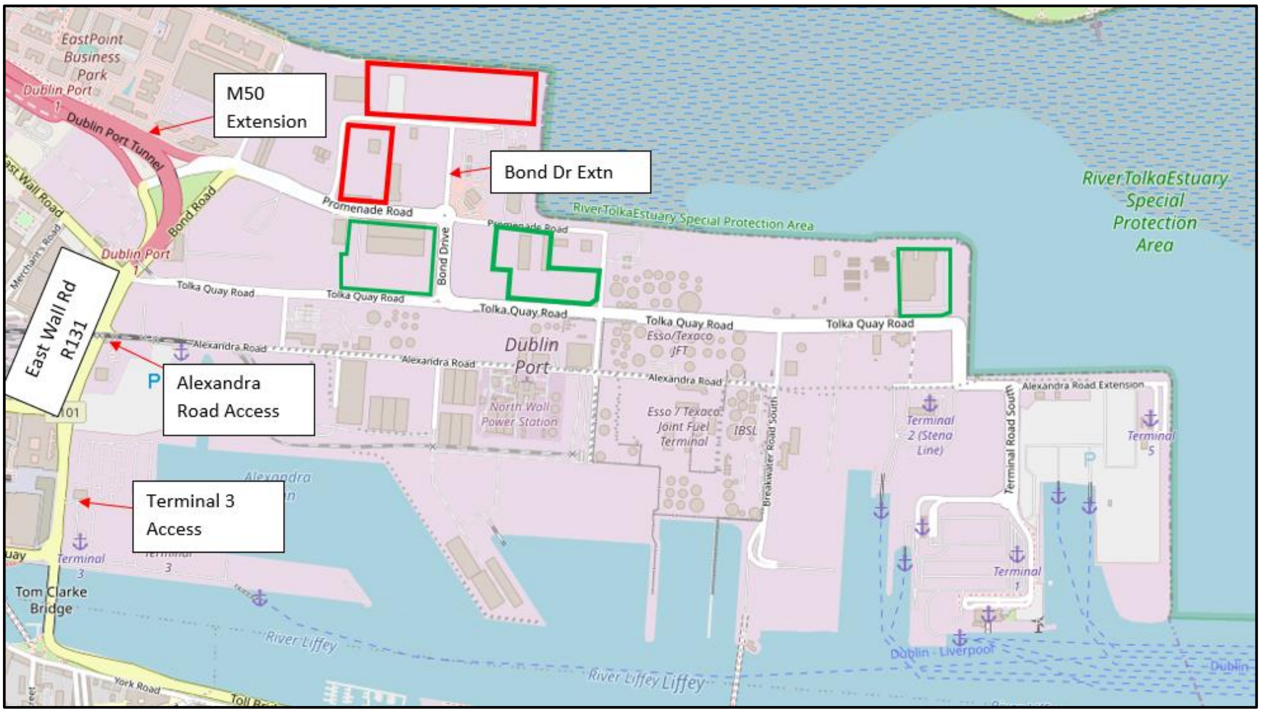

Figure 13.1 *Port Layout*

13.3.2 Existing Public Transport

The Port area is served by bus route 53 which travels between Talbot Street and the Dublin Ferry Port – via Promenade Road, passing the majority of the sites. Services run at approximately hourly intervals between 07:00 and 20:00 hours.

13.3.3 Road Safety

As part of the completion of this chapter, an assessment of collision statistics as published by the Road Safety Authority (RSA) was conducted. Collision statistics for 2005-2016 were reviewed. The collision statistics give information for fatal, serious or minor collisions. A total of four minor collisions were noted for the period 2005-2016 in the vicinity of the sites – as shown on Figure 13.2. It is worth noting that two of the collisions were at the existing priority junction of Tolka Quay Road/Bond Drive – which is being improved as a part of the Greenway Scheme – refer section 13.3.4.

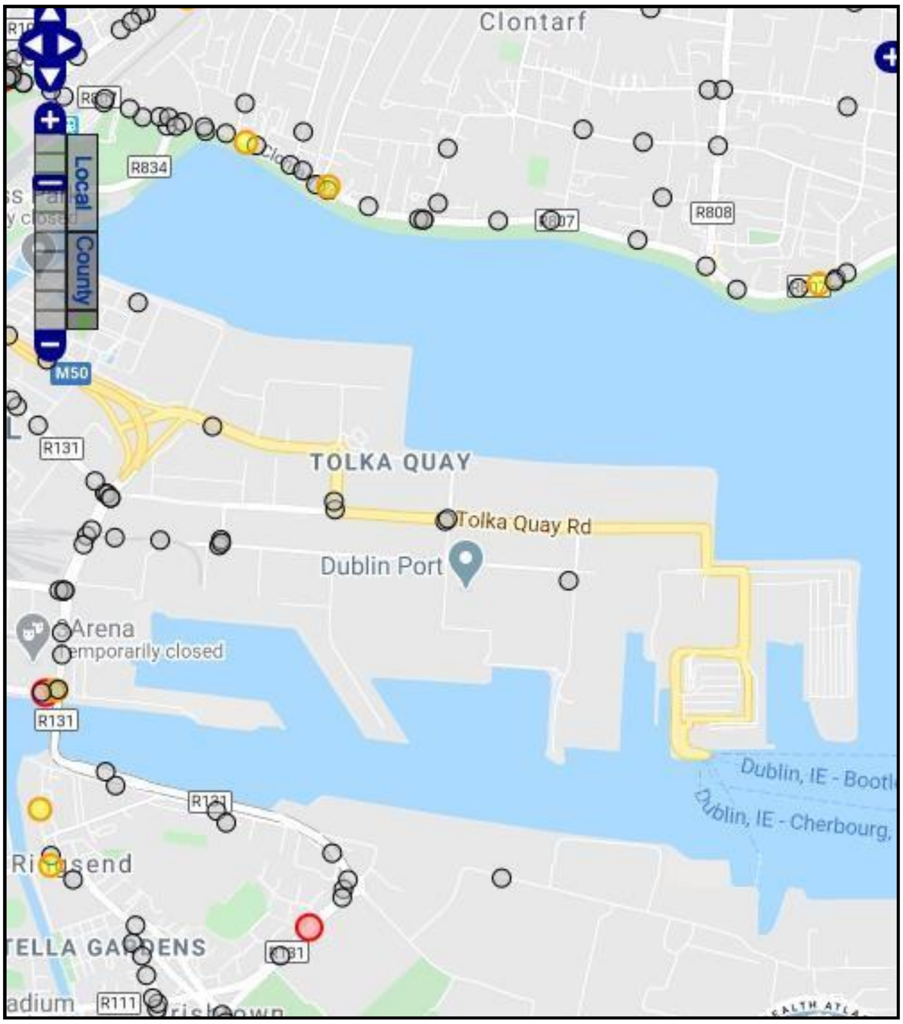

Figure 13. 2 *Collision Locations*

13.3.4 Existing Traffic Flow

Classified traffic survey data used by Dublin Port Company was used for this assessment. 24-hour counts were carried out on Wednesday 23 May 2018. For consistency we have used the same junction numbering references as used for the port traffic studies. Two particular junctions are considered (see Figure 13.3):

- Junction 10 – Promenade Road/Bond Drive Roundabout (known colloquially as 'Circle K Roundabout').
- Junction 17 – Tolka Quay Road/Bond Drive priority junction (currently being improved to become a roundabout junction at time of chapter preparation).

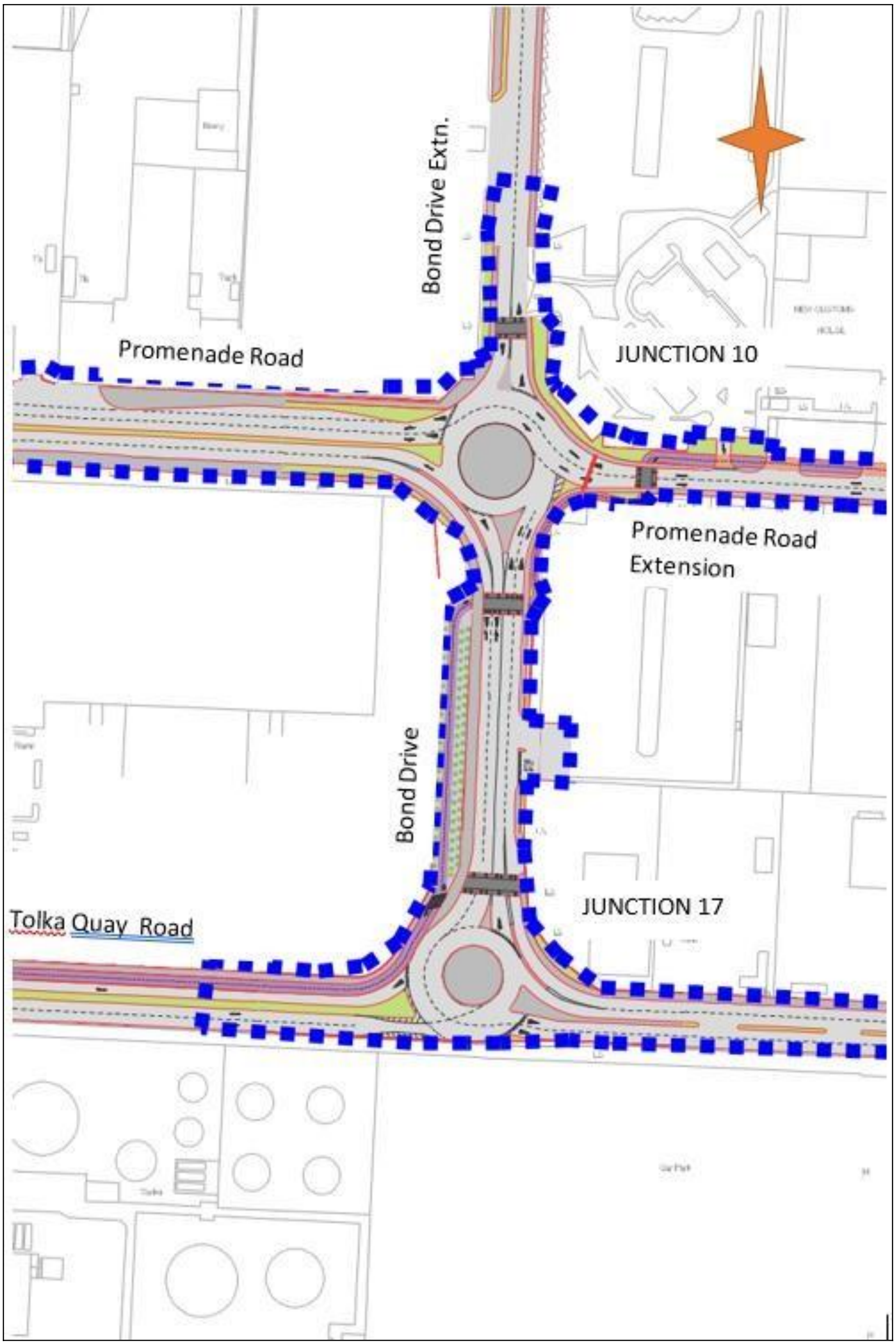

Figure 13.3 *Junctions 10 and 17 layouts*

Reassignments

DPC are currently constructing road project works – vis a vis Road Improvements including Greenway Routes, junction improvements and T10 relief road and Promenade Road Extension widening. These include improvements to Junction 10 – 'Circle K roundabout' and reconfiguration of Junction 17 to a roundabout junction and Promenade Road Extension widening. It is anticipated that these works will be completed by the end of 2020. As a result there will be some reassignments of existing traffic routings which need to be considered:

- T10 Link Road (see Figure 13.4) – that 66% of all traffic or 90% of all left-turning traffic on Bond Drive northbound will use T10 link road as an alternative route for exiting the port;
- Promenade Road Extension – that 50% of traffic destined for the ferry terminals entering from the west on Promenade Road will now go straight on to Promenade Road Extension;
- Traffic on Tolka Quay Road headed east will turn left onto T10 Link Road instead of continuing to Junction 17.

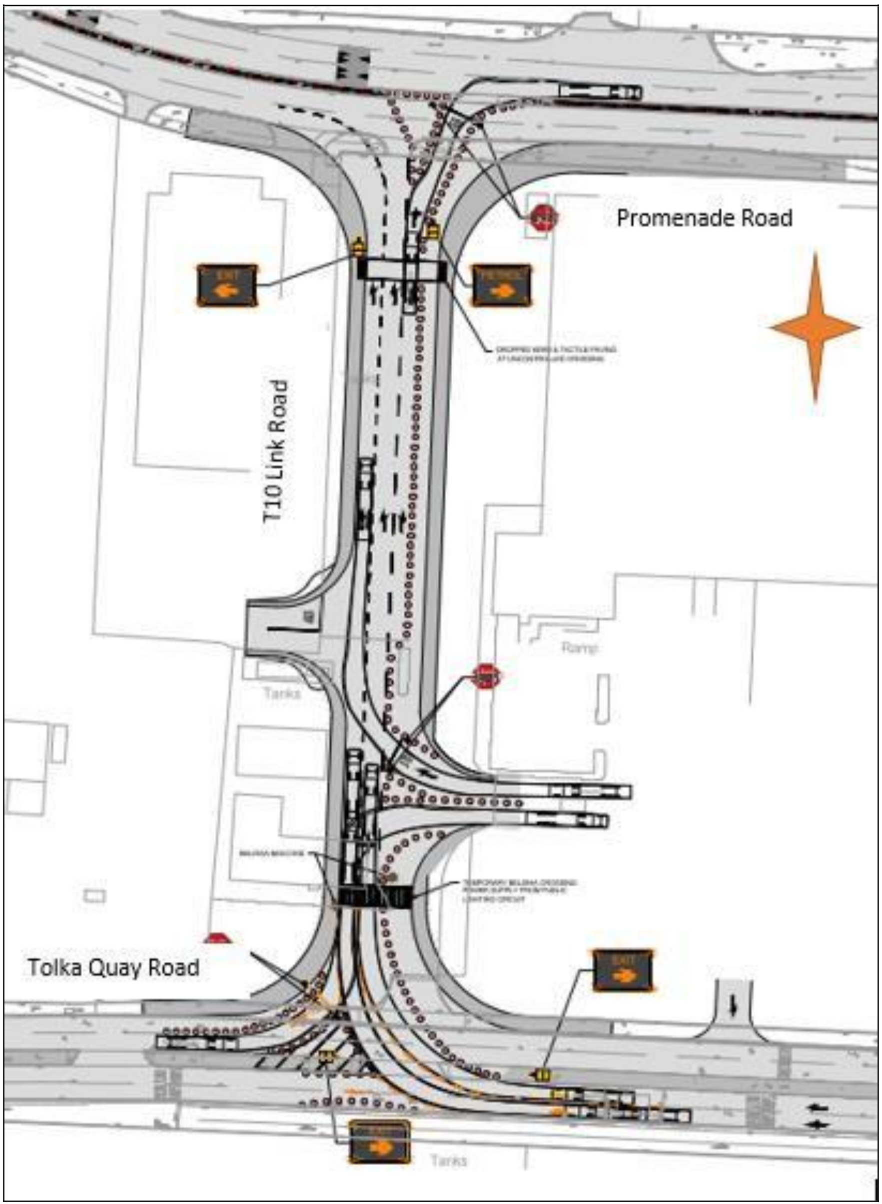

Figure 13.4 *T10 Link Road*

13.4 CHARACTERISTICS OF THE DEVELOPMENT

13.4.1 Construction Phase

The development sites largely comprise existing sites with warehouses and hardstand areas which will have minor new construction works or alterations to existing buildings and reuse of the hardstand areas.

13.4.2 Operational Phase

The proposals comprise various holding and assessment yards for incoming freight from the UK post Brexit which will be operated by various Government Agencies including Revenue, Environmental Health & Safety (EHS) and Department of Agriculture, Food and the Marine (DAFM) and their facilities management consultants. In addition export assessments will be carried out at one yard – Yard 3. A summary of the transportation oriented proposals at each of the sites is set out below (see Figure 13.5 for locations):

Bond Drive Extension Yard – Holding area for vehicles
175 HGV parking spaces, 62 car park spaces (including 4 disabled spaces), 48 bike spaces.

Yard 3 - Export Office and HGV parking & Yard 4 Inspection Facilities Promenade Road -
7 Inspection Bays, 30 HGV parking spaces, 13 car park spaces (including two disabled spaces), 28 cycle spaces.

Figure 13.5 *Development Locations*

Car Parking

Car parking provision is normally defined as a maximum quantum depending on the relative location within the Dublin City area and also the typology set out in Table 16.1 of the Dublin City Development Plan 2016-2022 (DCDP). However, the development proposed does not fall under any of the categories. Therefore an appropriate quantum of car parking has been defined for each of the Yards/Terminals by the OPW reflecting the anticipated staffing levels with a view to there being no overflow parking onto the surrounding roads. A total of 194 spaces are provided overall.

The DCDP requires that disabled parking of 5% of the total parking be provided. In the case of the Bond Drive Extension– and Yards 3&4 – four and two spaces are provided respectively, which is compliant.

Cycle Parking

As the description of type of development is not covered by Table 16.2 of the DCDP an appropriate quantum of 76 will be provided between the Bond Drive Extension and Yards 3&4.

13.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

13.5.1 Construction Phase

Minimal demolition and construction works are required as part of the proposed project works at each of the sites, as they are generally hardstand areas with warehousing facilities. There will be minimal construction traffic required for the proposed development works.

13.5.2 Operational Phase

Given the unique nature of the development, the projected trip generation has been derived based on the Government Agencies anticipated operating methodologies. Based on the current programme the development will be operational from the end of the post-Brexit transitional arrangements, i.e. the beginning of 2021.

The various Government Agencies have identified the anticipated number of vehicles which will have to be assessed upon arrival in Ireland.

The development facilities have been designed to process a peak number of reviews occurring upon the arrival of Stena and Irish Ferries between 05.30-06.00 daily. The methodology of vehicle assessment is such that approximately half will travel through the port and onward to the external road network as they have done historically. These so called 'Green' vehicles will pass through the port to the exit as they currently do – refer to Appendix 13.1 - Map 1. The number of vehicles to be processed further total 193 (so called 'Amber' or 'Red' vehicles) for the peak period out of approximately 400 commercial vehicles entering the port from sea on these services. These vehicles will be routed to the various yards/terminals as set out in the OPW routing diagrams – refer Appendix 13.1.

The rates of processing of vehicles varies depending on the types of assessment and the Government Agencies reviewing the vehicle. Only traffic identified as requiring further review by the relevant Government Agency needs to be addressed, i.e. the 193 vehicle movements derived account for an average processing rate through each of the relevant Yard/Terminal and the number of bays in each yard. The Bond Drive Extension Site facility will enable the processing of incoming vehicles for two further sites which are permitted development under Ministerial Orders:

- Terminal 9 - Tolka Quay Road – Inspection Facilities/Border Control Post - which include 13 Inspection Bays, Revenue Turnout Shed, 34 staff car spaces (Statutory Instrument S.I. No 57/2019);

- Terminal 10 – Tolka Quay Road - Inspection Facilities/Border Control Post which include 14 Inspection Bays, 37 HGV spaces, 54 staff car spaces. (Statutory Instrument S.I. No. 285/2019).

As these two sites together with Terminal 7 are part of the overall operation of the State Agencies inspection facilities development the generated additional traffic within the port area will be considered as part of the 'development traffic'. This means that the development traffic used for the assessment will be significantly higher than that generated by the development of Yard 3 & 4 and the Bond Drive Extension Yard alone. This will result in a conservative approach overall

The various routing movements associated with the development are summarised below:

Table 13.1: *Routing Movements*

Routing Diagram	Description
1. Green Vehicles	207 vehicles – no review required
2. Amber Vehicles Inward	52 transit checks/65 seal checks routed to Terminal 7
3. Green Vehicles from T7 outwards	34 vehicles per hour processed through T7. Once processed all vehicles will exit port via T10 link road
4. Red Vehicles from sea	76 vehicles per hour routed to -Bond Drive Extension for further assessment
5. Red Vehicles from Bond Drive Extension Yard	Vehicles remain in Bond Drive Extension until called to go to Y4, T9 and T10 for further review. Release rate based on state services units processing rates. Vehicles are then discharged from the port
6. (Export) Blue Vehicles to Yard 3	Vehicles routed to Yard 3 for processing in advance of outgoing sailing
7. (Export) Blue Vehicles to Ferries	Vehicles routed from Yard 3 to ferries.

13.5.3 Trip Generation

Trip generation will be from both the incoming vehicles from the ferries as well as to a lesser degree the Inspection staff deployed to each of the development site within the port.

Inspection Staff

There will be a total of 128 staff operating the sites from the Government Agencies and their facility management consultants. Even if all staff were to travel by private vehicles to the sites the number of equivalent PCU's (Passenger Car Units) would be low compared to the freight traffic being processed. It is expected that all staff trips will occur outside the peak hours – since they will need to be at the inspection areas when the ferries arrive for the AM peak – from 05:00 hours and any shift change will occur between the AM and PM peaks. Therefore, the staff associated traffic movements will not impact the Peak hours of operation of the facilities.

Freight Vehicles

The generated trips for each of the Red, Amber, Green and Blue type vehicles are based on assessments by the Government Agencies and are summarised in Table 13.1 above.

The following assumptions have been made in defining the peak-hour traffic flows:

(i) The peak traffic flowing out of the port will occur over the one-hour peak period – coinciding with the peak hour inward flow (to the port) upon which Dublin Port Company (DPC) traffic models are based – ie 05:30-06:30 hours which coincides with the arrival of Stena and Irish Ferries services which give rise to the peak processing load;

(ii) All vehicles processed by Government Agencies (development traffic) are OGV2 type – [Passenger Car Unit (PCU) factor 2.3];

(iii) Development traffic for the peak hour is not “grown” [background traffic is “grown” (increased annually) by an appropriate factor as outlined below] due to the limitation on number of ferries that can arrive at the peak hour, and because of point (i) above;

(iv) All yards and terminals will remain operational throughout the 15-year lifetime of the assessment;

(v) Existing trips to and from the various yards/terminals prior to development works at the time of survey have not been subtracted from the model;

(vi) Background traffic will grow at an annual rate of 3% (all vehicles).

The trip rates and processing rates presented do not factor in potential improvements which could be gained through streamlined procedures or technological solutions being developed by the relevant Government Agencies at the time of writing. Options are being developed to reduce the scale of the infrastructure currently required so the development described herein can be seen as preparations for a ‘worst case scenario’ to be functional at the end of the Brexit transition period.

In addition, a sensitivity check was undertaken for the PM peak hour (16.45-17.45 hours) to evaluate the effect of single ferry unloading concurrently with that peak. The profile of the deliveries entering the country outside the AM peak is assessed as being different and the relative percentage of vehicles requiring further checks will be lower. For the evaluation it is assumed that the PM development traffic requiring review will be 50% of the AM peak for traffic entering the port from sea, and that the processing rate at the yards/terminals is the same as the AM peak rate.

The development traffic flows are summarised in Appendix 13.2 – Figure 5.

The traffic flows set out in Appendix 13.2 account for the year of opening 2021, and the design year 2036 for the peak AM development flows together with an assessment with the PM flows. Base traffic assessment is based on the 2018 base surveyed traffic grown to 2021 figures. The reassignments as set out in section 13.3.2.1 were then applied to the 2021 Base traffic figures and evaluated to demonstrate the impacts of the road improvements that will be in place when the development is completed.

The impacts have been assessed for the opening year – 2021 Base traffic only, 2021 with reassignment and a design year of 2036 for both the Do Nothing and Do Something (with development) scenarios. It should be noted that the anticipated lifespan of the various terminals is short to medium term (ie less than 15 years), with a follow up project to consolidate the various terminals 7,9 and 10 at the Bond Drive Extension site. However, the two junctions have been assessed for the 15-year horizon for completeness.

Although no additional traffic will arrive/depart the port due to the end of the Brexit transitionary period the proposals will have an effect on the receiving environment through an increase of internal trips within the port complex due to the various processing works at different yards/terminals. It is these additional trips that will be evaluated.

It is anticipated that hauliers/logistics companies are likely to change their models towards packing their HGV consignments more efficiently with a move away from mixed consignments allowing a greater number of consignments to be green routed. As a result of this, there should be less traffic being sent to the Amber and Red Yards for checks in the medium term, ie a reduction in the development traffic movements within the port environment. This has not been accounted for in the generation of development traffic, therefore the assessed impact in the 2036 future year with development will be conservative.

13.5.4 Junction Assessments

The proposed altered and additional trips on the local road network have been assessed in the context of the development traffic. Under the requirements of the National Roads Authority's (now TII) Traffic and Transport Assessment Guidelines 2014 if the impact of a 'new' development amounts to more than 10% additional traffic on the local network the impact is considered material, even if the local network is not experiencing prolonged congestion. Where the network is experiencing prolonged congestion during peak period this threshold is reduced to 5%.

The relative new traffic movements on each of Junctions 10 and 17 (see Appendix 13.1 Figure 5) compared to Reassigned 2021 traffic (see Appendix 13.1 Figure 3) will be:

- Junction 10 344/906 = 38%;
- Junction 17 229/1142 = 20%.

Therefore, further assessment is warranted.

The roundabout junctions have been assessed using Arcady software. The assessment results are set out in tables below: The full output of the Arcady assessment is set out in Appendix 13.3.

Table 13.2: *Junction 10 – AM Assessments*

Scenario	**Approach Arm**	**RFC (%)**	**Max. Queue (PCU)**
		AM Peak	AM Peak
2021 Base Traffic	Bond Dr S	52%	0.9
	Promenade Rd W	35%	0.5
	Bond Dr Extn N	14%	0.1
2021 Reassigned Traffic (Do Nothing)	Bond Dr S	16%	0.2
	Promenade Rd W	28%	0.3
	Bond Dr Extn N	13%	0.2
2036 Traffic (Do Nothing)	Bond Dr S	26%	0.4
	Promenade Rd W	44%	0.8
	Bond Dr Extn N	24%	0.4
2021 (Do Something)	Bond Dr S	37%	0.7
	Promenade Rd W	30%	0.5
	Bond Dr Extn N	22%	0.3
2036 (Do Something)	Bond Dr S	47%	0.9
	Promenade Rd W	47%	0.7
	Bond Dr Extn N	32%	0.4

Table 13.3: *Junction 10 – PM Assessments*

Scenario	**Approach Arm**	**RFC (%)**	**Max. Queue (PCU)**
		PM Peak	PM Peak
2021 Base Traffic	Bond Dr S	70%	1.4
	Promenade Rd W	49%	0.9
	Bond Dr Extn N	14%	0.2
2021 Reassigned Traffic (Do Nothing)	Bond Dr S	32%	0.4
	Promenade Rd W	41%	0.7
	Bond Dr Extn N	14%	0.2
2036 Traffic (Do Nothing)	Bond Dr S	53%	1.0
	Promenade Rd W	66%	1.7
	Bond Dr Extn N	26%	0.4
2021 (Do Something)	Bond Dr S	43%	0.7
	Promenade Rd W	44%	0.7
	Bond Dr Extn N	23%	0.3
2036 (Do Something)	Bond Dr S	65%	1.7
	Promenade Rd W	69%	2.1
	Bond Dr Extn N	36%	0.5

Table 13.4: *Junction 17 – AM Assessments*

Scenario	**Approach Arm**	**RFC (%)**	**Max. Queue (PCU)**
		AM Peak	AM Peak
2021 Base Traffic	Tolka Quay Rd E	83%	4.7
	Tolka Quay Rd W	0%	0
	Bond Dr N	33%	0.4
2021 Reassigned Traffic (Do Nothing)	Tolka Quay Rd E	45%	0.5
	Tolka Quay Rd W	0%	0
	Bond Dr N	33%	0.5
2036 Traffic (Do Nothing)	Tolka Quay Rd E	76%	2.0
	Tolka Quay Rd W	0%	0
	Bond Dr N	52%	0.9
2021 (Do Something)	Tolka Quay Rd E	70%	1.8
	Tolka Quay Rd W	0%	0
	Bond Dr N	43%	0.8
2036 (Do Something)	Tolka Quay Rd E	**91%**	4.9
	Tolka Quay Rd W	0%	0
	Bond Dr N	63%	1.3

Table 13.5: *Junction 17 – PM Assessments*

Scenario	**Approach Arm**	**RFC (%)**	**Max. Queue (PCU)**
		PM Peak	PM Peak
2021 Base Traffic	Tolka Quay Rd E	**88%**	7.5
	Tolka Quay Rd W	0%	0
	Bond Dr N	50%	0.8
2021 Reassigned Traffic (Do Nothing)	Tolka Quay Rd E	49%	0.8
	Tolka Quay Rd W	0%	0
	Bond Dr N	27%	0.4
2036 Traffic (Do Nothing)	Tolka Quay Rd E	80%	2.3
	Tolka Quay Rd W	0%	0
	Bond Dr N	42%	0.7
2021 (Do Something)	Tolka Quay Rd E	64%	1.2
	Tolka Quay Rd W	0%	0
	Bond Dr N	34%	0.5
2036 (Do Something)	Tolka Quay Rd E	**91%**	4.7
	Tolka Quay Rd W	0%	0
	Bond Dr N	50%	0.8

A junction is considered to have sufficient reserve capacity if the Ratio of Flow to Capacity (RFC) does not exceed 85%.

From Tables 13.2 and 13.3 it can be seen that Junction 10 will have sufficient reserve capacity for all scenarios. Comparing the Do Something to Do Nothing scenarios for the various assessment years shows that there will be an increase in RFC values as would be expected, the average queue lengths increases are minimal.

From Tables 13.4 and 13.5 reassignment of traffic in the vicinity of Junctions 10 and 17 due to the Greenway project/T10 Link Road has a positive impact on the junction capacities for 2021. It can be seen that only in the 2036 Do Something scenario that Junction 17 will exceed its theoretical maximum capacity, for both the AM and PM peaks. However, the capacity is only slightly exceeded with average queues at 4.9 PCU's in length relative to 2.0 PCUs for the Do Nothing scenario and is minimal and would be considered to be acceptable.

The DPC's traffic consultants have carried out their own assessment of the traffic generation by the development proposals on the current traffic model for the port and have confirmed concurrence of conclusions with respect to capacity.

13.6 REMEDIAL AND MITIGATION MEASURES

13.6.1 Construction Phase

A Construction Management Plan will be prepared by the contractor. The plan will include measures to minimise the impacts associated with the construction phase upon the peak periods on the surrounding road network.

The majority of site operatives are anticipated to arrive into site c.07:30 hours, therefore avoiding the morning peak hour in. Furthermore, in the evening peak hour, approximately 50% of site operatives will depart outside of the evening peak hour, thus minimising the impacts on the surrounding road network.

HGV trips are anticipated to arrive and depart the site at a uniform rate throughout the day, to avoid pressure on the morning and evening peak hour periods. The contractor will set out a routing methodology for HGVs arriving to the site.

As the existing sites upon which the developments comprise upgrading existing buildings and hardstands, by reusing existing resources as much as practicable will ensure minimisation of construction material import and therefore construction related trips.

13.6.2 Operational Phase

The developments will include the provision of footpath access to external facilities surrounding the site providing pedestrian connectivity for staff between the various yards/terminals, thereby reducing vehicular trips between the different units.

Similarly, the provision of cycle parking facilities will provide means of reducing reliance on vehicular trips for staff in going to their workplace, and during shifts where staff move between the different yards/terminals.

As part of the DPC road improvements which will provide additional capacity to the network, road signage proposals erected on gantries incorporating variable message signage will aid in the routing of vehicles destined to the various yards and terminals. These will improve wayfinding and reduce potential for congestion caused by lost drivers.

13.7 PREDICTED IMPACTS OF THE DEVELOPMENT

13.7.1 Construction Phase

Demolition and construction works are required as part of the proposed project works at each of the sites. These works will not be significant overall. There will be construction traffic required for the proposed development works, but this will be low volume relative to the operational phase traffic. Therefore there will be imperceptible impacts on the receiving traffic and transportation environments. The proposed development requires limited construction works; therefore the impact of construction works will be short term, imperceptible and neutral.

13.7.2 Operational Phase

The proposed development will have an impact on the roads within the port, in particular the junctions in the proximity of the various elements of the development. The receiving road facilities are being upgraded to accommodate the overall traffic growth predicted at the port which will mitigate the impact of the development. Overall the impact of the development will be long term in duration of slight effect.

13.8 RESIDUAL IMPACTS

The residual traffic impacts of the development will be ***Not Significant.***

13.9 CUMULATIVE IMPACTS OF THE DEVELOPMENT

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (including other Brexit related developments at nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project (described in Chapter 3)) are discussed in Sections 13.9.1 and 13.9.2 below.

13.9.1 Construction Phase

The potential for impact on transportation during construction primarily arises from additional trips due to the works associated with the development. The proposed development requires relatively low construction input due to a significant part of the works be adapting existing facilities. Therefore the works are ***short term***, ***imperceptible*** and ***neutral***.

Contractors for the proposed development will be contractually required to operate in compliance with a CEMP which will include the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to mitigate traffic issues. As a result, there will be a minimal impact on the receiving environment. The cumulative impact is considered to be ***negative*** and ***not significant.***

13.9.2 Operational Phase

The proposed development will necessitate additional movements of vehicles between various elements of the development including those of the associated previously permitted proposals within the port to facilitate the inspections required by the Government Agencies. The scheme includes measures to provide onsite cycle and pedestrian facilities to align the works with improvements for such facilities in the broader port environment. At the year of opening the development will have an imperceptible impact. However, in the longer term background traffic growth of three percent when compounded will result in a slight impact on the receiving road junctions. The operation of the proposed development is concluded to have a ***long*** term, ***slight*** significance with a ***negative*** impact on traffic and transportation quality in the port.

The development will have a cumulative impact on the permitted developments set out above. The other developments will also incorporate works that will provide sustainable improvements to the roads network within the port. The short term impact will be imperceptible. However, due to the background traffic growth through the port there be a slightly adverse impact on the serviceability of the transport facilities at the design year. The cumulative impact of proposals will be of ***slight*** significance with a ***negative impact*** on traffic and transportation quality.

APPENDIX 13.1

VEHICULAR MOVEMENTS

CST Group Chartered Consulting Engineers

VEHICLE MOVEMENT KEY

🟩 GREEN - PROCEED TO DUBLIN PORT EXIT

Architectural Services

OPW Dublin,
52, St. Stephen's Gn, D2.
Telephone: (01) 647 6000
LoCall: 1890 213414
Website: www.opw.ie

State / Principal Architect

Ciarán O'Connor, FRIAI, State / Principal Architect
Director of Architectural Services

Charles Moore , MRIAI
Head of Brexit Unit

Design Team

Cliodhna Rice - MRIAI Senior Architect
Conor O'Donnell - MRIAI
Sarah Heery - MRIAI
Donal McIntyre - Graduate Architect

Drawing Revisions

REF DESCRIPTION DATE:
A REV:
B REV:
C REV:
D REV:
E REV:

Drawing Title

VEHICULAR MOVEMENT STRATEGY
GREEN ROUTE

DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

Project Title

Brexit Inf
Dublin P

PROJECT N

A.20.001

REV.

Routing 1

Architectural Services

OPW Dublin,
52, St. Stephen's Gn, D2.
Telephone: (01) 647 6000
LoCall: 1890 213414
Website: www.opw.ie

State / Principal Architect

Ciarán O'Connor, FRIAI, State / Principal Architect
Director of Architectural Services

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Head of Brexit Unit

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Donal McIntyre - Graduate Architect

Drawing Revisions

REF	DESCRIPTION	DATE:
A	REV:	
B	REV:	
C	REV:	
D	REV:	
E	REV:	

Drawing Title

VEHICULAR MOVEMENT STRATEGY
AMBER ROUTE 1

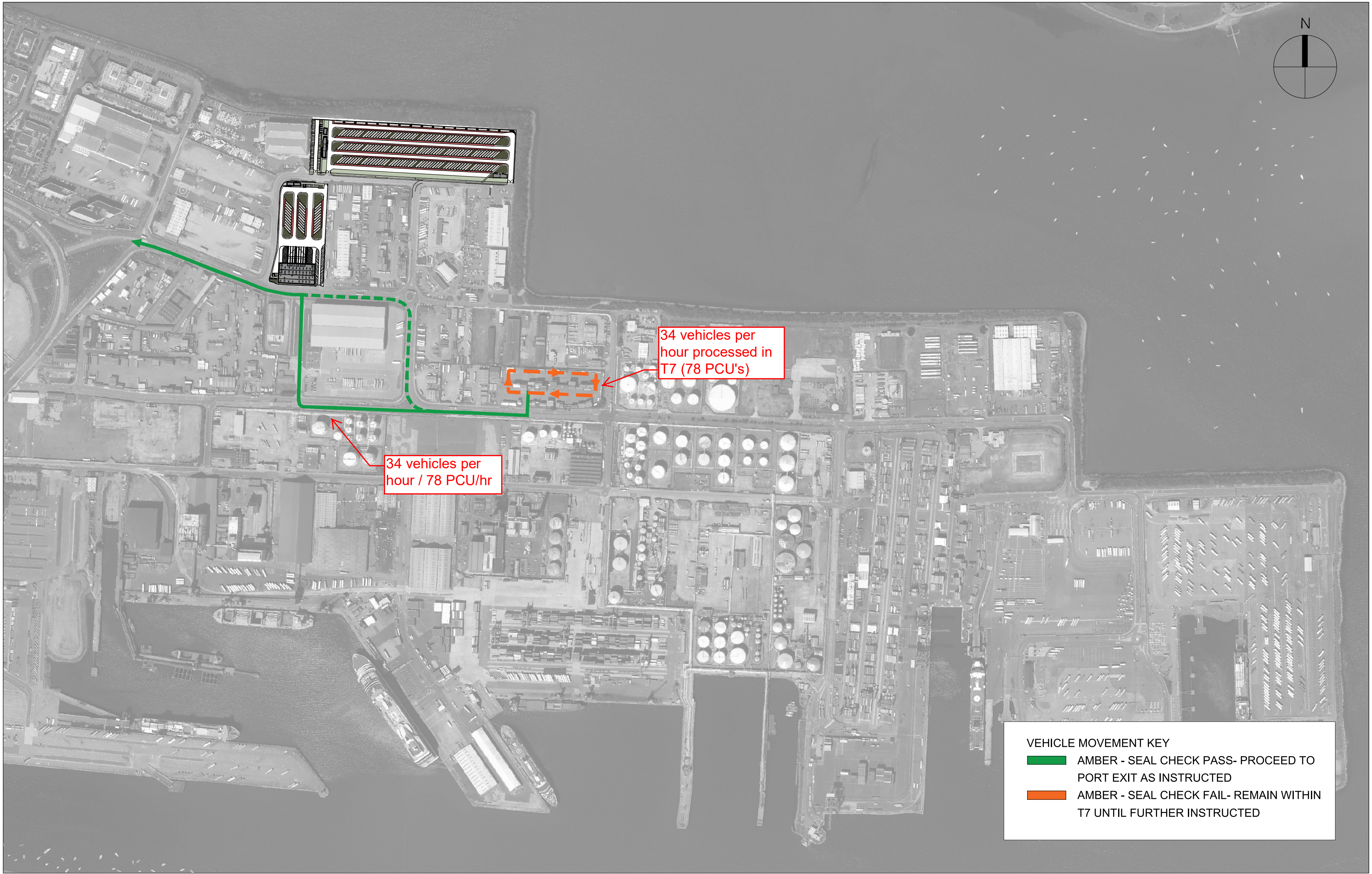
DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

Project Title

Brex
Dub

Routing 2

PROJE		REV.
A.20.001	EIAR	20-002-2



Architectural Services

OPW Dublin,
52, St. Stephen's Gn, D2.
Telephone: (01) 647 6000
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Donal McIntyre - Graduate Architect

Drawing Revisions

REF	DESCRIPTION	DATE:
A	REV:	
B	REV:	
C	REV:	
D	REV:	
E	REV:	

Drawing Title

VEHICULAR MOVEMENT STRATEGY
AMBER ROUTE 2

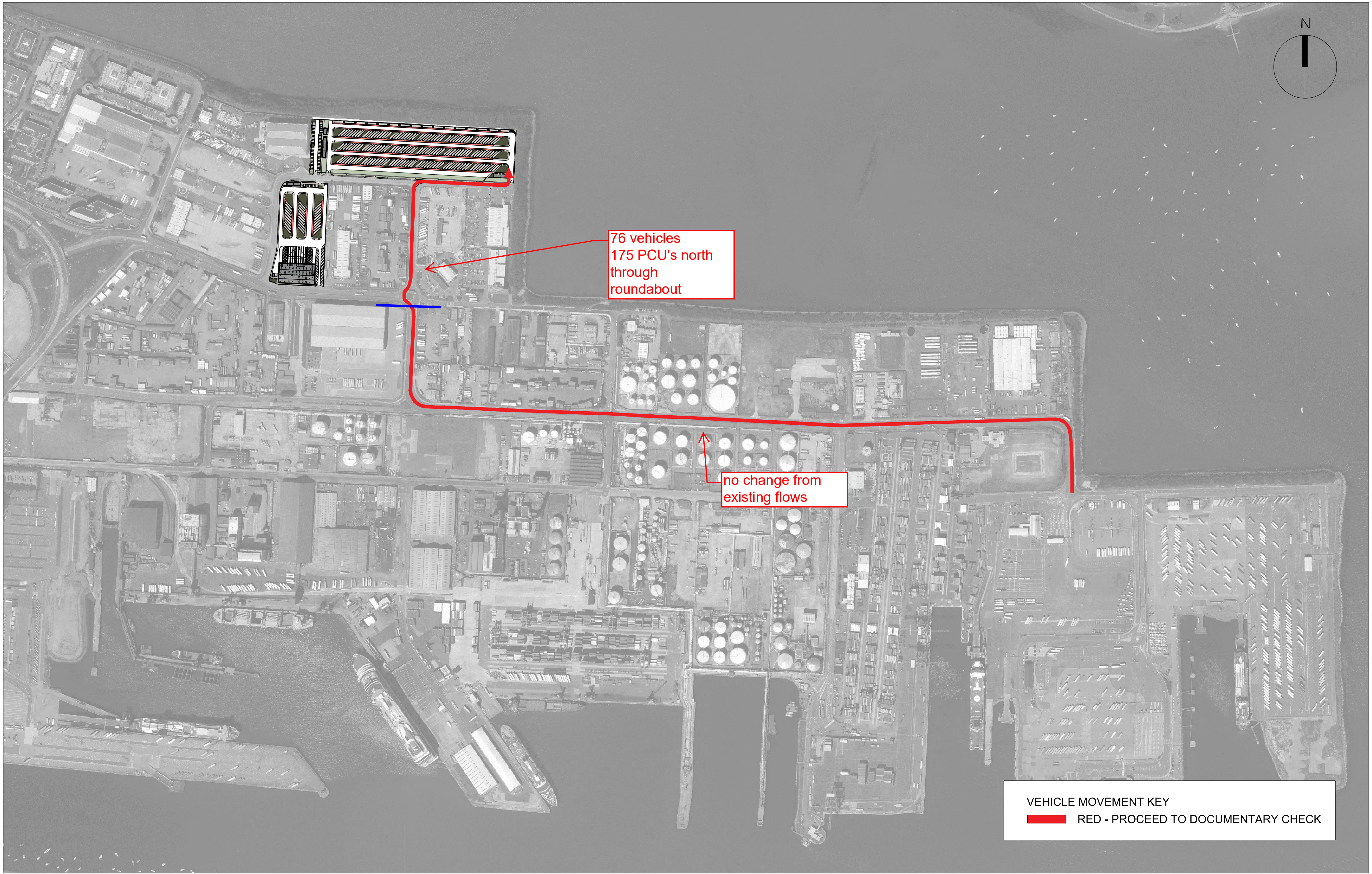
DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

Project Title

Brexit Infrastructu
Dublin Port, Dubli

PROJECT NO. ST
A.20.001 E

Routing 3



VEHICLE MOVEMENT KEY

🟥 RED - PROCEED TO DOCUMENTARY CHECK

OPW

Architectural Services
OPW Dublin,
52, St. Stephen's Gn, D2.
Telephone: (01) 647 6000
LoCall: 1890 213414
Website: www.opw.ie

State / Principal Architect
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Sarah Heery - MRIAI
Donal McIntyre - Graduate Architect

Drawing Revisions

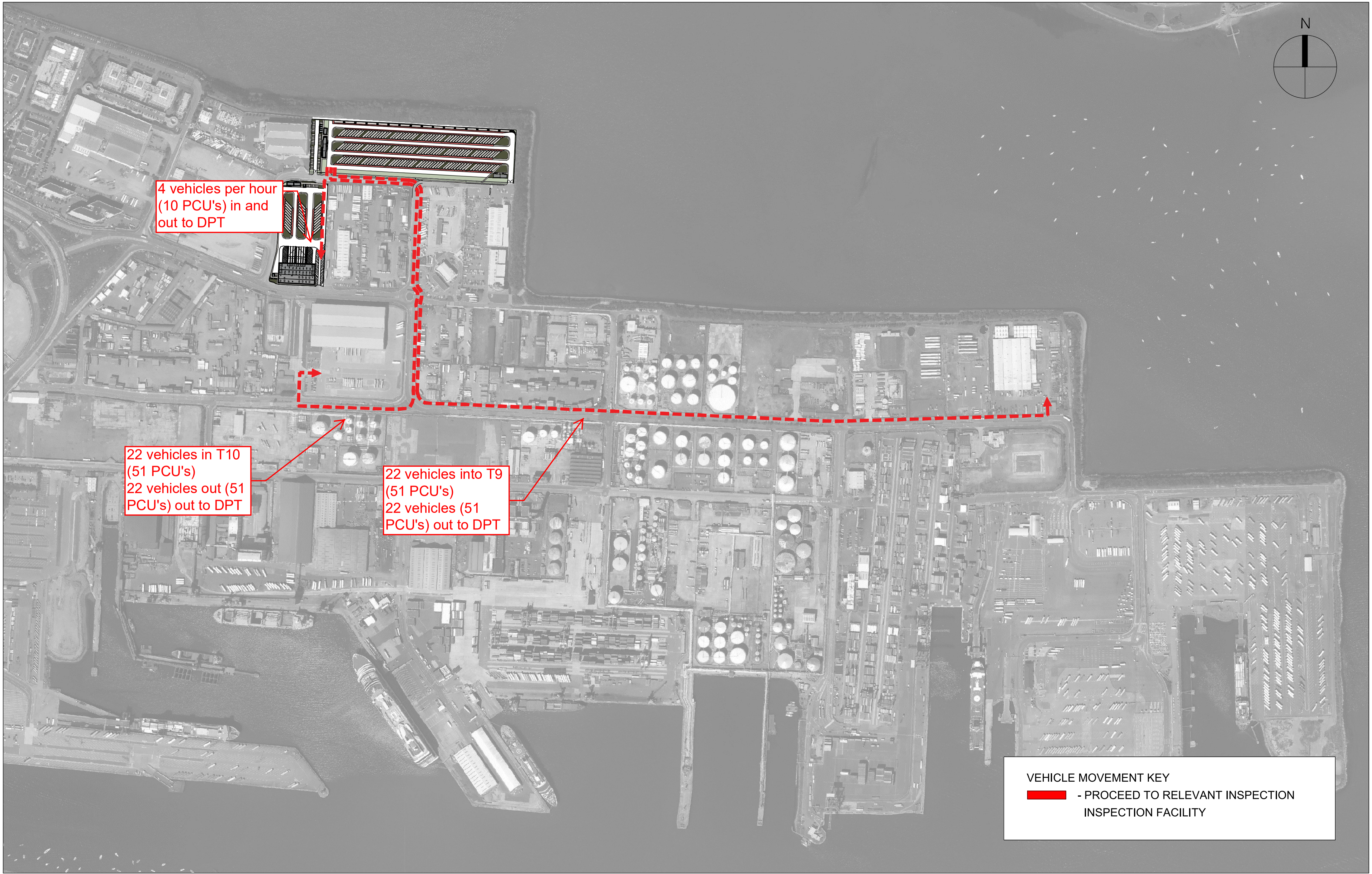
REF	DESCRIPTION	DATE:
A	REV:	
B	REV:	
C	REV:	
D	REV:	
E	REV:	

Drawing Title
VEHICULAR MOVEMENT STRATEGY
RED ROUTE TO PARKING AREA

DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

Project Title
Brexit Ir
Dublin P
PROJECT
A.20.001
EV.

Routing 4



Architectural Services

OPW Dublin,
52, St. Stephen's Gn, D2.
Telephone: (01) 647 6000
LoCall: 1890 213414
Website: www.opw.ie

State / Principal Architect

Ciarán O'Connor, FRIAI, State / Principal Architect
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Charles Moore , MRIAI
Head of Brexit Unit

Design Team

Cliodhna Rice - MRIAI Senior Architect
Conor O'Donnell - MRIAI
Sarah Heery - MRIAI
Donal McIntyre - Graduate Architect

Drawing Revisions

REF	DESCRIPTION	DATE:
A	REV:	
B	REV:	
C	REV:	
D	REV:	
E	REV:	

Drawing Title

VEHICULAR MOVEMENT STRATEGY
RED ROUTE 2

DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

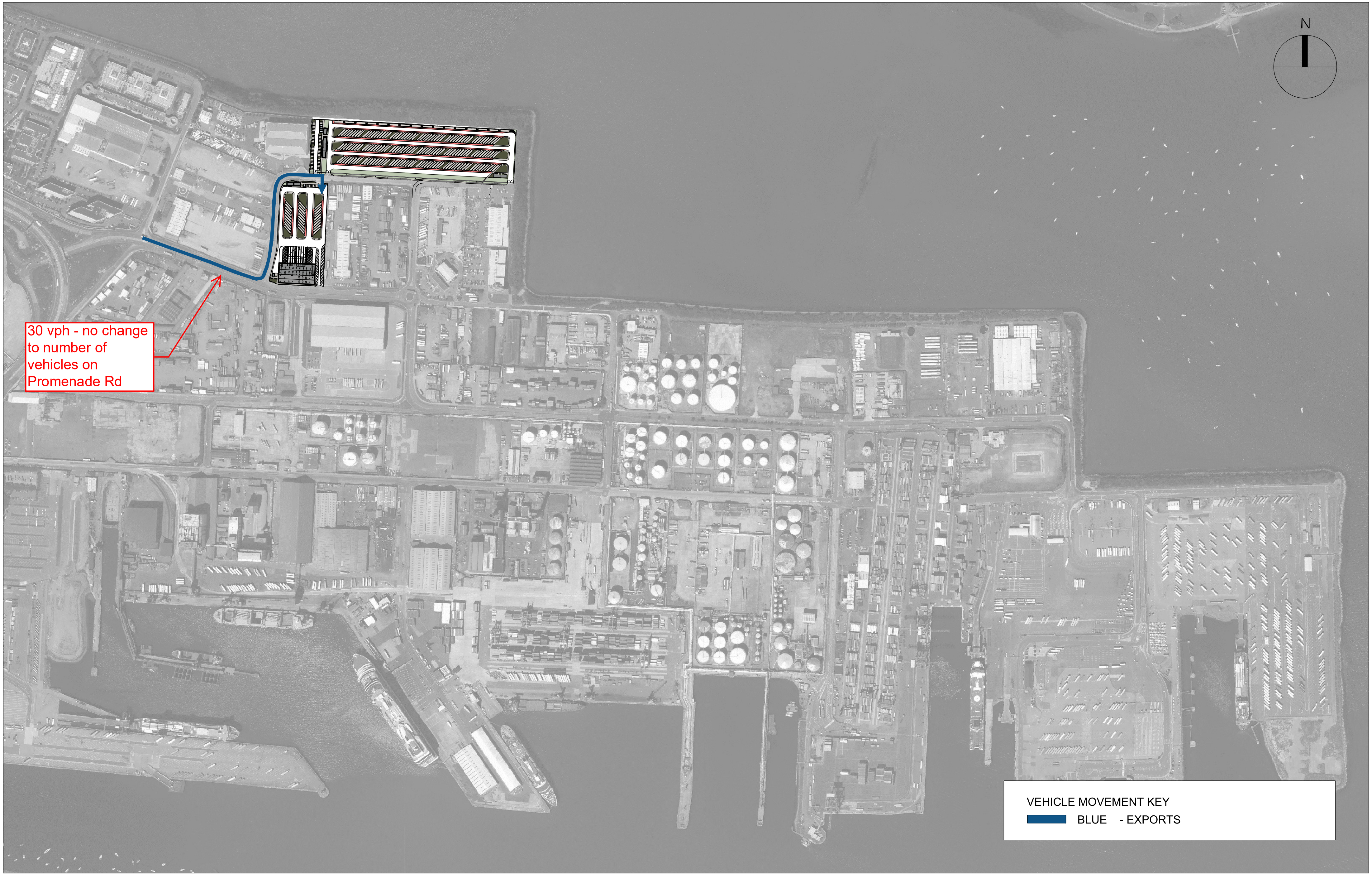
Project Title

Brexit Infrast
Dublin Port,

Routing 5

PROJECT NO.
A.20.001

V.



Architectural Services	State / Principal Architect	Design Team	Drawing Revisions	Drawing Title	Project Title
OPW Dublin, 52, St. Stephen's Gn, D2. Telephone: (01) 647 6000 LoCall: 1890 213414 Website: www.opw.ie	Ciarán O'Connor, FRIAI, State / Principal Architect Director of Architectural Services Charles Moore , MRIAI Head of Brexit Unit	Cliodhna Rice - MRIAI Senior Architect Conor O'Donnell - MRIAI Sarah Heery - MRIAI Donal McIntyre - Graduate Architect	REF DESCRIPTION DATE: A REV: B REV: C REV: D REV: E REV:	VEHICULAR MOVEMENT STRATEGY EXPORTS	Brexit Infrastru Dublin Port, Du PROJECT NO. A.20.001

DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

Routing 6

30 vph - no change to vehicles on Promenade Rd/ Promenade Rd Extn

VEHICLE MOVEMENT KEY

🟦 BLUE - EXPORTS- PROCEED TO THE FERRY TERMINAL

Routing 7

Architectural Services	State / Principal Architect	Design Team
OPW Dublin, 52, St. Stephen's Gn, D2. Telephone: (01) 647 6000 LoCall: 1890 213414 Website: www.opw.ie	Ciarán O'Connor, FRIAI, State / Principal Architect Director of Architectural Services Charles Moore , MRIAI Head of Brexit Unit	Cliodhna Rice - MRIAI Senior Architect Conor O'Donnell - MRIAI Sarah Heery - MRIAI Donal McIntyre - Graduate Architect

Drawing Revisions

REF	DESCRIPTION	DATE:
A	REV:	
B	REV:	
C	REV:	
D	REV:	
E	REV:	

Drawing Title

VEHICULAR MOVEMENT STRATEGY
EXPORTS TO FERRY TERMINAL

DRAWN	CHECKED	SCALE	DATE
COD	CR	NTS @A3	April 2020

Project Title

Brexit I
Dublin P
PROJECT
A.20.001
V.

APPENDIX 13.2

DEVELOPMENT TRAFFIC FLOWS

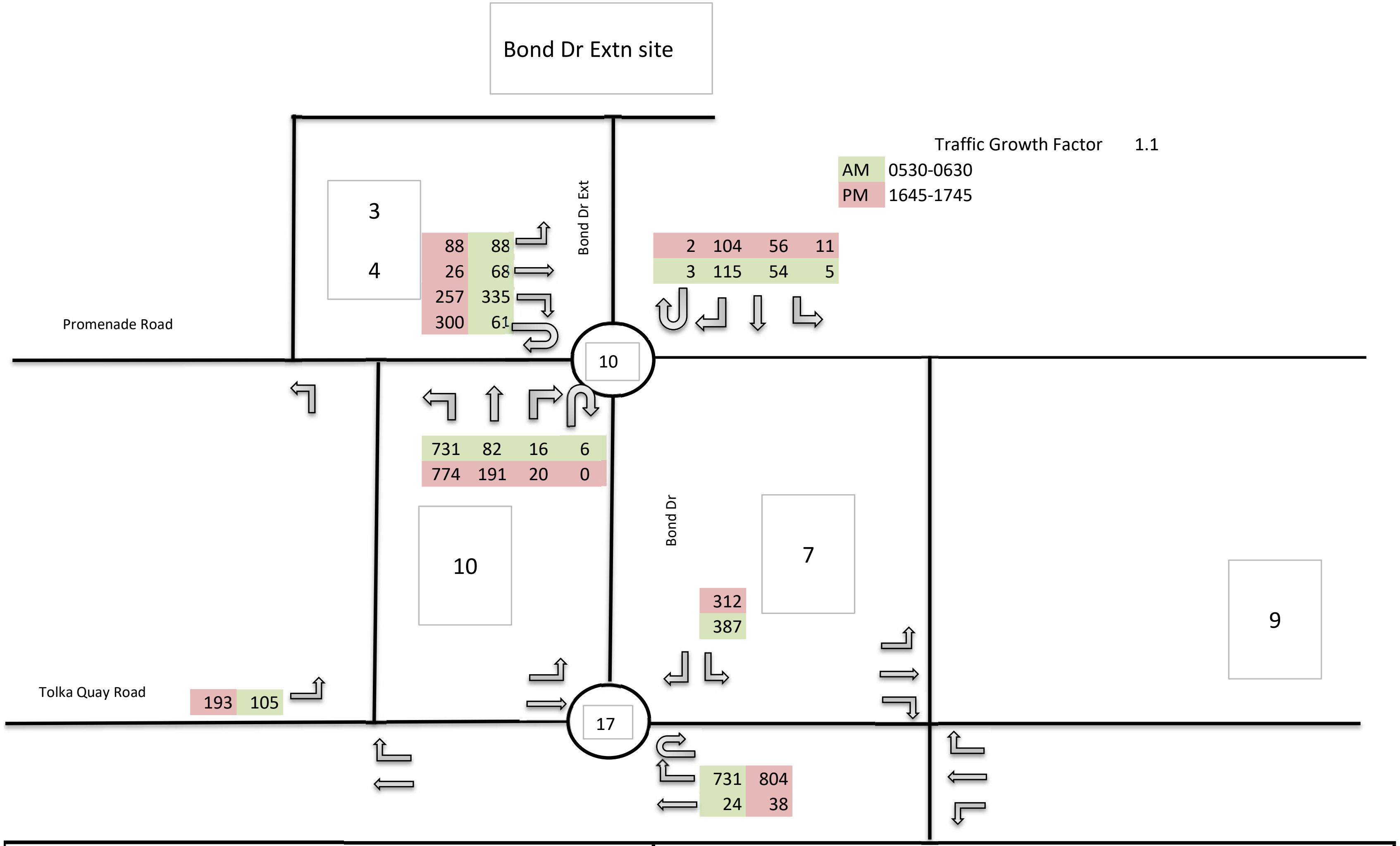
CST Group Chartered Consulting Engineers

CST Group
Chartered Consulting Engineers

Job No: 119271

Job Title: Dublin Port Central Case

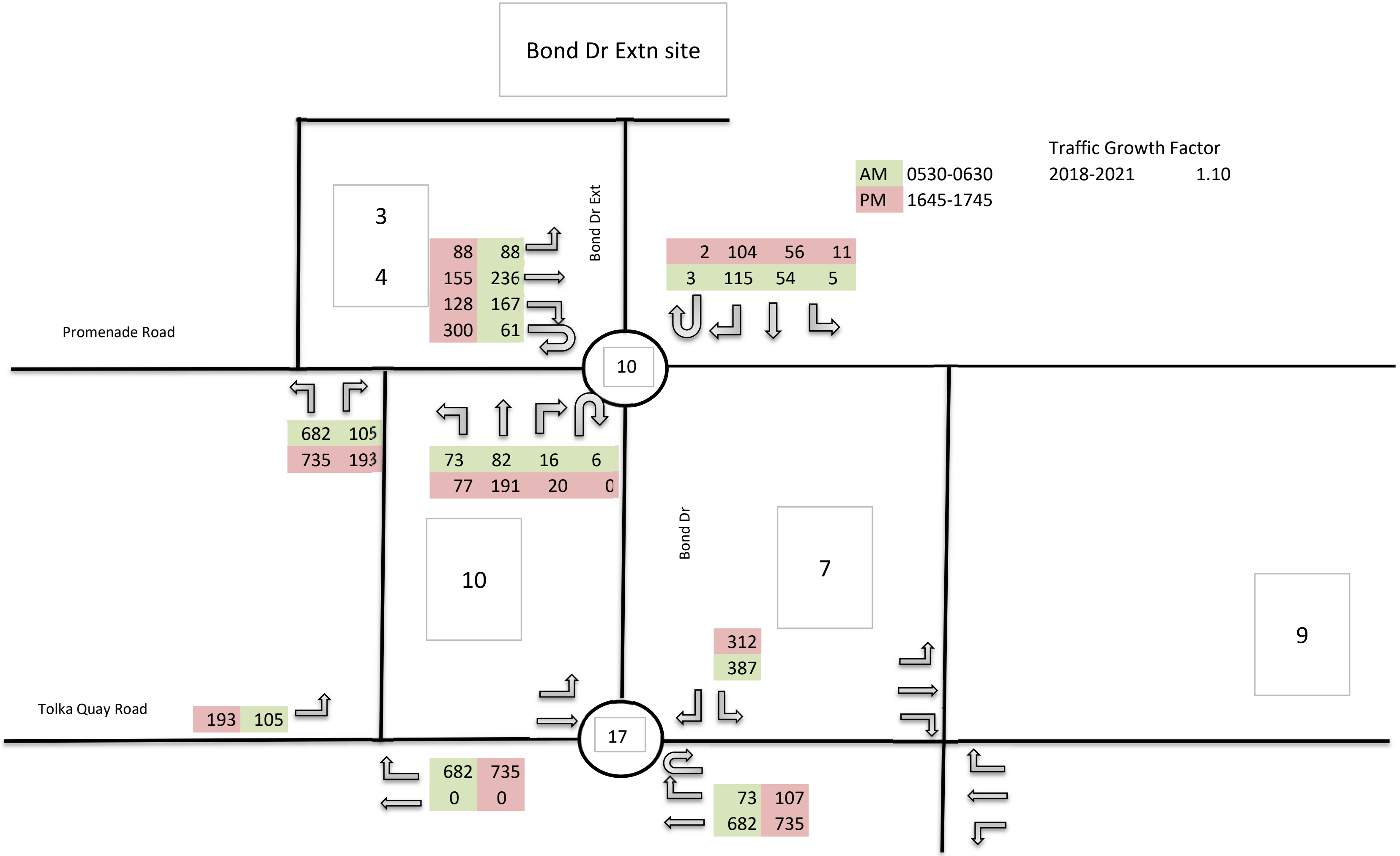
2018 Base Traffic (PCU's) - Figure 1



CST Group
Chartered Consulting Engineers

Job No: 119271
Job Title: Dublin Port Central Case

2021 Base Traffic (PCU's) - Figure 2

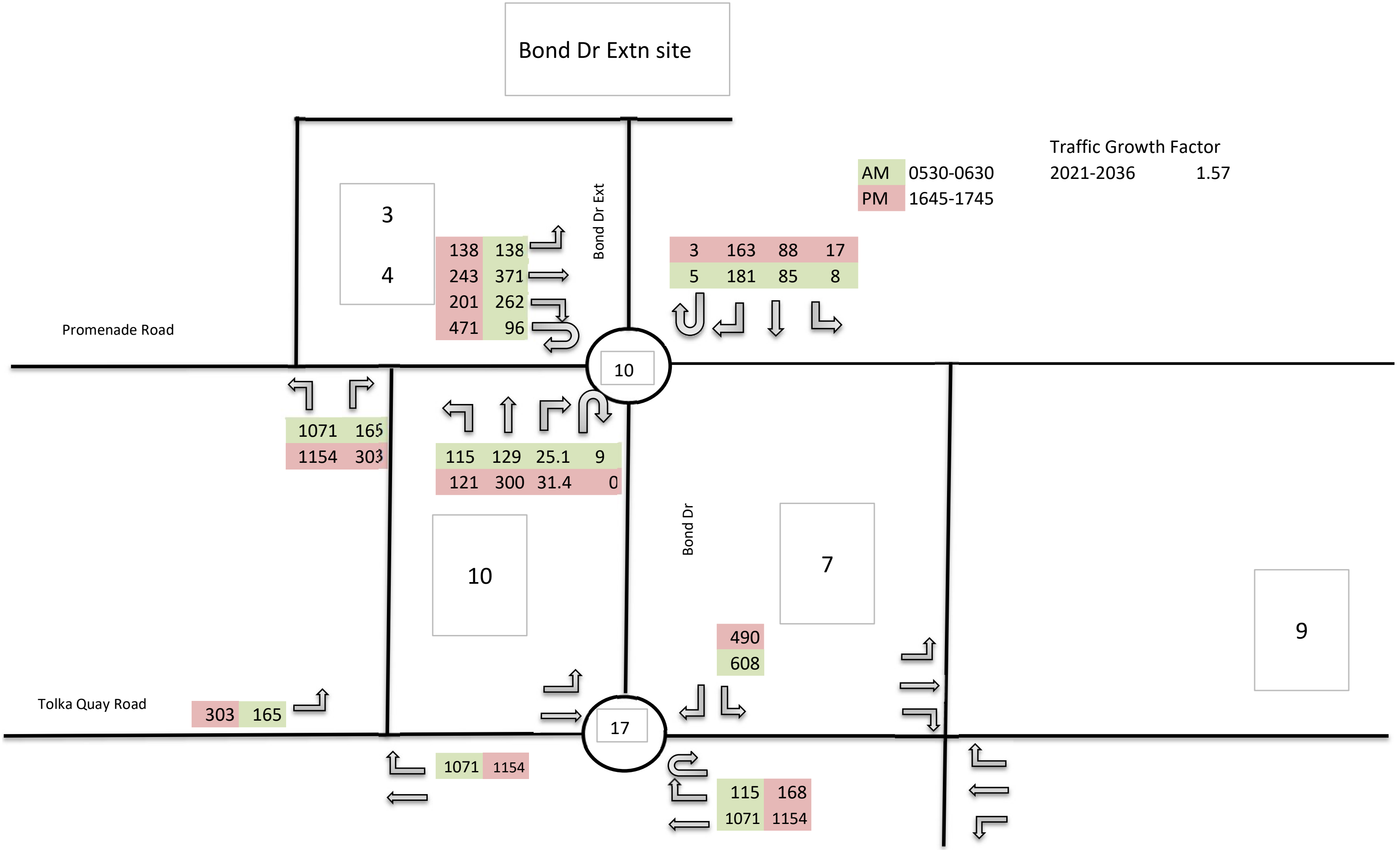


CST Group
Chartered Consulting Engineers

Job No: 119271

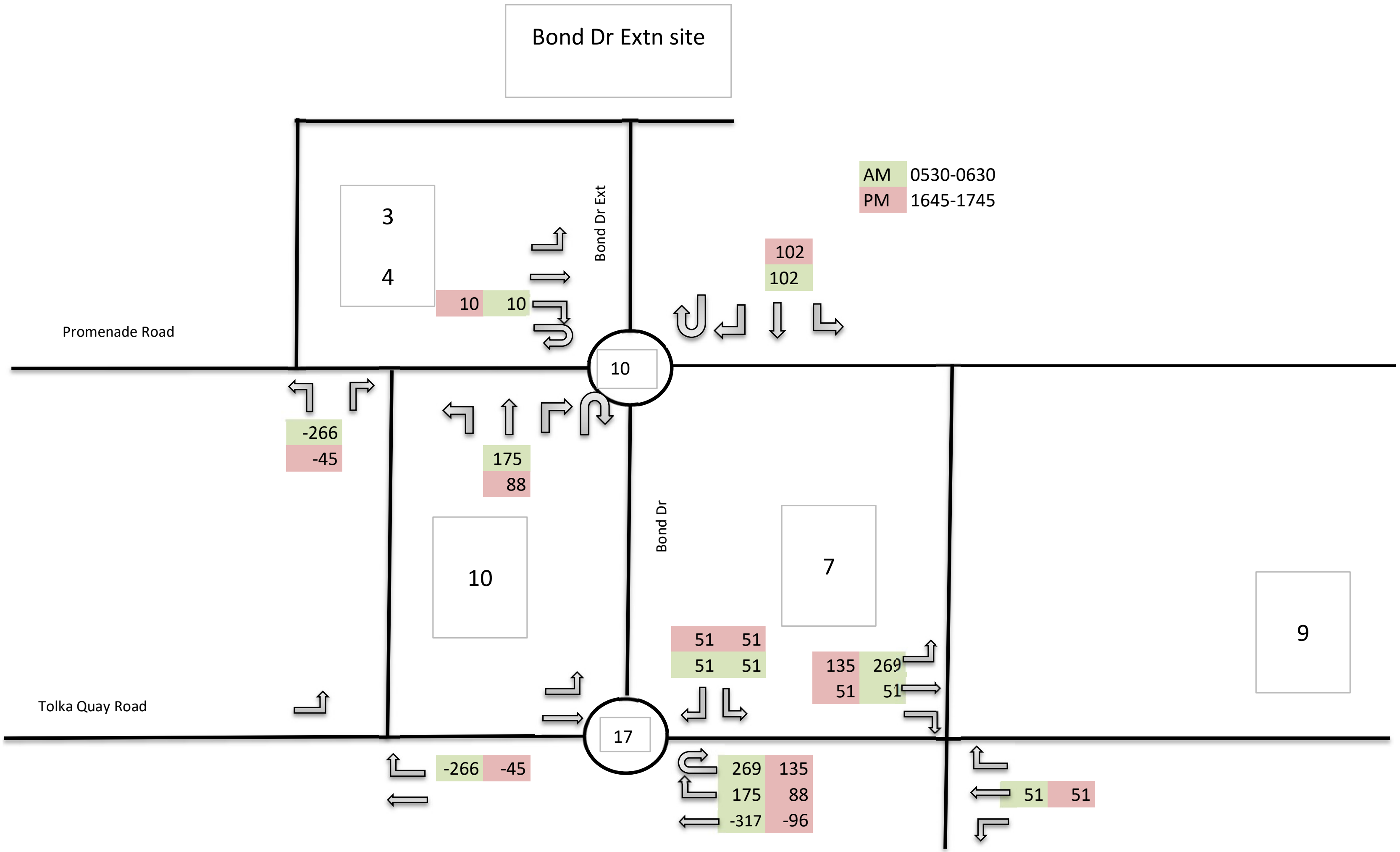
Job Title: Dublin Port Central Case

2021 Reassigned Traffic (PCU's) - Figure 3



Job No: 119271
Job Title: Dublin Port Central Case

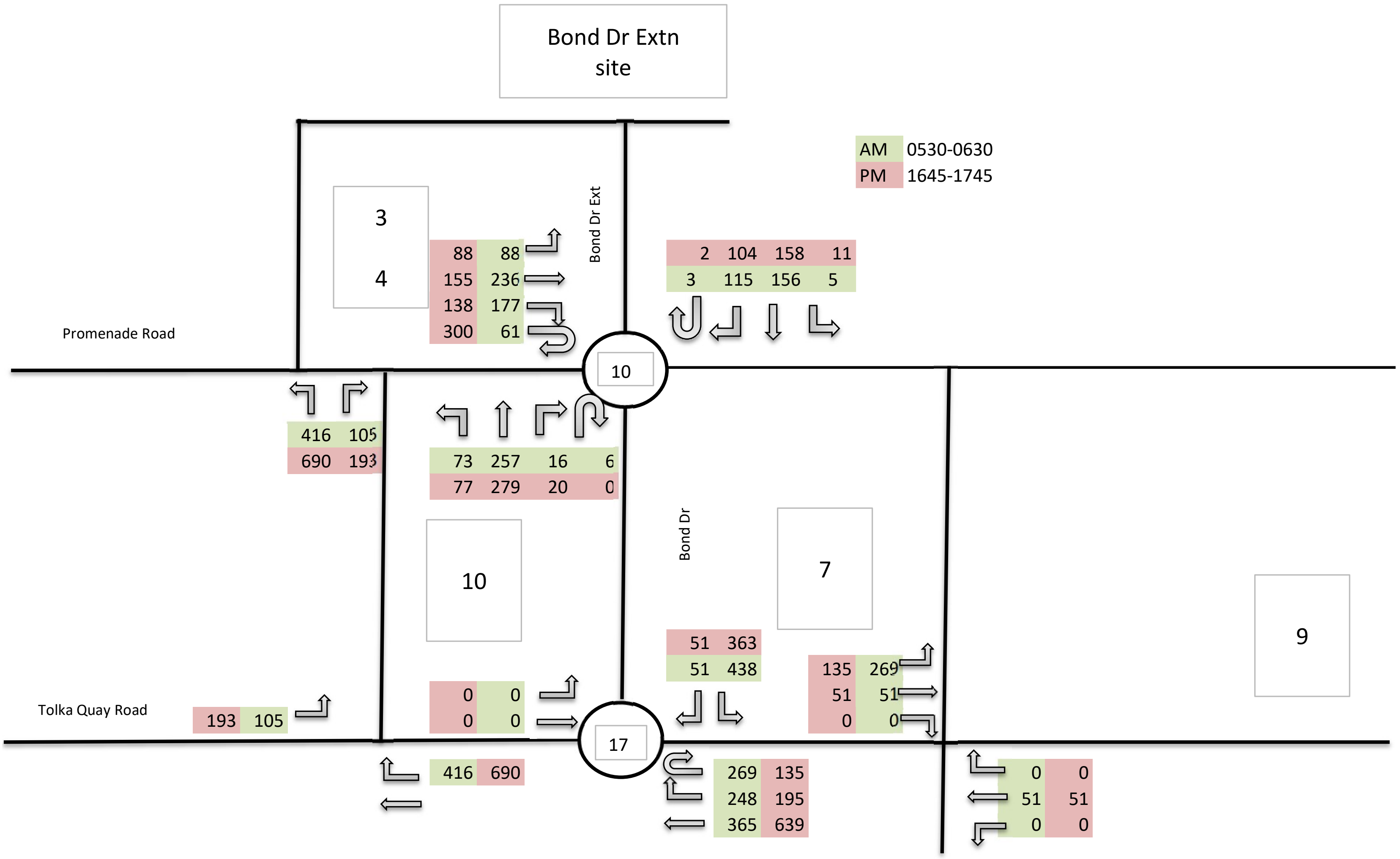
2036 Traffic (PCU's) - Figure 4



CST Group
Chartered Consulting Engineers

Job No: 119271
Job Title: Dublin Port Central Case

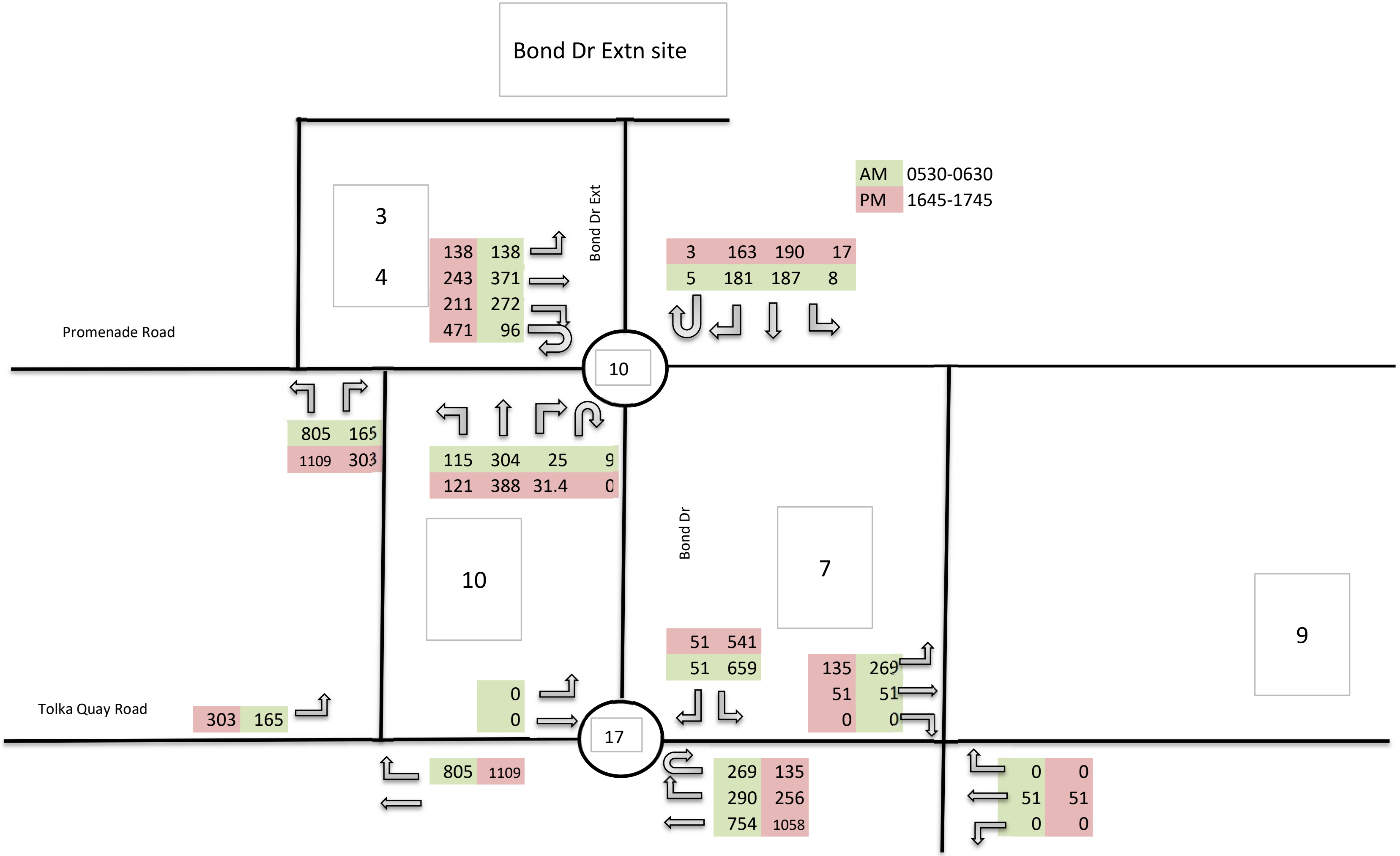
Development Traffic (PCU's) - Figure 5



Job No: 119271

Job Title: Dublin Port Central Case

2021 with Development (PCU's) - Figure 6



CST Group
Chartered Consulting Engineers

Job No: 119271
Job Title: Dublin Port Central Case

2036 with Development Traffic (PCU's) - Figure 7

APPENDIX 13.3

JUNCTION CAPACITY OUTPUT

CST Group Chartered Consulting Engineers

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.0.1.4646 []

For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758   email: software@trl.co.uk   Web: http://www.trlsoftware.co.uk

Filename: 119271 J10 Dublin Port 2020 04 27 ff.j9
Path: I:\CST\119\251-300\119271\calcs\ARCADY
Report generation date: 4/28/2020 9:45:43 AM

Summary of junction performance

	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
Arm 2	1.8	6.0	5.69		A	% [ ]	2.5	6.5	8.30		A	% [ ]
Arm 3	0.7	2.5	3.88		A		1.0	3.3	5.04		A	
Arm 4	0.1	1.0	2.94		A		0.2	0.8	3.08		A	
Arm 2	0.3	2.0	4.35		A	% [ ]	0.4	2.0	5.65		A	% [ ]
Arm 3	0.6	2.4	3.30		A		0.9	2.7	4.10		A	
Arm 4	0.2	1.0	2.88		A		0.3	0.9	3.09		A	
Arm 2	0.5	2.0	4.89		A	% [ ]	1.0	3.0	8.39		A	% [ ]
Arm 3	1.1	3.5	3.93		A		2.1	6.0	6.56		A	
Arm 4	0.4	2.0	3.79		A		0.4	1.4	4.28		A	
Arm 2	0.8	3.0	5.74		A	% [ ]	0.7	2.7	6.54		A	% [ ]
Arm 3	0.7	2.6	3.53		A		1.1	3.2	4.53		A	
Arm 4	0.3	1.0	3.18		A		0.3	1.5	3.32		A	
Arm 2	1.1	4.0	6.49		A	% [ ]	1.9	5.6	11.05		B	% [ ]
Arm 3	1.1	3.0	4.33		A		2.5	7.4	7.20		A	
Arm 4	0.4	1.6	4.34		A		0.6	1.9	4.87		A	
Arm 2	1.2	3.5	5.22		A	% [ ]	1.7	4.6	7.08		A	% [ ]
Arm 3	0.6	2.0	3.71		A		0.9	2.7	4.68		A	
Arm 4	0.1	1.0	2.81		A		0.2	1.0	2.94		A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Arm and junction delays are averages for all movements, including movements with zero delay. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	J10 Promenade Road Roundabout
Location	Dublin Port
Site number	
Date	4/9/2020
Version	
Status	Planning
Identifier	
Client	
Jobnumber	119271
Enumerator	S Sheehy
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

Lane Simulation options

Stop criteria (%)	Stop criteria time (s)	Stop criteria number of trials	Random seed	Results refresh speed (s)	Individual vehicle animation number of trials	Use crossings quick response	Last run random seed	Last run number of trials	Last run time taken (s)
1.00	100000	100000	-1	3	1	✓	747710689	101	5.53

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D1	2021 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓		
D2	2021 Reassigned Traffic	AM	ONE HOUR	05:30	07:00	15	✓		
D3	2036 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓		
D4	2021 Traffic with Dev	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D2+D6
D5	2036 Traffic with Dev	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D3+D6
D6	Dev Traffic	AM	ONE HOUR	05:30	07:00	15			
D7	2021 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓		
D8	2021 Reassigned Traffic	PM	ONE HOUR	16:45	18:15	15	✓		
D9	2036 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓		
D10	Dev Traffic	PM	ONE HOUR	16:45	18:15	15			
D11	2021 Traffic with Dev	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D8+D10
D12	2036 Traffic with Dev	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D10+D9
D13	2018 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓		
D14	2018 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓		

Analysis Set Details

ID	Use Lane Simulation	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	✓	100.000	100.000

2021 Base Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.74	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
1	untitled	
2	Bond Dr Ext	
3	Promenade Road	
4	Circle k	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1							✓
2	6.60	6.70	13.0	33.0	50.0	42.0	
3	7.50	11.00	13.0	20.0	50.0	40.0	
4	5.00	7.50	9.2	12.0	50.0	40.0	

Zebra Crossings

Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (m)	Crossing time (s)
4	3.00	4.00		Distance	10.00	7.14

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
1		
2	0.656	1984
3	0.796	2744
4	0.606	1791

The slope and intercept shown above include any corrections and adjustments.

Lane Simulation: Arm options

Arm	Lane capacity source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane level	Lane	Destination arms	Has limited storage	Storage (PCU)	Minimum capacity (PCU/hr)	Maximum capacity (PCU/hr)
2	**1 [Give-way line]**	**1**	3		Infinity	0	99999
		2	1,2,3,4		Infinity	0	99999
3	**1 [Give-way line]**	**1**	1,4		Infinity	0	99999
		2	1,2,3		Infinity	0	99999
4	**1 [Give-way line]**	**1**	1,2,3,4	✓	3.00	0	99999
	2	**1**	(1,2,3,4)		Infinity		

Entry Lane slope and intercept

Arm	Lane level	Lane	Final slope	Final intercept (PCU/hr)
2	**1 [Give-way line]**	**1**	0.328	992
		2	0.328	992
3	**1 [Give-way line]**	**1**	0.398	1372
		2	0.398	1372
4	**1 [Give-way line]**	**1**	0.606	1791

Lane Movements

Arm	Lane Level	Lane	Destination arm			
			1	**2**	**3**	**4**
2	**1 [Give-way line]**	**1**			✓	
		2	✓	✓	✓	✓
3	**1 [Give-way line]**	**1**	✓			✓
		2	✓	✓	✓	
4	**1 [Give-way line]**	**1**	✓	✓	✓	✓
	2	**1**	✓	✓	✓	✓

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2021 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	835	100.000
3		ONE HOUR	✓	552	100.000
4		ONE HOUR	✓	177	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	16	6	731	82
	3	68	335	61	88
	4	5	54	115	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	5.69	1.8	6.0	A	763	1144
3	3.88	0.7	2.5	A	509	763
4	2.94	0.1	1.0	A	163	244

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			69				
2	636	159	134		635	301	0.0	0.8	4.513	A
3	414	104	81		415	689	0.0	0.3	3.304	A
4	138	35	366	7.53	139	130	0.0	0.1	2.526	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			78				
2	733	183	156		732	350	0.8	1.0	4.920	A
3	492	123	92		491	797	0.3	0.5	3.455	A
4	152	38	431	8.99	153	152	0.1	0.1	2.607	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			92				
2	928	232	196		929	448	1.0	1.3	5.657	A
3	616	154	119		617	1011	0.5	0.7	3.875	A
4	200	50	541	11.01	200	195	0.1	0.1	2.919	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			102				
2	922	230	192		915	436	1.3	1.8	5.695	A
3	613	153	117		614	994	0.7	0.6	3.671	A
4	193	48	542	11.01	192	188	0.1	0.1	2.943	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			83				
2	740	185	165		743	353	1.8	0.9	4.965	A
3	502	125	97		502	813	0.6	0.4	3.457	A
4	159	40	442	8.99	161	157	0.1	0.1	2.709	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			74				
2	618	154	132		619	298	0.9	0.8	4.562	A
3	417	104	79		419	671	0.4	0.4	3.250	A
4	135	34	369	7.53	135	130	0.1	0.1	2.610	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.80	0.00	0.02	1.99	2.62
3	0.35	0.00	0.00	0.77	0.96
4	0.08	0.00	0.00	0.00	1.00

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.05	0.00	0.38	1.94	2.79
3	0.50	0.00	0.00	0.91	1.39
4	0.12	0.00	0.00	-0.01	0.62

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.31	0.00	0.37	2.98	3.98
3	0.67	0.00	0.00	1.82	2.49
4	0.15	0.00	0.00	0.26	0.72

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.81	0.00	0.80	3.65	5.98
3	0.63	0.00	0.00	1.61	2.49
4	0.15	0.00	0.00	0.24	0.66

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.87	0.00	0.10	1.89	2.79
3	0.43	0.00	0.00	0.95	1.79
4	0.11	0.00	0.00	1.00	1.00

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.80	0.00	0.09	1.59	2.48
3	0.41	0.00	0.00	0.90	1.59
4	0.12	0.00	0.00	0.09	0.60

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		69				69	0.0	0.0	0.000	A
2	Entry	1	1	3	295		948	0.311	295	0.0	0.4	4.421	A
			2	1,2,3,4	341		948	0.360	341	0.0	0.4	4.593	A
	Exit	1	1		301				301	0.0	0.0	0.000	A
3	Entry	1	1	1,4	95		1339	0.071	94	0.0	0.1	2.770	A
			2	1,2,3	320		1339	0.239	321	0.0	0.3	3.464	A
	Exit	1	1		689				689	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	138		1569	0.088	139	0.0	0.1	2.496	A
		2	1	(1,2,3,4)	138	7.53			138	0.0	0.0	0.031	A
	Exit	1	1		130	7.53			130	0.0	0.0	0.025	A
		2	1		130				130	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		78				78	0.0	0.0	0.000	A
2	Entry	1	1	3	345		941	0.367	346	0.4	0.4	4.783	A
			2	1,2,3,4	388		941	0.413	387	0.4	0.6	5.039	A
	Exit	1	1		350				350	0.0	0.0	0.000	A
3	Entry	1	1	1,4	115		1335	0.086	114	0.1	0.1	2.817	A
			2	1,2,3	377		1335	0.283	377	0.3	0.4	3.649	A
	Exit	1	1		797				797	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	152		1529	0.100	153	0.1	0.1	2.575	A
		2	1	(1,2,3,4)	152	8.99			152	0.0	0.0	0.031	A
	Exit	1	1		152	8.99			152	0.0	0.0	0.033	A
		2	1		152				152	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		92				92	0.0	0.0	0.000	A
2	Entry	1	1	3	441		928	0.475	440	0.4	0.7	5.493	A
			2	1,2,3,4	487		928	0.525	489	0.6	0.7	5.802	A
	Exit	1	1		448				448	0.0	0.0	0.000	A
3	Entry	1	1	1,4	147		1324	0.111	147	0.1	0.2	2.938	A
			2	1,2,3	469		1324	0.354	470	0.4	0.5	4.166	A
	Exit	1	1		1011				1011	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	200		1463	0.137	200	0.1	0.1	2.871	A
		2	1	(1,2,3,4)	200	11.01			200	0.0	0.0	0.049	A
	Exit	1	1		195	11.01			195	0.0	0.0	0.028	A
		2	1		195				195	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		102				102	0.0	0.0	0.000	A
2	Entry	1	1	3	436		929	0.469	433	0.7	0.9	5.575	A
			2	1,2,3,4	486		929	0.523	482	0.7	0.9	5.802	A
	Exit	1	1		436				436	0.0	0.0	0.000	A
3	Entry	1	1	1,4	147		1325	0.111	146	0.2	0.1	3.060	A
			2	1,2,3	466		1325	0.352	467	0.5	0.5	3.865	A
	Exit	1	1		994				994	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	193		1462	0.132	192	0.1	0.1	2.898	A
		2	1	(1,2,3,4)	193	11.01			193	0.0	0.0	0.045	A
	Exit	1	1		188	11.01			188	0.0	0.0	0.035	A
		2	1		188				188	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		83				83	0.0	0.0	0.000	A
2	Entry	1	1	3	342		938	0.365	343	0.9	0.5	4.799	A
			2	1,2,3,4	398		938	0.424	400	0.9	0.4	5.113	A
	Exit	1	1		353				353	0.0	0.0	0.000	A
3	Entry	1	1	1,4	119		1333	0.089	119	0.1	0.1	2.883	A
			2	1,2,3	383		1333	0.287	383	0.5	0.3	3.628	A
	Exit	1	1		813				813	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	159		1523	0.105	161	0.1	0.1	2.669	A
		2	1	(1,2,3,4)	159	8.99			159	0.0	0.0	0.040	A
	Exit	1	1		157	8.99			157	0.0	0.0	0.019	A
		2	1		157				157	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		74				74	0.0	0.0	0.000	A
2	Entry	1	1	3	284		949	0.299	284	0.5	0.4	4.425	A
			2	1,2,3,4	334		949	0.352	334	0.4	0.4	4.679	A
	Exit	1	1		298				298	0.0	0.0	0.000	A
3	Entry	1	1	1,4	98		1340	0.073	99	0.1	0.0	2.730	A
			2	1,2,3	319		1340	0.238	320	0.3	0.4	3.410	A
	Exit	1	1		671				671	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	135		1567	0.086	135	0.1	0.1	2.588	A
		2	1	(1,2,3,4)	135	7.53			135	0.0	0.0	0.021	A
	Exit	1	1		130	7.53			130	0.0	0.0	0.025	A
		2	1		130				130	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.37	0.00	0.00	0.77	0.93
			2	0.44	0.00	0.00	2.00	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.08	0.00	0.00	0.00	1.00
			2	0.27	0.00	0.00	0.66	0.90
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.07	0.00	0.00	0.00	1.00
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.43	0.00	0.00	0.87	2.00
			2	0.62	0.00	0.00	0.99	1.71
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.08	0.00	0.00	0.00	1.00
			2	0.43	0.00	0.00	0.82	0.97
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	-0.01	0.62
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.65	0.00	0.00	1.45	1.90
			2	0.65	0.00	0.00	1.58	3.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.18	0.00	0.00	0.43	0.75
			2	0.50	0.00	0.00	1.24	1.87
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.24	0.66
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.88	0.00	0.11	1.74	2.48
			2	0.93	0.00	0.02	2.18	3.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.13	0.00	0.00	0.10	0.66
			2	0.50	0.00	0.00	1.41	2.32
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	0.24	0.66
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.47	0.00	0.00	0.96	2.00
			2	0.41	0.00	0.00	0.85	1.24
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.10	0.00	0.00	0.00	0.42
			2	0.33	0.00	0.00	0.78	1.24
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.11	0.00	0.00	1.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.39	0.00	0.00	0.82	0.99
			2	0.42	0.00	0.00	0.86	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	0.00
			2	0.36	0.00	0.00	0.81	1.24
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	0.09	0.60
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Reassigned Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	3.42	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2021 Reassigned Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	177	100.000
3		ONE HOUR	✓	552	100.000
4		ONE HOUR	✓	177	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	16	6	73	82
	3	236	167	61	88
	4	5	54	115	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	4.35	0.3	2.0	A	164	246
3	3.30	0.6	2.4	A	506	760
4	2.88	0.2	1.0	A	161	241

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			195				
2	133	33	133		133	173	0.0	0.2	4.016	A
3	423	106	80		423	185	0.0	0.4	3.038	A
4	130	33	371	7.53	130	132	0.0	0.1	2.503	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			229				
2	154	39	159		154	201	0.2	0.2	4.256	A
3	492	123	94		493	225	0.4	0.4	3.134	A
4	157	39	437	8.99	158	149	0.1	0.1	2.532	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			274				
2	189	47	189		189	259	0.2	0.2	4.321	A
3	604	151	116		605	262	0.4	0.5	3.215	A
4	192	48	532	11.01	191	190	0.1	0.2	2.877	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			291				
2	199	50	191		199	249	0.2	0.3	4.354	A
3	610	153	123		609	267	0.5	0.6	3.297	A
4	192	48	540	11.01	191	193	0.2	0.2	2.864	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			227				
2	171	43	161		170	198	0.3	0.2	4.215	A
3	494	124	102		494	232	0.6	0.4	3.127	A
4	156	39	433	8.99	156	164	0.2	0.1	2.675	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			195				
2	135	34	138		135	169	0.2	0.1	4.123	A
3	416	104	81		415	191	0.4	0.4	3.018	A
4	138	34	364	7.53	137	132	0.1	0.2	2.585	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.21	0.00	0.00	0.49	0.99
3	0.38	0.00	0.00	0.99	1.62
4	0.13	0.00	0.00	1.00	1.00

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.18	0.00	0.00	0.38	0.77
3	0.44	0.00	0.00	0.89	1.39
4	0.13	0.00	0.00	1.00	1.00

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.21	0.00	0.00	0.53	0.86
3	0.50	0.00	0.00	0.99	1.55
4	0.18	0.00	0.00	0.41	0.83

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.26	0.00	0.00	0.62	0.83
3	0.64	0.00	0.00	1.66	2.39
4	0.21	0.00	0.00	0.49	0.81

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.23	0.00	0.00	0.61	2.00
3	0.38	0.00	0.00	0.84	2.00
4	0.14	0.00	0.00	0.19	0.70

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.11	0.00	0.00	-0.01	0.55
3	0.36	0.00	0.00	0.80	1.32
4	0.17	0.00	0.00	0.38	0.77

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		195				195	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	29		948	0.031	29	0.0	0.1	4.047	A
			2	1,2,3,4	104		948	0.110	104	0.0	0.1	4.007	A
	Exit	**1**	**1**		173				173	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	161		1340	0.120	161	0.0	0.2	2.924	A
			2	1,2,3	262		1340	0.195	261	0.0	0.2	3.110	A
	Exit	**1**	**1**		185				185	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	130		1566	0.083	130	0.0	0.1	2.463	A
		2	**1**	(1,2,3,4)	130	7.53			130	0.0	0.0	0.040	A
	Exit	**1**	**1**		132	7.53			132	0.0	0.0	0.030	A
		2	**1**		132				132	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		229				229	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	34		940	0.036	34	0.1	0.0	4.207	A
			2	1,2,3,4	121		940	0.128	120	0.1	0.1	4.270	A
	Exit	**1**	**1**		201				201	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	189		1334	0.141	189	0.2	0.1	2.940	A
			2	1,2,3	304		1334	0.227	304	0.2	0.3	3.258	A
	Exit	**1**	**1**		225				225	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	157		1526	0.103	158	0.1	0.1	2.502	A
		2	**1**	(1,2,3,4)	157	8.99			157	0.0	0.0	0.031	A
	Exit	**1**	**1**		149	8.99			149	0.0	0.0	0.025	A
		2	**1**		149				149	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		274				274	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	44		930	0.048	44	0.0	0.1	3.923	A
			2	1,2,3,4	145		930	0.156	146	0.1	0.1	4.442	A
	Exit	**1**	**1**		259				259	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	237		1325	0.179	236	0.1	0.3	3.081	A
			2	1,2,3	367		1325	0.277	368	0.3	0.2	3.301	A
	Exit	**1**	**1**		262				262	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	192		1469	0.130	191	0.1	0.2	2.826	A
		2	**1**	(1,2,3,4)	192	11.01			192	0.0	0.0	0.050	A
	Exit	**1**	**1**		190	11.01			190	0.0	0.0	0.033	A
		2	**1**		190				190	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		291				291	0.0	0.0	0.000	A
2	Entry	1	1	3	46		929	0.050	46	0.1	0.0	3.909	A
			2	1,2,3,4	153		929	0.165	153	0.1	0.2	4.489	A
	Exit	1	1		249				249	0.0	0.0	0.000	A
3	Entry	1	1	1,4	243		1323	0.184	241	0.3	0.3	3.064	A
			2	1,2,3	367		1323	0.278	368	0.2	0.3	3.447	A
	Exit	1	1		267				267	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	192		1464	0.131	191	0.2	0.2	2.823	A
		2	1	(1,2,3,4)	192	11.01			192	0.0	0.0	0.041	A
	Exit	1	1		193	11.01			193	0.0	0.0	0.033	A
		2	1		193				193	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		227				227	0.0	0.0	0.000	A
2	Entry	1	1	3	39		939	0.041	39	0.0	0.0	3.924	A
			2	1,2,3,4	132		939	0.141	132	0.2	0.2	4.301	A
	Exit	1	1		198				198	0.0	0.0	0.000	A
3	Entry	1	1	1,4	191		1331	0.144	192	0.3	0.1	2.957	A
			2	1,2,3	303		1331	0.227	303	0.3	0.3	3.235	A
	Exit	1	1		232				232	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	156		1528	0.102	156	0.2	0.1	2.643	A
		2	1	(1,2,3,4)	156	8.99			156	0.0	0.0	0.032	A
	Exit	1	1		164	8.99			164	0.0	0.0	0.040	A
		2	1		164				164	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		195				195	0.0	0.0	0.000	A
2	Entry	1	1	3	29		947	0.031	29	0.0	0.0	3.675	A
			2	1,2,3,4	105		947	0.111	106	0.2	0.1	4.248	A
	Exit	1	1		169				169	0.0	0.0	0.000	A
3	Entry	1	1	1,4	164		1340	0.122	164	0.1	0.1	2.907	A
			2	1,2,3	252		1340	0.188	251	0.3	0.2	3.089	A
	Exit	1	1		191				191	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	138		1570	0.088	137	0.1	0.2	2.564	A
		2	1	(1,2,3,4)	138	7.53			138	0.0	0.0	0.021	A
	Exit	1	1		132	7.53			132	0.0	0.0	0.025	A
		2	1		132				132	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.15	0.00	0.00	-0.02	0.83
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.16	0.00	0.00	0.35	0.71
			2	0.22	0.00	0.00	0.49	0.91
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.13	0.00	0.00	1.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.15	0.00	0.00	0.26	0.72
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.14	0.00	0.00	1.00	1.00
			2	0.30	0.00	0.00	0.76	1.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.13	0.00	0.00	1.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.10	0.00	0.00	1.00	1.00
			2	0.11	0.00	0.00	0.00	0.56
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.31	0.00	0.00	0.72	0.95
			2	0.20	0.00	0.00	0.49	0.78
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.18	0.00	0.00	0.41	0.83
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.21	0.00	0.00	0.52	0.79
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.30	0.00	0.00	0.71	0.95
			2	0.35	0.00	0.00	0.84	1.39
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.21	0.00	0.00	0.49	0.81
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.18	0.00	0.00	0.41	0.83
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.11	0.00	0.00	1.00	1.00
			2	0.27	0.00	0.00	0.64	0.84
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.19	0.70
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.04	0.00	0.00	0.00	0.00
			2	0.07	0.00	0.00	0.00	1.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.14	0.00	0.00	0.24	0.66
			2	0.22	0.00	0.00	0.52	0.82
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.17	0.00	0.00	0.38	0.77
		2	**1**	0.00	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

2036 Base Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.09	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2036 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	278	100.000
3		ONE HOUR	✓	867	100.000
4		ONE HOUR	✓	279	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	25	9	115	129
	3	371	262	96	138
	4	8	85	181	5

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	4.89	0.5	2.0	A	256	384
3	3.93	1.1	3.5	A	797	1195
4	3.79	0.4	2.0	A	255	383

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			322				
2	217	54	217		215	259	0.0	0.4	4.409	A
3	667	167	129		667	304	0.0	0.7	3.318	A
4	210	52	589	7.53	210	207	0.0	0.2	2.923	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			347				
2	251	63	259		250	309	0.4	0.4	4.689	A
3	754	188	151		755	361	0.7	0.7	3.560	A
4	251	63	668	8.99	251	239	0.2	0.2	3.172	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			438				
2	309	77	302		310	404	0.4	0.3	4.839	A
3	962	240	188		960	428	0.7	1.0	3.867	A
4	304	76	844	11.01	305	305	0.2	0.3	3.638	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			447				
2	307	77	321		307	388	0.3	0.5	4.894	A
3	958	240	186		957	442	1.0	1.1	3.932	A
4	313	78	843	11.01	313	301	0.3	0.4	3.791	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			357				
2	242	61	248		242	329	0.5	0.3	4.513	A
3	781	195	142		782	347	1.1	0.7	3.560	A
4	245	61	688	8.99	246	236	0.4	0.2	3.369	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			305				
2	211	53	211		211	271	0.3	0.3	4.442	A
3	657	164	132		662	291	0.7	0.4	3.373	A
4	209	52	580	7.53	209	215	0.2	0.2	2.940	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.37	0.00	0.00	0.89	1.49
3	0.69	0.00	0.00	1.58	1.99
4	0.16	0.00	0.00	0.11	0.74

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.38	0.00	0.00	0.82	2.00
3	0.73	0.00	0.00	1.69	2.49
4	0.23	0.00	0.00	0.52	0.82

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.35	0.00	0.00	0.85	2.00
3	1.03	0.00	0.23	2.18	3.48
4	0.27	0.00	0.00	0.66	0.94

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.51	0.00	0.00	1.26	1.72
3	1.12	0.00	0.31	2.56	3.39
4	0.36	0.00	0.00	0.87	1.74

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.30	0.00	0.00	0.75	2.00
3	0.73	0.00	0.00	1.61	1.98
4	0.21	0.00	0.00	0.54	2.00

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.29	0.00	0.00	0.69	0.91
3	0.44	0.00	0.00	0.89	1.33
4	0.16	0.00	0.00	0.35	0.71

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		322				322	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	53		921	0.057	53	0.0	0.0	3.932	A
			2	1,2,3,4	164		921	0.179	162	0.0	0.3	4.560	A
	Exit	**1**	**1**		259				259	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	267		1320	0.202	267	0.0	0.2	3.086	A
			2	1,2,3	400		1320	0.303	400	0.0	0.5	3.472	A
	Exit	**1**	**1**		304				304	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	210		1434	0.146	210	0.0	0.1	2.889	A
		2	**1**	(1,2,3,4)	210	7.53			210	0.0	0.0	0.032	A
	Exit	**1**	**1**		207	7.53			207	0.0	0.0	0.040	A
		2	**1**		207				207	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		347				347	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	56		907	0.061	55	0.0	0.1	4.042	A
			2	1,2,3,4	195		907	0.215	195	0.3	0.2	4.875	A
	Exit	**1**	**1**		309				309	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	296		1312	0.226	297	0.2	0.2	3.227	A
			2	1,2,3	458		1312	0.349	459	0.5	0.5	3.782	A
	Exit	**1**	**1**		361				361	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	251		1386	0.181	251	0.1	0.2	3.133	A
		2	**1**	(1,2,3,4)	251	8.99			251	0.0	0.0	0.041	A
	Exit	**1**	**1**		239	8.99			239	0.0	0.0	0.021	A
		2	**1**		239				239	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		438				438	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	75		893	0.084	75	0.1	0.1	4.002	A
			2	1,2,3,4	234		893	0.262	235	0.2	0.3	5.105	A
	Exit	**1**	**1**		404				404	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	391		1297	0.302	390	0.2	0.4	3.448	A
			2	1,2,3	571		1297	0.440	571	0.5	0.6	4.154	A
	Exit	**1**	**1**		428				428	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	304		1279	0.238	305	0.2	0.3	3.571	A
		2	**1**	(1,2,3,4)	304	11.01			304	0.0	0.0	0.066	A
	Exit	**1**	**1**		305	11.01			305	0.0	0.0	0.033	A
		2	**1**		305				305	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		447				447	0.0	0.0	0.000	A
2	Entry	1	1	3	73		887	0.082	72	0.1	0.1	4.105	A
			2	1,2,3,4	234		887	0.264	235	0.3	0.4	5.145	A
	Exit	1	1		388				388	0.0	0.0	0.000	A
3	Entry	1	1	1,4	396		1298	0.305	396	0.4	0.4	3.527	A
			2	1,2,3	563		1298	0.434	562	0.6	0.8	4.210	A
	Exit	1	1		442				442	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	313		1280	0.245	313	0.3	0.4	3.692	A
		2	1	(1,2,3,4)	313	11.01			313	0.0	0.0	0.099	A
	Exit	1	1		301	11.01			301	0.0	0.0	0.042	A
		2	1		301				301	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		357				357	0.0	0.0	0.000	A
2	Entry	1	1	3	59		911	0.064	60	0.1	0.0	3.791	A
			2	1,2,3,4	183		911	0.201	182	0.4	0.3	4.740	A
	Exit	1	1		329				329	0.0	0.0	0.000	A
3	Entry	1	1	1,4	311		1315	0.237	312	0.4	0.2	3.256	A
			2	1,2,3	470		1315	0.357	469	0.8	0.5	3.766	A
	Exit	1	1		347				347	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	246		1374	0.179	246	0.4	0.2	3.300	A
		2	1	(1,2,3,4)	245	8.99			246	0.0	0.0	0.069	A
	Exit	1	1		236	8.99			236	0.0	0.0	0.055	A
		2	1		236				236	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		305				305	0.0	0.0	0.000	A
2	Entry	1	1	3	47		923	0.051	46	0.0	0.1	3.896	A
			2	1,2,3,4	164		923	0.178	165	0.3	0.2	4.596	A
	Exit	1	1		271				271	0.0	0.0	0.000	A
3	Entry	1	1	1,4	270		1319	0.205	273	0.2	0.2	3.066	A
			2	1,2,3	387		1319	0.293	389	0.5	0.2	3.576	A
	Exit	1	1		291				291	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	208		1439	0.145	209	0.2	0.1	2.909	A
		2	1	(1,2,3,4)	209	7.53			208	0.0	0.0	0.031	A
	Exit	1	1		215	7.53			215	0.0	0.0	0.035	A
		2	1		215				215	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.32	0.00	0.00	0.86	1.42
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.23	0.00	0.00	0.57	0.81
			2	0.47	0.00	0.00	0.96	1.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	0.11	0.74
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.14	0.00	0.00	1.00	1.00
			2	0.24	0.00	0.00	0.59	0.82
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.20	0.00	0.00	0.49	0.81
			2	0.53	0.00	0.00	1.15	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.22	0.00	0.00	0.52	0.82
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.29	0.00	0.00	0.79	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.45	0.00	0.00	0.98	1.83
			2	0.58	0.00	0.00	1.36	1.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.26	0.00	0.00	0.66	0.94
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.09	0.00	0.00	0.00	1.00
			2	0.43	0.00	0.00	0.99	1.62
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.37	0.00	0.00	0.77	0.96
			2	0.75	0.00	0.00	1.69	2.65
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.36	0.00	0.00	0.87	1.74
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	0.29	0.00	0.00	0.71	0.95
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.21	0.00	0.00	0.49	0.81
			2	0.52	0.00	0.00	1.19	1.70
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.21	0.00	0.00	0.54	2.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.23	0.00	0.00	0.57	0.84
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.20	0.00	0.00	0.49	0.78
			2	0.24	0.00	0.00	0.57	0.84
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	0.30	0.69
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Traffic with Dev, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D4	2021 Traffic with Dev	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D2+D6

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	352	100.000
3		ONE HOUR	✓	562	100.000
4		ONE HOUR	✓	279	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	16	6	73	257
	3	236	177	61	88
	4	5	156	115	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	5.74	0.8	3.0	A	330	495
3	3.53	0.7	2.6	A	513	770
4	3.18	0.3	1.0	A	262	393

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			198				
2	269	67	142		270	263	0.0	0.3	4.744	A
3	429	107	220		429	192	0.0	0.4	3.117	A
4	221	55	381	7.53	221	268	0.0	0.1	2.680	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			226				
2	323	81	170		323	293	0.3	0.4	5.111	A
3	498	125	259		499	234	0.4	0.5	3.288	A
4	255	64	435	8.99	255	324	0.1	0.2	2.839	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			282				
2	384	96	199		383	368	0.4	0.5	5.568	A
3	612	153	309		613	273	0.5	0.6	3.530	A
4	305	76	542	11.01	307	381	0.2	0.1	3.153	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			286				
2	402	101	196		398	377	0.5	0.8	5.741	A
3	617	154	318		615	276	0.6	0.7	3.514	A
4	322	81	535	11.01	324	398	0.1	0.3	3.176	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			232				
2	320	80	164		317	304	0.8	0.6	4.978	A
3	507	127	253		506	229	0.7	0.5	3.357	A
4	253	63	446	8.99	255	313	0.3	0.2	2.935	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			192				
2	281	70	142		282	247	0.6	0.4	4.803	A
3	416	104	227		417	197	0.5	0.4	3.213	A
4	213	53	367	7.53	213	277	0.2	0.1	2.693	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.30	0.00	0.00	0.76	1.19
3	0.37	0.00	0.00	0.80	0.99
4	0.15	0.00	0.00	0.26	0.72

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.42	0.00	0.00	0.99	1.62
3	0.46	0.00	0.00	0.93	1.49
4	0.23	0.00	0.00	0.56	0.93

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.54	0.00	0.00	1.13	1.85
3	0.56	0.00	0.00	1.35	1.81
4	0.15	0.00	0.00	0.19	0.70

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.83	0.00	0.00	1.90	2.99
3	0.73	0.00	0.00	1.77	2.59
4	0.28	0.00	0.00	0.68	0.94

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.59	0.00	0.00	1.29	1.80
3	0.46	0.00	0.00	0.95	1.66
4	0.16	0.00	0.00	1.00	1.00

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.36	0.00	0.00	0.80	1.32
3	0.40	0.00	0.00	0.91	1.42
4	0.14	0.00	0.00	1.00	1.00

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		198				198	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	32		945	0.034	32	0.0	0.0	3.950	A
			2	1,2,3,4	238		945	0.251	238	0.0	0.3	4.861	A
	Exit	**1**	**1**		263				263	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	161		1284	0.125	161	0.0	0.1	2.926	A
			2	1,2,3	268		1284	0.209	268	0.0	0.3	3.236	A
	Exit	**1**	**1**		192				192	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	221		1560	0.142	221	0.0	0.1	2.632	A
		2	**1**	(1,2,3,4)	221	7.53			221	0.0	0.0	0.047	A
	Exit	**1**	**1**		268	7.53			268	0.0	0.0	0.031	A
		2	**1**		268				268	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		226				226	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	42		936	0.045	42	0.0	0.1	3.927	A
			2	1,2,3,4	281		936	0.300	281	0.3	0.3	5.293	A
	Exit	**1**	**1**		293				293	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	197		1268	0.156	197	0.1	0.2	3.112	A
			2	1,2,3	301		1268	0.237	302	0.3	0.3	3.400	A
	Exit	**1**	**1**		234				234	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	255		1527	0.167	255	0.1	0.2	2.791	A
		2	**1**	(1,2,3,4)	255	8.99			255	0.0	0.0	0.048	A
	Exit	**1**	**1**		324	8.99			324	0.0	0.0	0.030	A
		2	**1**		324				324	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		282				282	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	49		927	0.053	50	0.1	0.0	3.916	A
			2	1,2,3,4	335		927	0.362	334	0.3	0.5	5.827	A
	Exit	**1**	**1**		368				368	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	240		1249	0.192	240	0.2	0.3	3.285	A
			2	1,2,3	372		1249	0.298	374	0.3	0.3	3.689	A
	Exit	**1**	**1**		273				273	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	305		1462	0.208	307	0.2	0.1	3.077	A
		2	**1**	(1,2,3,4)	305	11.01			305	0.0	0.0	0.076	A
	Exit	**1**	**1**		381	11.01			381	0.0	0.0	0.042	A
		2	**1**		381				381	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		286				286	0.0	0.0	0.000	A
2	Entry	1	1	3	57		928	0.062	57	0.0	0.1	4.103	A
			2	1,2,3,4	345		928	0.372	341	0.5	0.7	5.998	A
	Exit	1	1		377				377	0.0	0.0	0.000	A
3	Entry	1	1	1,4	247		1245	0.199	247	0.3	0.2	3.222	A
			2	1,2,3	370		1245	0.297	368	0.3	0.5	3.706	A
	Exit	1	1		276				276	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	322		1466	0.220	324	0.1	0.3	3.123	A
		2	1	(1,2,3,4)	322	11.01			322	0.0	0.0	0.053	A
	Exit	1	1		398	11.01			398	0.0	0.0	0.048	A
		2	1		398				398	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		232				232	0.0	0.0	0.000	A
2	Entry	1	1	3	39		938	0.042	40	0.1	0.0	3.687	A
			2	1,2,3,4	280		938	0.299	278	0.7	0.6	5.162	A
	Exit	1	1		304				304	0.0	0.0	0.000	A
3	Entry	1	1	1,4	194		1271	0.152	194	0.2	0.1	3.113	A
			2	1,2,3	313		1271	0.246	312	0.5	0.3	3.513	A
	Exit	1	1		229				229	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	253		1521	0.166	255	0.3	0.1	2.894	A
		2	1	(1,2,3,4)	253	8.99			253	0.0	0.0	0.042	A
	Exit	1	1		313	8.99			313	0.0	0.0	0.040	A
		2	1		313				313	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		192				192	0.0	0.0	0.000	A
2	Entry	1	1	3	36		946	0.038	36	0.0	0.0	4.160	A
			2	1,2,3,4	245		946	0.259	246	0.6	0.3	4.899	A
	Exit	1	1		247				247	0.0	0.0	0.000	A
3	Entry	1	1	1,4	165		1282	0.129	165	0.1	0.1	3.044	A
			2	1,2,3	252		1282	0.196	252	0.3	0.3	3.319	A
	Exit	1	1		197				197	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	213		1568	0.136	213	0.1	0.1	2.658	A
		2	1	(1,2,3,4)	213	7.53			213	0.0	0.0	0.034	A
	Exit	1	1		277	7.53			277	0.0	0.0	0.034	A
		2	1		277				277	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.27	0.00	0.00	0.73	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.10	0.00	0.00	0.00	0.49
			2	0.27	0.00	0.00	0.65	0.90
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	0.26	0.72
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.09	0.00	0.00	0.00	1.00
			2	0.33	0.00	0.00	0.82	1.39
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.19	0.00	0.00	0.46	0.76
			2	0.27	0.00	0.00	0.63	0.86
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.23	0.00	0.00	0.56	0.93
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	0.53	0.00	0.00	1.11	1.74
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.28	0.00	0.00	0.68	0.91
			2	0.29	0.00	0.00	0.72	0.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.10	0.66
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.09	0.00	0.00	0.00	0.42
			2	0.74	0.00	0.00	1.88	2.79
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.25	0.00	0.00	0.62	0.93
			2	0.49	0.00	0.00	1.24	1.87
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.28	0.00	0.00	0.68	0.94
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.57	0.00	0.00	1.29	1.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.13	0.00	0.00	1.00	1.00
			2	0.33	0.00	0.00	0.78	1.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	1.00	1.00
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.04	0.00	0.00	0.00	0.00
			2	0.32	0.00	0.00	0.72	0.98
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.13	0.00	0.00	1.00	1.00
			2	0.27	0.00	0.00	0.68	0.94
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.14	0.00	0.00	1.00	1.00
		2	**1**	0.00	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

2036 Traffic with Dev, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.90	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D5	2036 Traffic with Dev	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D3+D6

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	453	100.000
3		ONE HOUR	✓	877	100.000
4		ONE HOUR	✓	381	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	25	9	115	304
	3	371	272	96	138
	4	8	187	181	5

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	6.49	1.1	4.0	A	417	626
3	4.33	1.1	3.0	A	806	1208
4	4.34	0.4	1.6	A	350	525

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			315				
2	345	86	219		346	351	0.0	0.4	5.097	A
3	668	167	261		668	304	0.0	0.6	3.469	A
4	294	74	592	7.53	294	338	0.0	0.3	2.974	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			366				
2	406	101	270		408	425	0.4	0.5	5.651	A
3	807	202	306		807	371	0.6	0.8	3.904	A
4	350	88	710	8.99	350	404	0.3	0.4	3.585	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			447				
2	500	125	307		501	516	0.5	0.8	6.493	A
3	965	241	381		964	429	0.8	1.0	4.269	A
4	413	103	857	11.01	415	489	0.4	0.4	4.133	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			444				
2	509	127	314		509	505	0.8	1.1	6.321	A
3	965	241	386		965	435	1.0	1.1	4.327	A
4	409	102	853	11.01	410	498	0.4	0.4	4.336	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			355				
2	400	100	253		399	416	1.1	0.6	5.800	A
3	782	196	303		782	351	1.1	1.0	3.862	A
4	336	84	689	8.99	337	396	0.4	0.3	3.614	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			296				
2	344	86	222		347	355	0.6	0.5	5.002	A
3	647	162	260		648	309	1.0	0.6	3.627	A
4	299	75	574	7.53	300	334	0.3	0.2	3.156	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.41	0.00	0.00	0.95	1.56
3	0.56	0.00	0.00	0.99	1.55
4	0.30	0.00	0.00	0.73	0.99

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.49	0.00	0.00	0.93	1.59
3	0.81	0.00	0.17	1.61	1.98
4	0.43	0.00	0.00	0.90	1.59

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.83	0.00	0.00	1.79	2.49
3	1.01	0.00	0.28	1.93	2.98
4	0.42	0.00	0.00	0.88	1.49

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.06	0.00	0.10	2.38	3.98
3	1.07	0.00	0.20	2.39	2.90
4	0.45	0.00	0.00	0.92	1.59

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.58	0.00	0.00	1.99	2.55
3	0.96	0.00	0.20	1.82	2.65
4	0.29	0.00	0.00	0.76	1.33

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.47	0.00	0.00	1.10	1.66
3	0.57	0.00	0.00	1.13	1.85
4	0.20	0.00	0.00	0.43	0.75

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		315				315	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	56		920	0.061	56	0.0	0.0	4.076	A
			2	1,2,3,4	289		920	0.314	289	0.0	0.4	5.293	A
	Exit	**1**	**1**		351				351	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	264		1268	0.208	263	0.0	0.2	3.166	A
			2	1,2,3	404		1268	0.319	405	0.0	0.3	3.665	A
	Exit	**1**	**1**		304				304	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	294		1432	0.205	294	0.0	0.3	2.909	A
		2	**1**	(1,2,3,4)	294	7.53			294	0.0	0.0	0.065	A
	Exit	**1**	**1**		338	7.53			338	0.0	0.0	0.036	A
		2	**1**		338				338	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		366				366	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	68		903	0.076	68	0.0	0.1	4.174	A
			2	1,2,3,4	338		903	0.374	339	0.4	0.4	5.941	A
	Exit	**1**	**1**		425				425	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	320		1250	0.256	319	0.2	0.3	3.469	A
			2	1,2,3	487		1250	0.390	488	0.3	0.5	4.194	A
	Exit	**1**	**1**		371				371	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	350		1360	0.257	350	0.3	0.4	3.500	A
		2	**1**	(1,2,3,4)	350	8.99			350	0.0	0.0	0.083	A
	Exit	**1**	**1**		404	8.99			404	0.0	0.0	0.043	A
		2	**1**		404				404	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		447				447	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	86		891	0.097	86	0.1	0.0	4.462	A
			2	1,2,3,4	414		891	0.464	415	0.4	0.8	6.913	A
	Exit	**1**	**1**		516				516	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	393		1220	0.322	394	0.3	0.3	3.713	A
			2	1,2,3	572		1220	0.469	571	0.5	0.7	4.656	A
	Exit	**1**	**1**		429				429	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	413		1271	0.325	415	0.4	0.4	3.978	A
		2	**1**	(1,2,3,4)	413	11.01			413	0.0	0.0	0.157	A
	Exit	**1**	**1**		489	11.01			489	0.0	0.0	0.045	A
		2	**1**		489				489	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		444				444	0.0	0.0	0.000	A
2	Entry	1	1	3	87		889	0.098	86	0.0	0.1	4.110	A
			2	1,2,3,4	422		889	0.474	422	0.8	0.9	6.786	A
	Exit	1	1		505				505	0.0	0.0	0.000	A
3	Entry	1	1	1,4	387		1218	0.318	388	0.3	0.3	3.827	A
			2	1,2,3	578		1218	0.474	577	0.7	0.7	4.667	A
	Exit	1	1		435				435	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	410		1274	0.322	410	0.4	0.4	4.101	A
		2	1	(1,2,3,4)	409	11.01			410	0.0	0.0	0.235	A
	Exit	1	1		498	11.01			498	0.0	0.0	0.050	A
		2	1		498				498	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		355				355	0.0	0.0	0.000	A
2	Entry	1	1	3	67		909	0.073	67	0.1	0.0	4.037	A
			2	1,2,3,4	333		909	0.367	332	0.9	0.5	6.147	A
	Exit	1	1		416				416	0.0	0.0	0.000	A
3	Entry	1	1	1,4	310		1251	0.247	310	0.3	0.3	3.489	A
			2	1,2,3	473		1251	0.378	472	0.7	0.6	4.110	A
	Exit	1	1		351				351	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	336		1373	0.245	337	0.4	0.3	3.507	A
		2	1	(1,2,3,4)	336	8.99			336	0.0	0.0	0.107	A
	Exit	1	1		396	8.99			396	0.0	0.0	0.042	A
		2	1		396				396	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		296				296	0.0	0.0	0.000	A
2	Entry	1	1	3	58		919	0.063	58	0.0	0.1	4.007	A
			2	1,2,3,4	286		919	0.311	289	0.5	0.4	5.194	A
	Exit	1	1		355				355	0.0	0.0	0.000	A
3	Entry	1	1	1,4	254		1268	0.200	255	0.3	0.2	3.272	A
			2	1,2,3	393		1268	0.310	393	0.6	0.4	3.860	A
	Exit	1	1		309				309	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	299		1443	0.207	300	0.3	0.2	3.092	A
		2	1	(1,2,3,4)	299	7.53			299	0.0	0.0	0.065	A
	Exit	1	1		334	7.53			334	0.0	0.0	0.029	A
		2	1		334				334	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.37	0.00	0.00	0.90	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.25	0.00	0.00	0.63	0.89
			2	0.32	0.00	0.00	0.73	0.95
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.30	0.00	0.00	0.73	0.99
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.07	0.00	0.00	0.00	1.00
			2	0.42	0.00	0.00	0.87	1.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.32	0.00	0.00	0.70	0.89
			2	0.50	0.00	0.00	0.91	1.39
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.40	0.00	0.00	0.90	1.59
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.79	0.00	0.00	1.73	2.32
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.27	0.00	0.00	0.66	0.94
			2	0.74	0.00	0.00	1.66	2.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.41	0.00	0.00	0.88	1.39
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.14	0.00	0.00	1.00	1.00
			2	0.92	0.00	0.00	1.97	3.65
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.34	0.00	0.00	0.79	2.00
			2	0.73	0.00	0.00	1.84	2.66
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.45	0.00	0.00	0.92	1.59
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.54	0.00	0.00	1.84	2.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.34	0.00	0.00	0.77	0.99
			2	0.62	0.00	0.00	1.43	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.28	0.00	0.00	0.76	1.33
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.07	0.00	0.00	0.00	1.00
			2	0.40	0.00	0.00	0.90	1.49
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.21	0.00	0.00	0.52	0.82
			2	0.37	0.00	0.00	0.80	0.99
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.19	0.00	0.00	0.43	0.75
		2	**1**	0.01	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

2021 Base Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	6.61	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2021 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	985	100.000
3		ONE HOUR	✓	671	100.000
4		ONE HOUR	✓	173	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	20	0	774	191
	3	26	257	300	88
	4	11	56	104	2

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	8.30	2.5	6.5	A	906	1359
3	5.04	1.0	3.3	A	615	923
4	3.08	0.2	0.8	A	159	239

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			45				
2	743	186	306		744	234	0.0	1.1	5.366	A
3	505	126	162		505	888	0.0	0.5	3.820	A
4	130	32	455	7.53	130	213	0.0	0.1	2.552	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			51				
2	884	221	369		883	280	1.1	1.6	6.180	A
3	601	150	194		600	1059	0.5	0.8	4.267	A
4	160	40	541	8.99	160	253	0.1	0.1	2.797	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			62				
2	1079	270	450		1080	343	1.6	2.3	8.177	A
3	741	185	232		742	1298	0.8	1.0	5.041	A
4	188	47	666	11.01	189	308	0.1	0.1	3.080	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			65				
2	1095	274	447		1096	342	2.3	2.5	8.301	A
3	736	184	237		738	1308	1.0	1.0	5.025	A
4	190	48	665	11.01	190	310	0.1	0.2	3.068	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			52				
2	883	221	366		884	278	2.5	1.6	6.431	A
3	602	151	188		602	1061	1.0	0.8	4.321	A
4	158	39	538	8.99	158	252	0.2	0.1	2.794	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			43				
2	751	188	303		750	239	1.6	1.3	5.517	A
3	505	126	167		505	887	0.8	0.5	3.916	A
4	131	33	455	7.53	131	217	0.1	0.1	2.680	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.11	0.00	0.28	2.44	3.29
3	0.54	0.00	0.00	1.24	1.99
4	0.09	0.00	0.00	0.00	0.44

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.57	0.00	0.76	3.13	4.21
3	0.82	0.00	0.00	1.87	2.82
4	0.12	0.00	0.00	0.13	0.60

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	2.31	0.00	1.32	4.73	5.94
3	0.98	0.00	0.00	2.46	3.33
4	0.14	0.00	0.00	0.25	0.70

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	2.45	0.00	1.30	5.18	6.49
3	1.01	0.00	0.15	2.24	3.29
4	0.17	0.00	0.00	0.38	0.80

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.59	0.00	0.70	3.08	4.08
3	0.77	0.00	0.00	1.78	2.42
4	0.13	0.00	0.00	0.13	0.63

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.26	0.00	0.37	2.92	3.99
3	0.52	0.00	0.00	1.19	1.90
4	0.09	0.00	0.00	0.00	0.45

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		45				45	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	331		892	0.371	332	0.0	0.4	4.996	A
			2	1,2,3,4	412		892	0.462	412	0.0	0.7	5.659	A
	Exit	**1**	**1**		234				234	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	79		1307	0.060	79	0.0	0.1	2.923	A
			2	1,2,3	427		1307	0.326	426	0.0	0.5	3.988	A
	Exit	**1**	**1**		888				888	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	130		1515	0.086	130	0.0	0.1	2.519	A
		2	**1**	(1,2,3,4)	130	7.53			130	0.0	0.0	0.032	A
	Exit	**1**	**1**		213	7.53			213	0.0	0.0	0.034	A
		2	**1**		213				213	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		51				51	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	395		871	0.454	395	0.4	0.7	5.800	A
			2	1,2,3,4	489		871	0.561	489	0.7	0.9	6.487	A
	Exit	**1**	**1**		280				280	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	93		1295	0.072	93	0.1	0.1	2.901	A
			2	1,2,3	508		1295	0.392	507	0.5	0.7	4.521	A
	Exit	**1**	**1**		1059				1059	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	160		1463	0.109	160	0.1	0.1	2.771	A
		2	**1**	(1,2,3,4)	160	8.99			160	0.0	0.0	0.026	A
	Exit	**1**	**1**		253	8.99			253	0.0	0.0	0.025	A
		2	**1**		253				253	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		62				62	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	503		844	0.596	504	0.7	1.0	7.529	A
			2	1,2,3,4	575		844	0.681	576	0.9	1.3	8.742	A
	Exit	**1**	**1**		343				343	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	117		1279	0.092	117	0.1	0.1	3.007	A
			2	1,2,3	624		1279	0.488	624	0.7	0.9	5.424	A
	Exit	**1**	**1**		1298				1298	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	188		1387	0.135	189	0.1	0.1	3.037	A
		2	**1**	(1,2,3,4)	188	11.01			188	0.0	0.0	0.044	A
	Exit	**1**	**1**		308	11.01			308	0.0	0.0	0.038	A
		2	**1**		308				308	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		65				65	0.0	0.0	0.000	A
2	Entry	1	1	3	506		845	0.599	507	1.0	1.1	7.764	A
			2	1,2,3,4	589		845	0.697	589	1.3	1.4	8.764	A
	Exit	1	1		342				342	0.0	0.0	0.000	A
3	Entry	1	1	1,4	116		1278	0.091	116	0.1	0.1	3.077	A
			2	1,2,3	620		1278	0.485	622	0.9	0.9	5.392	A
	Exit	1	1		1308				1308	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	190		1388	0.137	190	0.1	0.2	3.029	A
		2	1	(1,2,3,4)	190	11.01			190	0.0	0.0	0.040	A
	Exit	1	1		310	11.01			310	0.0	0.0	0.045	A
		2	1		310				310	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		52				52	0.0	0.0	0.000	A
2	Entry	1	1	3	397		872	0.456	398	1.1	0.6	6.025	A
			2	1,2,3,4	486		872	0.558	486	1.4	1.0	6.762	A
	Exit	1	1		278				278	0.0	0.0	0.000	A
3	Entry	1	1	1,4	97		1297	0.075	97	0.1	0.1	3.016	A
			2	1,2,3	505		1297	0.390	505	0.9	0.7	4.568	A
	Exit	1	1		1061				1061	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	158		1465	0.108	158	0.2	0.1	2.762	A
		2	1	(1,2,3,4)	158	8.99			158	0.0	0.0	0.033	A
	Exit	1	1		252	8.99			252	0.0	0.0	0.034	A
		2	1		252				252	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		43				43	0.0	0.0	0.000	A
2	Entry	1	1	3	331		892	0.370	331	0.6	0.5	5.175	A
			2	1,2,3,4	421		892	0.471	419	1.0	0.8	5.786	A
	Exit	1	1		239				239	0.0	0.0	0.000	A
3	Entry	1	1	1,4	77		1305	0.059	77	0.1	0.0	2.930	A
			2	1,2,3	428		1305	0.328	428	0.7	0.5	4.096	A
	Exit	1	1		887				887	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	131		1515	0.087	131	0.1	0.1	2.654	A
		2	1	(1,2,3,4)	131	7.53			131	0.0	0.0	0.026	A
	Exit	1	1		217	7.53			217	0.0	0.0	0.028	A
		2	1		217				217	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.42	0.00	0.00	0.91	1.38
			2	0.70	0.00	0.00	1.56	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	0.00
			2	0.48	0.00	0.00	1.07	1.92
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.09	0.00	0.00	0.00	0.44
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.68	0.00	0.00	1.47	1.93
			2	0.89	0.00	0.19	1.85	2.46
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.09	0.00	0.00	0.00	0.43
			2	0.73	0.00	0.00	1.77	2.66
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	0.13	0.60
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	1.00	0.00	0.29	2.08	2.68
			2	1.31	0.00	0.60	2.57	3.36
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.09	0.00	0.00	0.00	0.44
			2	0.89	0.00	0.00	2.31	3.26
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.25	0.70
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	1.06	0.00	0.20	2.30	2.94
			2	1.40	0.00	0.57	2.82	3.77
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.11	0.00	0.00	0.07	0.57
			2	0.90	0.00	0.00	2.07	2.88
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.17	0.00	0.00	0.34	0.79
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.61	0.00	0.00	1.34	1.82
			2	0.98	0.00	0.27	1.99	2.63
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.10	0.00	0.00	0.00	0.53
			2	0.67	0.00	0.00	1.64	2.23
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	0.11	0.60
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.49	0.00	0.00	1.03	1.73
			2	0.77	0.00	0.04	1.66	2.23
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	0.00
			2	0.48	0.00	0.00	1.06	1.79
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.09	0.00	0.00	0.00	0.45
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Reassigned Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.33	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2021 Reassigned Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	288	100.000
3		ONE HOUR	✓	671	100.000
4		ONE HOUR	✓	173	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	20	0	77	191
	3	155	128	300	88
	4	11	56	104	2

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	5.65	0.4	2.0	A	262	393
3	4.10	0.9	2.7	A	620	930
4	3.09	0.3	0.9	A	161	241

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			140				
2	222	55	312		222	145	0.0	0.3	4.896	A
3	516	129	162		514	372	0.0	0.5	3.354	A
4	134	33	463	7.53	135	214	0.0	0.0	2.522	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			170				
2	253	63	379		253	162	0.3	0.4	5.267	A
3	620	155	186		621	447	0.5	0.6	3.768	A
4	162	41	550	8.99	161	257	0.0	0.2	2.800	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			208				
2	319	80	442		321	207	0.4	0.4	5.574	A
3	743	186	244		740	520	0.6	0.9	4.006	A
4	197	49	660	11.01	197	323	0.2	0.2	3.088	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			207				
2	305	76	444		306	205	0.4	0.4	5.652	A
3	737	184	232		735	517	0.9	0.8	4.097	A
4	194	49	661	11.01	193	306	0.2	0.3	3.020	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			165				
2	258	64	362		257	162	0.4	0.3	5.088	A
3	602	150	192		602	429	0.8	0.6	3.760	A
4	154	38	536	8.99	154	257	0.3	0.1	2.806	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			135				
2	214	54	305		212	140	0.3	0.4	4.717	A
3	504	126	157		503	361	0.6	0.6	3.600	A
4	125	31	456	7.53	125	204	0.1	0.1	2.634	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.26	0.00	0.00	0.71	2.00
3	0.51	0.00	0.00	0.96	1.66
4	0.04	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.36	0.00	0.00	0.80	1.32
3	0.61	0.00	0.00	0.98	1.83
4	0.18	0.00	0.00	0.43	0.75

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.43	0.00	0.00	0.89	1.33
3	0.87	0.00	0.11	1.78	2.39
4	0.17	0.00	0.00	0.33	0.75

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.38	0.00	0.00	0.80	0.98
3	0.80	0.00	0.04	1.69	2.65
4	0.28	0.00	0.00	0.66	0.94

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.30	0.00	0.00	0.84	1.42
3	0.64	0.00	0.00	1.24	1.87
4	0.12	0.00	0.00	-0.01	0.62

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.36	0.00	0.00	0.83	2.00
3	0.57	0.00	0.00	1.21	1.77
4	0.08	0.00	0.00	0.00	0.33

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		140				140	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	34		890	0.038	34	0.0	0.0	3.961	A
			2	1,2,3,4	188		890	0.211	188	0.0	0.2	5.065	A
	Exit	**1**	**1**		145				145	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	139		1307	0.106	138	0.0	0.1	2.871	A
			2	1,2,3	377		1307	0.289	376	0.0	0.4	3.533	A
	Exit	**1**	**1**		372				372	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	134		1510	0.089	135	0.0	0.0	2.493	A
		2	**1**	(1,2,3,4)	134	7.53			134	0.0	0.0	0.029	A
	Exit	**1**	**1**		214	7.53			214	0.0	0.0	0.028	A
		2	**1**		214				214	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		170				170	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	41		868	0.047	42	0.0	0.0	4.211	A
			2	1,2,3,4	212		868	0.244	211	0.2	0.3	5.473	A
	Exit	**1**	**1**		162				162	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	176		1298	0.136	175	0.1	0.1	3.064	A
			2	1,2,3	444		1298	0.342	445	0.4	0.5	4.040	A
	Exit	**1**	**1**		447				447	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	162		1457	0.111	161	0.0	0.2	2.774	A
		2	**1**	(1,2,3,4)	162	8.99			162	0.0	0.0	0.025	A
	Exit	**1**	**1**		257	8.99			257	0.0	0.0	0.037	A
		2	**1**		257				257	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		208				208	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	49		847	0.058	49	0.0	0.1	4.425	A
			2	1,2,3,4	271		847	0.319	272	0.3	0.4	5.810	A
	Exit	**1**	**1**		207				207	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	214		1275	0.168	212	0.1	0.2	3.215	A
			2	1,2,3	528		1275	0.414	528	0.5	0.6	4.310	A
	Exit	**1**	**1**		520				520	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	197		1391	0.141	197	0.2	0.2	3.057	A
		2	**1**	(1,2,3,4)	197	11.01			197	0.0	0.0	0.031	A
	Exit	**1**	**1**		323	11.01			323	0.0	0.0	0.041	A
		2	**1**		323				323	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		207				207	0.0	0.0	0.000	A
2	Entry	1	1	3	48		846	0.057	48	0.1	0.1	4.465	A
			2	1,2,3,4	256		846	0.303	258	0.4	0.3	5.894	A
	Exit	1	1		205				205	0.0	0.0	0.000	A
3	Entry	1	1	1,4	209		1280	0.163	208	0.2	0.1	3.118	A
			2	1,2,3	528		1280	0.412	527	0.6	0.7	4.473	A
	Exit	1	1		517				517	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	194		1390	0.140	193	0.2	0.2	2.978	A
		2	1	(1,2,3,4)	194	11.01			194	0.0	0.0	0.042	A
	Exit	1	1		306	11.01			306	0.0	0.0	0.037	A
		2	1		306				306	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		165				165	0.0	0.0	0.000	A
2	Entry	1	1	3	42		873	0.049	43	0.1	0.0	4.040	A
			2	1,2,3,4	215		873	0.247	215	0.3	0.3	5.285	A
	Exit	1	1		162				162	0.0	0.0	0.000	A
3	Entry	1	1	1,4	168		1295	0.130	168	0.1	0.1	3.072	A
			2	1,2,3	434		1295	0.335	433	0.7	0.5	4.017	A
	Exit	1	1		429				429	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	154		1466	0.105	154	0.2	0.1	2.762	A
		2	1	(1,2,3,4)	154	8.99			154	0.0	0.0	0.044	A
	Exit	1	1		257	8.99			257	0.0	0.0	0.026	A
		2	1		257				257	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		135				135	0.0	0.0	0.000	A
2	Entry	1	1	3	34		892	0.038	34	0.0	0.0	4.142	A
			2	1,2,3,4	180		892	0.202	178	0.3	0.3	4.820	A
	Exit	1	1		140				140	0.0	0.0	0.000	A
3	Entry	1	1	1,4	134		1309	0.102	133	0.1	0.2	2.971	A
			2	1,2,3	371		1309	0.283	370	0.5	0.4	3.833	A
	Exit	1	1		361				361	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	125		1515	0.082	125	0.1	0.1	2.616	A
		2	1	(1,2,3,4)	125	7.53			125	0.0	0.0	0.018	A
	Exit	1	1		204	7.53			204	0.0	0.0	0.027	A
		2	1		204				204	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.21	0.00	0.00	0.53	0.92
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.13	0.00	0.00	0.17	0.63
			2	0.39	0.00	0.00	0.80	0.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.04	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.32	0.00	0.00	0.77	1.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.14	0.00	0.00	1.00	1.00
			2	0.48	0.00	0.00	0.96	1.56
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.17	0.00	0.00	0.39	0.73
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.37	0.00	0.00	0.80	0.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.24	0.00	0.00	0.62	0.93
			2	0.63	0.00	0.00	1.54	1.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.17	0.00	0.00	0.33	0.75
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.07	0.00	0.00	0.00	1.00
			2	0.31	0.00	0.00	0.71	0.95
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.15	0.00	0.00	0.30	0.69
			2	0.65	0.00	0.00	1.39	1.90
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.25	0.00	0.00	0.61	0.89
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.28	0.00	0.00	0.76	1.33
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.12	0.00	0.00	1.00	1.00
			2	0.52	0.00	0.00	0.96	1.79
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	-0.01	0.62
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.33	0.00	0.00	0.80	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.18	0.00	0.00	0.41	0.83
			2	0.40	0.00	0.00	0.81	1.32
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.07	0.00	0.00	0.00	0.19
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2036 Base Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	6.68	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2036 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	452	100.000
3		ONE HOUR	✓	1053	100.000
4		ONE HOUR	✓	271	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	31	0	121	300
	3	243	201	471	138
	4	17	88	163	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	8.39	1.0	3.0	A	416	624
3	6.56	2.1	6.0	A	966	1449
4	4.28	0.4	1.4	A	248	373

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			213				
2	338	84	487		340	220	0.0	0.5	5.632	A
3	789	197	252		792	575	0.0	0.9	4.229	A
4	210	53	710	7.53	210	334	0.0	0.2	2.994	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			259				
2	408	102	576		410	257	0.5	0.6	6.641	A
3	950	238	305		948	683	0.9	1.6	5.019	A
4	240	60	854	8.99	240	399	0.2	0.2	3.501	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			323				
2	500	125	698		502	322	0.6	1.0	7.960	A
3	1163	291	366		1169	834	1.6	1.7	6.196	A
4	296	74	1047	11.01	296	488	0.2	0.4	4.060	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			314				
2	504	126	689		507	324	1.0	1.0	8.393	A
3	1148	287	377		1146	821	1.7	2.1	6.557	A
4	300	75	1030	11.01	300	493	0.4	0.4	4.283	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			263				
2	410	103	562		409	262	1.0	0.9	7.120	A
3	944	236	307		946	666	2.1	1.2	5.012	A
4	240	60	849	8.99	239	404	0.4	0.3	3.573	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			225				
2	335	84	492		333	211	0.9	0.6	5.883	A
3	802	201	244		804	581	1.2	0.8	4.329	A
4	204	51	723	7.53	204	325	0.3	0.2	3.219	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.46	0.00	0.00	0.88	1.29
3	0.91	0.00	0.16	1.85	2.56
4	0.16	0.00	0.00	0.30	0.75

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.64	0.00	0.00	1.41	1.82
3	1.56	0.00	0.74	3.43	4.17
4	0.19	0.00	0.00	0.48	0.81

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.01	0.00	0.08	2.40	3.00
3	1.74	0.00	0.69	3.89	5.00
4	0.36	0.00	0.00	0.78	1.00

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.01	0.00	0.09	2.44	3.00
3	2.12	0.00	0.81	5.18	6.00
4	0.36	0.00	0.00	0.86	1.40

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.92	0.00	0.02	2.08	2.83
3	1.16	0.00	0.29	2.55	3.50
4	0.31	0.00	0.00	0.72	0.95

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.57	0.00	0.00	1.37	1.84
3	0.79	0.00	0.00	2.00	2.75
4	0.16	0.00	0.00	0.30	0.75

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		213				213	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	56		832	0.067	56	0.0	0.1	4.313	A
			2	1,2,3,4	282		832	0.339	284	0.0	0.4	5.899	A
	Exit	**1**	**1**		220				220	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	219		1271	0.172	219	0.0	0.2	3.146	A
			2	1,2,3	570		1271	0.448	572	0.0	0.7	4.649	A
	Exit	**1**	**1**		575				575	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	210		1360	0.154	210	0.0	0.2	2.954	A
		2	**1**	(1,2,3,4)	210	7.53			210	0.0	0.0	0.040	A
	Exit	**1**	**1**		334	7.53			334	0.0	0.0	0.037	A
		2	**1**		334				334	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		259				259	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	72		803	0.090	73	0.1	0.1	4.650	A
			2	1,2,3,4	336		803	0.418	337	0.4	0.6	7.061	A
	Exit	**1**	**1**		257				257	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	272		1250	0.218	273	0.2	0.2	3.438	A
			2	1,2,3	678		1250	0.542	676	0.7	1.3	5.667	A
	Exit	**1**	**1**		683				683	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	240		1273	0.188	240	0.2	0.2	3.445	A
		2	**1**	(1,2,3,4)	240	8.99			240	0.0	0.0	0.056	A
	Exit	**1**	**1**		400	8.99			399	0.0	0.0	0.044	A
		2	**1**		399				399	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		323				323	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	98		763	0.128	100	0.1	0.1	4.967	A
			2	1,2,3,4	402		763	0.527	402	0.6	1.0	8.689	A
	Exit	**1**	**1**		322				322	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	354		1226	0.289	355	0.2	0.4	3.829	A
			2	1,2,3	809		1226	0.660	815	1.3	1.4	7.214	A
	Exit	**1**	**1**		834				834	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	296		1156	0.256	296	0.2	0.3	3.956	A
		2	**1**	(1,2,3,4)	296	11.01			296	0.0	0.0	0.104	A
	Exit	**1**	**1**		488	11.01			488	0.0	0.0	0.046	A
		2	**1**		488				488	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		314				314	0.0	0.0	0.000	A
2	Entry	1	1	3	95		766	0.124	95	0.1	0.1	5.205	A
			2	1,2,3,4	410		766	0.535	412	1.0	0.9	9.147	A
	Exit	1	1		324				324	0.0	0.0	0.000	A
3	Entry	1	1	1,4	346		1222	0.283	345	0.4	0.5	3.823	A
			2	1,2,3	802		1222	0.656	801	1.4	1.7	7.722	A
	Exit	1	1		821				821	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	300		1166	0.257	300	0.3	0.4	4.165	A
		2	1	(1,2,3,4)	300	11.01			300	0.0	0.0	0.118	A
	Exit	1	1		493	11.01			493	0.0	0.0	0.055	A
		2	1		493				493	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		263				263	0.0	0.0	0.000	A
2	Entry	1	1	3	72		808	0.090	72	0.1	0.1	4.842	A
			2	1,2,3,4	338		808	0.419	337	0.9	0.8	7.622	A
	Exit	1	1		262				262	0.0	0.0	0.000	A
3	Entry	1	1	1,4	274		1250	0.220	275	0.5	0.3	3.512	A
			2	1,2,3	670		1250	0.536	671	1.7	0.9	5.625	A
	Exit	1	1		666				666	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	240		1276	0.188	239	0.4	0.3	3.515	A
		2	1	(1,2,3,4)	240	8.99			240	0.0	0.0	0.059	A
	Exit	1	1		404	8.99			404	0.0	0.0	0.040	A
		2	1		404				404	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		225				225	0.0	0.0	0.000	A
2	Entry	1	1	3	59		831	0.071	59	0.1	0.1	4.547	A
			2	1,2,3,4	276		831	0.332	274	0.8	0.5	6.161	A
	Exit	1	1		211				211	0.0	0.0	0.000	A
3	Entry	1	1	1,4	228		1275	0.179	227	0.3	0.2	3.203	A
			2	1,2,3	575		1275	0.451	576	0.9	0.6	4.768	A
	Exit	1	1		581				581	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	204		1352	0.151	204	0.3	0.2	3.177	A
		2	1	(1,2,3,4)	204	7.53			204	0.0	0.0	0.042	A
	Exit	1	1		325	7.53			325	0.0	0.0	0.025	A
		2	1		325				325	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.41	0.00	0.00	0.85	1.29
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.21	0.00	0.00	0.50	0.78
			2	0.70	0.00	0.00	1.58	1.96
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.16	0.00	0.00	0.30	0.75
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.59	0.00	0.00	1.33	1.76
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.24	0.00	0.00	0.67	2.00
			2	1.31	0.00	0.44	3.20	3.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.19	0.00	0.00	0.46	0.81
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.96	0.00	0.00	2.33	2.93
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.35	0.00	0.00	0.85	1.36
			2	1.39	0.00	0.39	3.17	4.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.34	0.00	0.00	0.78	1.00
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.14	0.00	0.00	0.27	0.68
			2	0.86	0.00	0.00	1.96	2.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.46	0.00	0.00	1.13	1.69
			2	1.67	0.00	0.39	4.40	5.86
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.36	0.00	0.00	0.86	1.40
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.09	0.00	0.00	0.00	0.42
			2	0.83	0.00	0.00	1.96	2.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.27	0.00	0.00	0.63	0.87
			2	0.89	0.00	0.00	2.09	2.91
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.30	0.00	0.00	0.71	0.95
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.09	0.00	0.00	0.00	0.43
			2	0.48	0.00	0.00	1.07	1.71
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.22	0.00	0.00	0.56	0.92
			2	0.57	0.00	0.00	1.47	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.16	0.00	0.00	0.30	0.75
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Traffic with Dev, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Pedestrian Crossing	Arm 4 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.85	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D11	2021 Traffic with Dev	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D8+D10

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	376	100.000
3		ONE HOUR	✓	681	100.000
4		ONE HOUR	✓	275	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	20	0	77	279
	3	155	138	300	88
	4	11	158	104	2

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	6.54	0.7	2.7	A	344	516
3	4.53	1.1	3.2	A	625	938
4	3.32	0.3	1.5	A	251	377

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			144				
2	288	72	312		288	222	0.0	0.4	5.246	A
3	524	131	230		524	370	0.0	0.6	3.512	A
4	202	51	476	0.00	203	278	0.0	0.1	2.651	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			158				
2	340	85	363		341	262	0.4	0.6	5.819	A
3	606	151	274		603	430	0.6	0.9	3.771	A
4	246	62	538	0.00	245	339	0.1	0.2	2.979	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			207				
2	405	101	440		408	336	0.6	0.6	6.532	A
3	749	187	327		746	521	0.9	1.1	4.335	A
4	313	78	670	0.00	314	403	0.2	0.3	3.324	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			213				
2	423	106	446		421	314	0.6	0.7	6.539	A
3	751	188	337		753	530	1.1	0.8	4.527	A
4	297	74	677	0.00	297	413	0.3	0.3	3.259	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			170				
2	336	84	366		336	262	0.7	0.6	5.657	A
3	620	155	268		619	435	0.8	0.7	3.886	A
4	244	61	554	0.00	244	333	0.3	0.2	3.064	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			139				
2	272	68	295		273	220	0.6	0.4	5.178	A
3	502	126	214		502	354	0.7	0.5	3.592	A
4	206	52	449	0.00	205	267	0.2	0.2	2.759	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.44	0.00	0.00	0.96	1.49
3	0.60	0.00	0.00	1.61	2.33
4	0.15	0.00	0.00	0.19	0.70

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.60	0.00	0.00	1.18	2.24
3	0.85	0.00	0.02	1.86	2.74
4	0.21	0.00	0.00	0.53	0.86

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.59	0.00	0.00	1.38	1.77
3	1.07	0.00	0.20	2.41	3.24
4	0.26	0.00	0.00	0.63	0.86

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.73	0.00	0.00	1.90	2.66
3	0.84	0.00	0.00	2.13	2.85
4	0.33	0.00	0.00	0.86	1.49

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.62	0.00	0.00	1.18	2.24
3	0.70	0.00	0.00	1.56	1.93
4	0.17	0.00	0.00	0.39	0.73

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.36	0.00	0.00	0.80	1.24
3	0.50	0.00	0.00	0.99	1.62
4	0.19	0.00	0.00	0.45	0.90

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		144				144	0.0	0.0	0.000	A
2	Entry	1	1	3	38		890	0.042	37	0.0	0.1	4.183	A
			2	1,2,3,4	250		890	0.282	251	0.0	0.4	5.399	A
	Exit	1	1		222				222	0.0	0.0	0.000	A
3	Entry	1	1	1,4	134		1280	0.105	135	0.0	0.1	2.971	A
			2	1,2,3	390		1280	0.305	389	0.0	0.5	3.709	A
	Exit	1	1		370				370	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	202		1502	0.135	203	0.0	0.1	2.644	A
		2	1	(1,2,3,4)	202	0.00			202	0.0	0.0	0.007	A
	Exit	1	1		278	0.00			278	0.0	0.0	0.000	A
		2	1		278				278	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		158				158	0.0	0.0	0.000	A
2	Entry	1	1	3	44		873	0.051	44	0.1	0.0	4.313	A
			2	1,2,3,4	296		873	0.339	296	0.4	0.6	6.054	A
	Exit	1	1		262				262	0.0	0.0	0.000	A
3	Entry	1	1	1,4	163		1263	0.129	163	0.1	0.1	3.083	A
			2	1,2,3	443		1263	0.351	441	0.5	0.7	4.025	A
	Exit	1	1		430				430	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	246		1465	0.168	245	0.1	0.2	2.967	A
		2	1	(1,2,3,4)	246	0.00			246	0.0	0.0	0.012	A
	Exit	1	1		339	0.00			339	0.0	0.0	0.000	A
		2	1		339				339	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		207				207	0.0	0.0	0.000	A
2	Entry	1	1	3	56		848	0.066	55	0.0	0.1	4.404	A
			2	1,2,3,4	349		848	0.412	353	0.6	0.5	6.876	A
	Exit	1	1		336				336	0.0	0.0	0.000	A
3	Entry	1	1	1,4	212		1242	0.170	211	0.1	0.2	3.321	A
			2	1,2,3	537		1242	0.433	534	0.7	0.9	4.727	A
	Exit	1	1		521				521	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	313		1385	0.226	314	0.2	0.3	3.285	A
		2	1	(1,2,3,4)	313	0.00			313	0.0	0.0	0.039	A
	Exit	1	1		403	0.00			403	0.0	0.0	0.000	A
		2	1		403				403	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		213				213	0.0	0.0	0.000	A
2	Entry	1	1	3	59		846	0.070	59	0.1	0.0	4.201	A
			2	1,2,3,4	364		846	0.430	362	0.5	0.7	6.918	A
	Exit	1	1		314				314	0.0	0.0	0.000	A
3	Entry	1	1	1,4	210		1237	0.169	211	0.2	0.2	3.398	A
			2	1,2,3	541		1237	0.437	542	0.9	0.7	4.957	A
	Exit	1	1		530				530	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	297		1381	0.215	297	0.3	0.3	3.237	A
		2	1	(1,2,3,4)	297	0.00			297	0.0	0.0	0.021	A
	Exit	1	1		413	0.00			413	0.0	0.0	0.000	A
		2	1		413				413	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		170				170	0.0	0.0	0.000	A
2	Entry	1	1	3	44		872	0.051	44	0.0	0.1	3.922	A
			2	1,2,3,4	291		872	0.334	292	0.7	0.5	5.916	A
	Exit	1	1		262				262	0.0	0.0	0.000	A
3	Entry	1	1	1,4	173		1265	0.136	172	0.2	0.2	3.042	A
			2	1,2,3	447		1265	0.353	447	0.7	0.5	4.201	A
	Exit	1	1		435				435	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	244		1455	0.168	244	0.3	0.2	3.048	A
		2	1	(1,2,3,4)	244	0.00			244	0.0	0.0	0.016	A
	Exit	1	1		333	0.00			333	0.0	0.0	0.000	A
		2	1		333				333	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		139				139	0.0	0.0	0.000	A
2	Entry	1	1	3	35		895	0.039	34	0.1	0.1	3.965	A
			2	1,2,3,4	238		895	0.266	239	0.5	0.3	5.358	A
	Exit	1	1		220				220	0.0	0.0	0.000	A
3	Entry	1	1	1,4	140		1287	0.109	140	0.2	0.1	3.057	A
			2	1,2,3	362		1287	0.281	362	0.5	0.4	3.791	A
	Exit	1	1		354				354	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	206		1519	0.136	205	0.2	0.2	2.754	A
		2	1	(1,2,3,4)	206	0.00			206	0.0	0.0	0.005	A
	Exit	1	1		267	0.00			267	0.0	0.0	0.000	A
		2	1		267				267	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.38	0.00	0.00	0.87	1.33
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.08	0.00	0.00	0.00	0.24
			2	0.52	0.00	0.00	1.15	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.15	0.00	0.00	0.19	0.70
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.55	0.00	0.00	0.98	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.13	0.00	0.00	1.00	1.00
			2	0.72	0.00	0.00	1.78	2.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.21	0.00	0.00	0.53	0.86
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.11	0.00	0.00	1.00	1.00
			2	0.49	0.00	0.00	1.10	1.66
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.20	0.00	0.00	1.00	1.00
			2	0.87	0.00	0.00	1.93	2.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.26	0.00	0.00	0.63	0.86
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.68	0.00	0.00	1.81	2.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.17	0.00	0.00	0.33	0.75
			2	0.67	0.00	0.00	1.38	2.65
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.33	0.00	0.00	0.86	1.49
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.08	0.00	0.00	0.00	1.00
			2	0.54	0.00	0.00	0.96	1.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.18	0.00	0.00	0.43	0.75
			2	0.52	0.00	0.00	1.17	1.63
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.17	0.00	0.00	0.39	0.73
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.09	0.00	0.00	0.00	1.00
			2	0.27	0.00	0.00	0.64	0.98
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.11	0.00	0.00	-0.01	0.55
			2	0.39	0.00	0.00	0.84	1.19
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.19	0.00	0.00	0.45	0.90
		2	**1**	0.00	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

2036 Traffic with Dev, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Pedestrian Crossing	Arm 4 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	7.81	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D12	2036 Traffic with Dev	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D10+D9

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	540	100.000
3		ONE HOUR	✓	1063	100.000
4		ONE HOUR	✓	373	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	31	0	121	388
	3	243	211	471	138
	4	17	190	163	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	11.05	1.9	5.6	B	494	741
3	7.20	2.5	7.4	A	975	1462
4	4.87	0.6	1.9	A	343	514

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			221				
2	402	101	478		404	308	0.0	0.7	6.352	A
3	798	199	317		797	565	0.0	1.0	4.403	A
4	289	72	719	0.00	288	395	0.0	0.3	3.198	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			259				
2	484	121	571		483	359	0.7	1.2	7.815	A
3	952	238	377		952	677	1.0	1.4	5.351	A
4	332	83	856	0.00	332	472	0.3	0.4	3.783	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			326				
2	599	150	698		600	444	1.2	1.7	10.319	B
3	1174	294	467		1171	831	1.4	2.5	7.201	A
4	414	103	1054	0.00	415	584	0.4	0.5	4.782	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			316				
2	592	148	710		591	437	1.7	1.9	11.050	B
3	1167	292	462		1169	839	2.5	2.3	7.105	A
4	409	102	1054	0.00	409	578	0.5	0.6	4.867	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			261				
2	482	121	572		483	356	1.9	1.1	8.251	A
3	953	238	375		953	679	2.3	1.4	5.435	A
4	333	83	855	0.00	334	473	0.6	0.3	3.999	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			225				
2	405	101	477		405	299	1.1	0.7	6.769	A
3	804	201	313		803	569	1.4	1.0	4.604	A
4	279	70	722	0.00	279	395	0.3	0.3	3.341	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.66	0.00	0.00	1.64	2.34
3	1.05	0.00	0.22	2.29	3.38
4	0.33	0.00	0.00	0.80	1.24

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.15	0.00	0.17	2.86	3.69
3	1.39	0.00	0.56	2.83	3.97
4	0.38	0.00	0.00	0.83	1.40

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.68	0.00	0.56	4.15	5.58
3	2.53	0.00	1.29	5.52	7.40
4	0.52	0.00	0.00	0.98	1.77

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.88	0.00	0.87	3.97	5.40
3	2.35	0.00	1.36	4.70	6.48
4	0.58	0.00	0.00	1.33	1.86

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.06	0.00	0.08	2.54	4.10
3	1.38	0.00	0.53	2.85	3.90
4	0.33	0.00	0.00	0.78	1.23

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.74	0.00	0.00	1.78	2.43
3	1.03	0.00	0.20	2.28	3.10
4	0.25	0.00	0.00	0.64	0.97

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		221				221	0.0	0.0	0.000	A
2	Entry	1	1	3	61		835	0.073	61	0.0	0.1	4.336	A
			2	1,2,3,4	342		835	0.409	343	0.0	0.6	6.708	A
	Exit	1	1		308				308	0.0	0.0	0.000	A
3	Entry	1	1	1,4	223		1246	0.179	223	0.0	0.2	3.222	A
			2	1,2,3	575		1246	0.462	574	0.0	0.8	4.859	A
	Exit	1	1		565				565	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	289		1355	0.213	288	0.0	0.3	3.171	A
		2	1	(1,2,3,4)	289	0.00			289	0.0	0.0	0.026	A
	Exit	1	1		395	0.00			395	0.0	0.0	0.000	A
		2	1		395				395	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		259				259	0.0	0.0	0.000	A
2	Entry	1	1	3	78		805	0.097	78	0.1	0.1	4.775	A
			2	1,2,3,4	406		805	0.504	405	0.6	1.0	8.399	A
	Exit	1	1		359				359	0.0	0.0	0.000	A
3	Entry	1	1	1,4	277		1222	0.227	276	0.2	0.3	3.507	A
			2	1,2,3	675		1222	0.552	675	0.8	1.1	6.102	A
	Exit	1	1		677				677	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	332		1272	0.261	332	0.3	0.4	3.718	A
		2	1	(1,2,3,4)	332	0.00			332	0.0	0.0	0.063	A
	Exit	1	1		472	0.00			472	0.0	0.0	0.000	A
		2	1		472				472	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		326				326	0.0	0.0	0.000	A
2	Entry	1	1	3	106		763	0.139	106	0.1	0.2	5.235	A
			2	1,2,3,4	494		763	0.647	495	1.0	1.5	11.386	B
	Exit	1	1		444				444	0.0	0.0	0.000	A
3	Entry	1	1	1,4	358		1186	0.302	358	0.3	0.4	4.073	A
			2	1,2,3	816		1186	0.688	812	1.1	2.1	8.557	A
	Exit	1	1		831				831	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	414		1152	0.359	415	0.4	0.5	4.577	A
		2	1	(1,2,3,4)	414	0.00			414	0.0	0.0	0.206	A
	Exit	1	1		584	0.00			584	0.0	0.0	0.000	A
		2	1		584				584	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		316				316	0.0	0.0	0.000	A
2	Entry	1	1	3	103		759	0.135	103	0.2	0.2	5.149	A
			2	1,2,3,4	489		759	0.644	489	1.5	1.7	12.311	B
	Exit	1	1		437				437	0.0	0.0	0.000	A
3	Entry	1	1	1,4	351		1188	0.296	351	0.4	0.4	3.999	A
			2	1,2,3	816		1188	0.687	819	2.1	1.9	8.429	A
	Exit	1	1		839				839	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	409		1152	0.355	409	0.5	0.5	4.648	A
		2	1	(1,2,3,4)	409	0.00			409	0.0	0.0	0.217	A
	Exit	1	1		578	0.00			578	0.0	0.0	0.000	A
		2	1		578				578	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		261				261	0.0	0.0	0.000	A
2	Entry	1	1	3	79		804	0.098	78	0.2	0.1	4.868	A
			2	1,2,3,4	404		804	0.502	404	1.7	1.0	8.905	A
	Exit	1	1		356				356	0.0	0.0	0.000	A
3	Entry	1	1	1,4	275		1222	0.225	275	0.4	0.3	3.634	A
			2	1,2,3	678		1222	0.554	678	1.9	1.1	6.175	A
	Exit	1	1		679				679	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	333		1272	0.262	334	0.5	0.3	3.913	A
		2	1	(1,2,3,4)	333	0.00			333	0.0	0.0	0.089	A
	Exit	1	1		473	0.00			473	0.0	0.0	0.000	A
		2	1		473				473	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		225				225	0.0	0.0	0.000	A
2	Entry	1	1	3	65		835	0.077	64	0.1	0.1	4.559	A
			2	1,2,3,4	340		835	0.407	341	1.0	0.7	7.174	A
	Exit	1	1		299				299	0.0	0.0	0.000	A
3	Entry	1	1	1,4	227		1247	0.182	227	0.3	0.2	3.350	A
			2	1,2,3	577		1247	0.463	577	1.1	0.8	5.098	A
	Exit	1	1		569				569	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	279		1353	0.206	279	0.3	0.3	3.317	A
		2	1	(1,2,3,4)	279	0.00			279	0.0	0.0	0.024	A
	Exit	1	1		395	0.00			395	0.0	0.0	0.000	A
		2	1		395				395	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.60	0.00	0.00	1.48	2.15
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.20	0.00	0.00	0.49	0.82
			2	0.85	0.00	0.00	1.87	3.10
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.32	0.00	0.00	0.80	1.24
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.12	0.00	0.00	0.14	0.58
			2	1.03	0.00	0.00	2.63	3.60
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.30	0.00	0.00	0.78	1.28
			2	1.10	0.00	0.28	2.17	3.28
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.36	0.00	0.00	0.83	1.40
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.18	0.00	0.00	0.45	0.77
			2	1.50	0.00	0.38	3.90	5.48
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.40	0.00	0.00	0.90	1.46
			2	2.13	0.00	0.90	4.63	6.63
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.50	0.00	0.00	0.98	1.77
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.15	0.00	0.00	0.32	0.71
			2	1.73	0.00	0.74	3.64	4.88
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.42	0.00	0.00	0.90	1.56
			2	1.93	0.00	1.00	4.04	5.20
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.55	0.00	0.00	1.33	1.86
		2	1	0.04	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.10	0.00	0.00	0.00	0.49
			2	0.96	0.00	0.00	2.35	3.76
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.30	0.00	0.00	0.71	0.98
			2	1.08	0.00	0.19	2.46	3.35
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.33	0.00	0.00	0.78	1.23
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.07	0.00	0.00	0.00	1.00
			2	0.67	0.00	0.00	1.63	2.27
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.23	0.00	0.00	0.57	0.85
			2	0.80	0.00	0.00	1.86	2.77
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.25	0.00	0.00	0.64	0.97
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2018 Base Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	4.41	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D13	2018 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	762	100.000
3		ONE HOUR	✓	503	100.000
4		ONE HOUR	✓	162	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	**2**	**3**	**4**
From	**1**	Exit-only	Exit-only	Exit-only	Exit-only
	2	15	5	664	78
	3	62	304	56	81
	4	5	49	105	3

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	5.22	1.2	3.5	A	705	1057
3	3.71	0.6	2.0	A	458	687
4	2.81	0.1	1.0	A	151	227

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			62				
2	570	143	117		571	272	0.0	0.8	4.386	A
3	373	93	76		374	612	0.0	0.3	3.147	A
4	119	30	333	7.53	119	118	0.0	0.1	2.521	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			75				
2	685	171	147		686	323	0.8	0.9	4.707	A
3	450	112	93		449	740	0.3	0.4	3.300	A
4	145	36	399	8.99	146	143	0.1	0.1	2.599	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			93				
2	845	211	185		847	395	0.9	1.1	5.172	A
3	562	140	114		559	919	0.4	0.6	3.713	A
4	186	47	487	11.01	187	186	0.1	0.1	2.806	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			88				
2	862	215	190		863	384	1.1	1.2	5.216	A
3	536	134	110		536	943	0.6	0.4	3.575	A
4	191	48	471	11.01	191	176	0.1	0.1	2.782	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			73				
2	690	172	145		689	318	1.2	0.9	4.795	A
3	454	114	90		453	744	0.4	0.4	3.399	A
4	145	36	391	8.99	144	152	0.1	0.1	2.662	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			61				
2	576	144	122		577	262	0.9	0.6	4.445	A
3	373	93	77		373	623	0.4	0.4	3.242	A
4	122	30	325	7.53	121	125	0.1	0.1	2.379	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.80	0.00	0.04	1.66	2.32
3	0.28	0.00	0.00	0.70	0.99
4	0.07	0.00	0.00	0.00	1.00

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.86	0.00	0.05	1.85	2.74
3	0.42	0.00	0.00	0.89	1.33
4	0.12	0.00	0.00	-0.01	0.55

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.10	0.00	0.43	2.19	2.70
3	0.62	0.00	0.00	1.49	1.98
4	0.14	0.00	0.00	0.19	0.70

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.16	0.00	0.25	2.41	3.48
3	0.45	0.00	0.00	0.92	1.59
4	0.12	0.00	0.00	1.00	1.00

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.85	0.00	0.20	1.66	1.98
3	0.45	0.00	0.00	0.89	1.39
4	0.14	0.00	0.00	0.24	0.66

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.63	0.00	0.00	1.41	2.24
3	0.38	0.00	0.00	0.87	2.00
4	0.12	0.00	0.00	-0.01	0.62

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		62				62	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	259		954	0.272	259	0.0	0.3	4.248	A
			2	1,2,3,4	311		954	0.326	312	0.0	0.5	4.502	A
	Exit	**1**	**1**		272				272	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	84		1341	0.062	84	0.0	0.1	2.782	A
			2	1,2,3	289		1341	0.216	290	0.0	0.2	3.254	A
	Exit	**1**	**1**		612				612	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	119		1589	0.075	119	0.0	0.1	2.494	A
		2	**1**	(1,2,3,4)	119	7.53			119	0.0	0.0	0.027	A
	Exit	**1**	**1**		118	7.53			118	0.0	0.0	0.020	A
		2	**1**		118				118	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		75				75	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	313		944	0.332	314	0.3	0.4	4.610	A
			2	1,2,3,4	371		944	0.393	372	0.5	0.5	4.790	A
	Exit	**1**	**1**		323				323	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	103		1335	0.077	103	0.1	0.1	2.807	A
			2	1,2,3	347		1335	0.260	346	0.2	0.3	3.450	A
	Exit	**1**	**1**		740				740	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	145		1549	0.094	146	0.1	0.1	2.578	A
		2	**1**	(1,2,3,4)	145	8.99			145	0.0	0.0	0.021	A
	Exit	**1**	**1**		143	8.99			143	0.0	0.0	0.021	A
		2	**1**		143				143	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		93				93	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	394		931	0.423	393	0.4	0.5	4.962	A
			2	1,2,3,4	451		931	0.485	454	0.5	0.6	5.359	A
	Exit	**1**	**1**		395				395	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	138		1327	0.104	138	0.1	0.1	2.903	A
			2	1,2,3	424		1327	0.320	421	0.3	0.6	3.967	A
	Exit	**1**	**1**		919				919	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	186		1496	0.125	187	0.1	0.1	2.770	A
		2	**1**	(1,2,3,4)	186	11.01			186	0.0	0.0	0.035	A
	Exit	**1**	**1**		186	11.01			186	0.0	0.0	0.044	A
		2	**1**		186				186	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		88				88	0.0	0.0	0.000	A
2	Entry	1	1	3	410		930	0.441	411	0.5	0.5	4.981	A
			2	1,2,3,4	451		930	0.486	452	0.6	0.6	5.427	A
	Exit	1	1		384				384	0.0	0.0	0.000	A
3	Entry	1	1	1,4	126		1328	0.095	126	0.1	0.1	2.964	A
			2	1,2,3	410		1328	0.309	410	0.6	0.4	3.767	A
	Exit	1	1		943				943	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	191		1505	0.127	191	0.1	0.1	2.757	A
		2	1	(1,2,3,4)	191	11.01			191	0.0	0.0	0.025	A
	Exit	1	1		176	11.01			176	0.0	0.0	0.034	A
		2	1		176				176	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		73				73	0.0	0.0	0.000	A
2	Entry	1	1	3	316		944	0.335	316	0.5	0.4	4.680	A
			2	1,2,3,4	373		944	0.395	373	0.6	0.4	4.894	A
	Exit	1	1		318				318	0.0	0.0	0.000	A
3	Entry	1	1	1,4	110		1336	0.082	110	0.1	0.0	2.873	A
			2	1,2,3	344		1336	0.258	343	0.4	0.4	3.558	A
	Exit	1	1		744				744	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	145		1554	0.093	144	0.1	0.1	2.638	A
		2	1	(1,2,3,4)	145	8.99			145	0.0	0.0	0.024	A
	Exit	1	1		152	8.99			152	0.0	0.0	0.030	A
		2	1		152				152	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		61				61	0.0	0.0	0.000	A
2	Entry	1	1	3	265		952	0.278	266	0.4	0.3	4.347	A
			2	1,2,3,4	311		952	0.327	312	0.4	0.4	4.530	A
	Exit	1	1		262				262	0.0	0.0	0.000	A
3	Entry	1	1	1,4	87		1341	0.065	87	0.0	0.0	2.835	A
			2	1,2,3	286		1341	0.213	285	0.4	0.3	3.364	A
	Exit	1	1		623				623	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	121		1594	0.076	121	0.1	0.1	2.356	A
		2	1	(1,2,3,4)	122	7.53			121	0.0	0.0	0.023	A
	Exit	1	1		125	7.53			125	0.0	0.0	0.022	A
		2	1		125				125	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.32	0.00	0.00	0.73	0.95
			2	0.49	0.00	0.00	0.84	0.97
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.06	0.00	0.00	0.00	1.00
			2	0.22	0.00	0.00	0.56	0.87
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.07	0.00	0.00	0.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.39	0.00	0.00	0.95	2.00
			2	0.48	0.00	0.00	0.93	1.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.09	0.00	0.00	0.00	1.00
			2	0.33	0.00	0.00	0.77	0.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	-0.01	0.55
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.53	0.00	0.00	0.97	1.49
			2	0.56	0.00	0.00	0.97	1.49
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.06	0.00	0.00	0.00	-0.01
			2	0.56	0.00	0.00	1.39	1.90
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.19	0.70
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.51	0.00	0.00	0.96	1.79
			2	0.64	0.00	0.00	1.29	1.80
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.09	0.00	0.00	0.00	1.00
			2	0.36	0.00	0.00	0.85	1.39
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	1.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.41	0.00	0.00	0.85	1.19
			2	0.45	0.00	0.00	0.90	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.40	0.00	0.00	0.88	1.33
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.14	0.00	0.00	0.24	0.66
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.28	0.00	0.00	0.70	0.95
			2	0.36	0.00	0.00	0.80	0.99
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.04	0.00	0.00	0.00	0.00
			2	0.34	0.00	0.00	0.85	2.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.11	0.00	0.00	0.00	0.56
		2	**1**	0.01	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

2018 Base Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	Promenade Road Roundabout	Standard Roundabout	1,2,3,4	5.80	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D14	2018 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1					
2		ONE HOUR	✓	895	100.000
3		ONE HOUR	✓	611	100.000
4		ONE HOUR	✓	157	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3		
4	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	18	0	703	174
	3	24	234	273	80
	4	10	51	94	2

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	Exit-only	Exit-only	Exit-only	Exit-only
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1						
2	7.08	1.7	4.6	A	819	1228
3	4.68	0.9	2.7	A	566	849
4	2.94	0.2	1.0	A	145	217

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			44				
2	691	173	283		691	224	0.0	0.9	4.959	A
3	485	121	147		483	827	0.0	0.6	3.653	A
4	118	29	433	7.53	119	198	0.0	0.1	2.545	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			48				
2	799	200	332		800	256	0.9	1.2	5.669	A
3	546	137	170		547	962	0.6	0.5	3.960	A
4	149	37	488	8.99	149	228	0.1	0.1	2.733	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			55				
2	973	243	404		979	319	1.2	1.7	7.047	A
3	674	169	216		675	1167	0.5	0.9	4.672	A
4	171	43	606	11.01	172	285	0.1	0.1	2.814	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			54				
2	981	245	404		985	306	1.7	1.7	7.076	A
3	659	165	220		662	1170	0.9	0.8	4.680	A
4	169	42	596	11.01	169	286	0.1	0.2	2.940	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			49				
2	795	199	340		794	261	1.7	1.2	5.785	A
3	570	143	174		567	962	0.8	0.8	4.176	A
4	145	36	507	8.99	145	234	0.2	0.2	2.684	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1			0			38				
2	674	169	271		676	224	1.2	1.0	5.075	A
3	462	115	147		464	801	0.8	0.5	3.736	A
4	117	29	416	7.53	117	194	0.2	0.1	2.560	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.92	0.00	0.22	1.78	1.98
3	0.56	0.00	0.00	1.27	1.98
4	0.11	0.00	0.00	-0.01	0.55

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.25	0.00	0.37	2.76	3.65
3	0.51	0.00	0.00	1.49	1.91
4	0.08	0.00	0.00	0.00	1.00

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.66	0.00	0.74	3.78	4.56
3	0.88	0.00	0.16	1.74	2.48
4	0.12	0.00	0.00	-0.01	0.62

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.71	0.00	0.73	3.56	4.49
3	0.84	0.00	0.00	2.11	2.74
4	0.19	0.00	0.00	1.00	1.00

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	1.25	0.00	0.47	2.69	3.39
3	0.78	0.00	0.00	1.82	2.49
4	0.17	0.00	0.00	0.29	0.80

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1					
2	0.96	0.00	0.29	1.83	2.65
3	0.47	0.00	0.00	0.93	1.49
4	0.09	0.00	0.00	0.00	1.00

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		44				44	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	307		899	0.342	308	0.0	0.3	4.723	A
			2	1,2,3,4	383		899	0.426	383	0.0	0.6	5.142	A
	Exit	**1**	**1**		224				224	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	77		1313	0.059	77	0.0	0.1	2.933	A
			2	1,2,3	408		1313	0.310	406	0.0	0.5	3.782	A
	Exit	**1**	**1**		827				827	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	118		1528	0.077	119	0.0	0.1	2.518	A
		2	**1**	(1,2,3,4)	118	7.53			118	0.0	0.0	0.027	A
	Exit	**1**	**1**		198	7.53			198	0.0	0.0	0.041	A
		2	**1**		198				198	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		48				48	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	357		883	0.404	357	0.3	0.5	5.299	A
			2	1,2,3,4	442		883	0.501	443	0.6	0.7	5.966	A
	Exit	**1**	**1**		256				256	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	88		1304	0.068	88	0.1	0.0	2.852	A
			2	1,2,3	458		1304	0.351	459	0.5	0.5	4.175	A
	Exit	**1**	**1**		962				962	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	149		1495	0.100	149	0.1	0.1	2.708	A
		2	**1**	(1,2,3,4)	149	8.99			149	0.0	0.0	0.026	A
	Exit	**1**	**1**		229	8.99			228	0.0	0.0	0.027	A
		2	**1**		228				228	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Exit**	**1**	**1**		55				55	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	447		859	0.520	450	0.5	0.7	6.521	A
			2	1,2,3,4	526		859	0.612	529	0.7	0.9	7.490	A
	Exit	**1**	**1**		319				319	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1,4	106		1286	0.082	106	0.0	0.0	2.959	A
			2	1,2,3	569		1286	0.442	570	0.5	0.8	4.990	A
	Exit	**1**	**1**		1167				1167	0.0	0.0	0.000	A
4	**Entry**	**1**	**1**	1,2,3,4	171		1423	0.120	172	0.1	0.1	2.784	A
		2	**1**	(1,2,3,4)	171	11.01			171	0.0	0.0	0.030	A
	Exit	**1**	**1**		285	11.01			285	0.0	0.0	0.031	A
		2	**1**		285				285	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		54				54	0.0	0.0	0.000	A
2	Entry	1	1	3	443		860	0.515	444	0.7	0.7	6.569	A
			2	1,2,3,4	538		860	0.626	541	0.9	1.0	7.500	A
	Exit	1	1		306				306	0.0	0.0	0.000	A
3	Entry	1	1	1,4	100		1284	0.078	101	0.0	0.1	3.121	A
			2	1,2,3	559		1284	0.435	561	0.8	0.8	4.961	A
	Exit	1	1		1170				1170	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	169		1430	0.118	169	0.1	0.2	2.899	A
		2	1	(1,2,3,4)	169	11.01			169	0.0	0.0	0.041	A
	Exit	1	1		286	11.01			286	0.0	0.0	0.037	A
		2	1		286				286	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		49				49	0.0	0.0	0.000	A
2	Entry	1	1	3	352		880	0.399	351	0.7	0.5	5.458	A
			2	1,2,3,4	444		880	0.504	443	1.0	0.8	6.046	A
	Exit	1	1		261				261	0.0	0.0	0.000	A
3	Entry	1	1	1,4	92		1303	0.070	91	0.1	0.1	2.915	A
			2	1,2,3	479		1303	0.367	475	0.8	0.7	4.407	A
	Exit	1	1		962				962	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	145		1484	0.098	145	0.2	0.2	2.662	A
		2	1	(1,2,3,4)	145	8.99			145	0.0	0.0	0.022	A
	Exit	1	1		234	8.99			234	0.0	0.0	0.024	A
		2	1		234				234	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Exit	1	1		38				38	0.0	0.0	0.000	A
2	Entry	1	1	3	297		903	0.328	297	0.5	0.4	4.784	A
			2	1,2,3,4	377		903	0.418	379	0.8	0.6	5.303	A
	Exit	1	1		224				224	0.0	0.0	0.000	A
3	Entry	1	1	1,4	70		1313	0.053	71	0.1	0.1	2.925	A
			2	1,2,3	392		1313	0.298	394	0.7	0.4	3.884	A
	Exit	1	1		801				801	0.0	0.0	0.000	A
4	Entry	1	1	1,2,3,4	117		1538	0.076	117	0.2	0.1	2.533	A
		2	1	(1,2,3,4)	117	7.53			117	0.0	0.0	0.027	A
	Exit	1	1		194	7.53			194	0.0	0.0	0.027	A
		2	1		194				194	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.34	0.00	0.00	0.73	0.90
			2	0.58	0.00	0.00	1.19	1.70
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.11	0.00	0.00	0.00	0.56
			2	0.46	0.00	0.00	0.95	1.56
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.11	0.00	0.00	-0.01	0.55
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.54	0.00	0.00	1.19	1.70
			2	0.70	0.00	0.00	1.56	1.87
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.48	0.00	0.00	1.39	1.90
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.08	0.00	0.00	0.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.72	0.00	0.00	1.70	2.42
			2	0.94	0.00	0.14	1.99	2.62
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.83	0.00	0.05	1.73	2.48
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.12	0.00	0.00	-0.01	0.62
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.72	0.00	0.00	1.59	1.93
			2	0.99	0.00	0.27	1.78	2.48
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.08	0.00	0.00	0.00	0.33
			2	0.76	0.00	0.00	1.99	2.71
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.19	0.00	0.00	1.00	1.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.50	0.00	0.00	2.00	2.00
			2	0.75	0.00	0.04	1.58	1.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.09	0.00	0.00	0.00	0.42
			2	0.69	0.00	0.00	1.68	1.98
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
4	Entry	1	1	0.16	0.00	0.00	0.21	0.77
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Exit**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.40	0.00	0.00	0.81	0.97
			2	0.56	0.00	0.00	1.09	1.60
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.06	0.00	0.00	0.00	1.00
			2	0.41	0.00	0.00	0.88	1.39
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
4	**Entry**	**1**	**1**	0.08	0.00	0.00	0.00	1.00
		2	**1**	0.01	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.0.1.4646 []

For sales and distribution information, program advice and maintenance, contact TRL:
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Filename: 119271 J17 Dublin Port 2020 04 27 ff.j9
Path: I:\CST\119\251-300\119271\calcs\ARCADY
Report generation date: 4/28/2020 9:58:57 AM

»2021 Base Traffic, AM
»2021 Reassigned Traffic, AM
»2036 Base Traffic, AM
»2021 With Dev Traffic, AM
»2036 With Dev Traffic, AM
»2021 Base Traffic, PM
»2021 Reassigned Traffic, PM
»2036 Base Traffic, PM
»2021 With Dev Traffic, PM
»2036 With Dev Traffic, PM

Summary of junction performance

	Queue (PCU)	**95% Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**	**Network Residual Capacity**	**Queue (PCU)**	**95% Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**	**Network Residual Capacity**
Arm 1	4.7	14.4	20.10		C	% [ ]	7.5	23.0	27.34		D	% [ ]
Arm 2	0.0	~1	0.00		A		0.0	~1	0.00		A	
Arm 3	0.5	1.6	4.28		A		0.4	2.0	3.95		A	
Arm 1	1.0	3.0	5.00		A	% [ ]	1.5	3.5	4.98		A	% [ ]
Arm 2	0.0	~1	0.00		A		0.0	~1	0.00		A	
Arm 3	0.5	1.7	4.24		A		0.4	1.6	3.85		A	
Arm 1	3.8	11.8	9.83		A	% [ ]	4.5	14.1	10.64		B	% [ ]
Arm 2	0.0	~1	0.00		A		0.0	~1	0.00		A	
Arm 3	1.2	3.7	5.99		A		0.8	2.8	4.99		A	
Arm 1	2.2	6.3	8.29		A	% [ ]	1.9	5.0	6.36		A	% [ ]
Arm 2	0.0	~1	0.00		A		0.0	~1	0.00		A	
Arm 3	1.0	3.2	5.36		A		0.6	3.0	4.26		A	
Arm 1	7.5	19.2	17.72		C	% [ ]	8.7	24.5	17.76		C	% [ ]
Arm 2	0.0	~1	0.00		A		0.0	~1	0.00		A	
Arm 3	1.9	6.3	8.40		A		1.1	3.9	5.64		A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Arm and junction delays are averages for all movements, including movements with zero delay. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	119271 J17 Dublin Port
Location	
Site number	J17
Date	4/8/2020
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	119271
Enumerator	S Sheehy
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

Lane Simulation options

Stop criteria (%)	Stop criteria time (s)	Stop criteria number of trials	Random seed	Results refresh speed (s)	Individual vehicle animation number of trials	Use crossings quick response	Last run random seed	Last run number of trials	Last run time taken (s)
1.00	100000	100000	-1	3	1	✓	2107651874	417	18.02

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically	Relationship type	Relationship
D1	2021 Base Traffic	AM	ONE HOUR	05:30	07:00		15	✓		
D2	2021 Reassigned Traffic	AM	ONE HOUR	05:30	07:00		15	✓		
D3	2036 Base Traffic	AM	ONE HOUR	05:30	07:00		15	✓		
D4	2021 With Dev Traffic	AM	ONE HOUR	05:30	07:00		15	✓	Simple	D2+D6
D5	2036 With Dev Traffic	AM	ONE HOUR	05:30	07:00		15	✓	Simple	D3+D6
D6	Dev Traffic	AM	DIRECT	05:30	07:00	90	15			
D7	2021 Base Traffic	PM	ONE HOUR	16:45	18:15		15	✓		
D8	2021 Reassigned Traffic	PM	ONE HOUR	16:45	18:15		15	✓		
D9	2036 Base Traffic	PM	ONE HOUR	16:45	18:15		15	✓		
D10	2021 With Dev Traffic	PM	ONE HOUR	16:45	18:15		15	✓	Simple	D12+D8
D11	2036 With Dev Traffic	PM	ONE HOUR	16:45	18:15		15	✓	Simple	D12+D9
D12	Dev Traffic	PM	ONE HOUR	16:45	18:15		15			

Analysis Set Details

ID	Use Lane Simulation	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	✓	100.000	100.000

2021 Base Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	14.73	B

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
1	Tolka Quay Rd Westbound	
2	Tolka Quay Road Eastbound	
3	Bond Drive	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	7.00	10.00	12.0	11.0	45.0	60.0	
2	7.50	8.50	15.0	14.0	45.0	45.0	
3	7.00	10.70	20.0	30.0	45.0	60.0	

Zebra Crossings

Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (m)	Crossing time (s)
3	6.00	3.00		Distance	17.50	12.50

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
1	0.692	2248
2	0.731	2338
3	0.773	2577

The slope and intercept shown above include any corrections and adjustments.

Lane Simulation: Arm options

Arm	Lane capacity source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00

Lanes

Arm	Lane level	Lane	Destination arms	Has limited storage	Storage (PCU)	Minimum capacity (PCU/hr)	Maximum capacity (PCU/hr)
1	1 [Give-way line]	1	2		Infinity	0	99999
		2	1,2,3		Infinity	0	99999
2	1 [Give-way line]	1	3		Infinity	0	99999
3	1 [Give-way line]	1	1	✓	3.00	0	99999
		2	1,2	✓	3.00	0	99999
	2	1	(1,2,3)		Infinity		

Entry Lane slope and intercept

Arm	Lane level	Lane	Final slope	Final intercept (PCU/hr)
1	1 [Give-way line]	1	0.346	1124
		2	0.346	1124
2	1 [Give-way line]	1	0.731	2338
3	1 [Give-way line]	1	0.387	1289
		2	0.387	1289

Lane Movements

Arm	Lane Level	Lane	Destination arm		
			1	2	3
1	1 [Give-way line]	1		✓	
		2	✓	✓	✓
2	1 [Give-way line]	1			✓
3	1 [Give-way line]	1	✓		
		2	✓	✓	
	2	1	✓	✓	✓

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2021 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	755	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	387	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	2	3
From	1	0	24	731
	2	0	0	0
	3	0	387	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	**2**	**3**
From	**1**	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	20.10	4.7	14.4	C	691	1037
2	0.00	0.0	~1	A	0	0
3	4.28	0.5	1.6	A	355	533

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	567	142	295		566	0	0.0	1.2	7.168	A
2	0	0	547		0	315	0.0	0.0	0.000	A
3	296	74	0	7.53	296	547	0.0	0.3	3.703	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	677	169	339		678	0	1.2	1.9	10.091	B
2	0	0	656		0	367	0.0	0.0	0.000	A
3	346	87	0	8.99	346	656	0.3	0.4	3.904	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	831	208	420		829	0	1.9	4.7	18.608	C
2	0	0	802		0	452	0.0	0.0	0.000	A
3	425	106	0	11.01	425	802	0.4	0.4	4.275	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	828	207	421		830	0	4.7	4.4	20.102	C
2	0	0	804		0	451	0.0	0.0	0.000	A
3	424	106	0	11.01	425	805	0.4	0.5	4.233	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	673	168	341		676	0	4.4	1.8	11.161	B
2	0	0	655		0	363	0.0	0.0	0.000	A
3	341	85	0	8.99	343	655	0.5	0.4	3.881	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	570	143	296		570	0	1.8	1.2	7.542	A
2	0	0	552		0	315	0.0	0.0	0.000	A
3	297	74	0	7.53	297	552	0.4	0.3	3.743	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.22	0.00	0.14	3.01	4.02
2	0.00	0.00	0.00	0.00	0.00
3	0.30	0.00	0.00	0.74	1.07

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.95	0.00	0.69	4.75	6.09
2	0.00	0.00	0.00	0.00	0.00
3	0.35	0.00	0.00	0.82	1.36

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	4.66	0.00	2.55	11.26	13.72
2	0.00	0.00	0.00	0.00	0.00
3	0.40	0.00	0.00	0.85	1.42

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	4.43	0.00	2.32	10.47	14.38
2	0.00	0.00	0.00	0.00	0.00
3	0.46	0.00	0.00	0.97	1.63

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.83	0.00	0.71	4.19	5.60
2	0.00	0.00	0.00	0.00	0.00
3	0.36	0.00	0.00	0.86	1.44

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.18	0.00	0.27	2.79	3.59
2	0.00	0.00	0.00	0.00	0.00
3	0.27	0.00	0.00	0.66	0.94

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	15		1022	0.014	15	0.0	0.0	3.470	A
			2	1,2,3	552		1022	0.541	551	0.0	1.2	7.263	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1939	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		315				315	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	296		1289	0.230	296	0.0	0.3	3.570	A
		2	**1**	(1,2,3)	296	7.53			296	0.0	0.0	0.133	A
	Exit	**1**	**1**		547	7.53			547	0.0	0.0	0.111	A
		2	**1**		547				547	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	18		1006	0.018	18	0.0	0.0	3.686	A
			2	1,2,3	659		1006	0.654	660	1.2	1.9	10.261	B
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1859	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		367				367	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	346		1289	0.268	346	0.3	0.3	3.763	A
		2	**1**	(1,2,3)	346	8.99			346	0.0	0.0	0.141	A
	Exit	**1**	**1**		656	8.99			656	0.0	0.0	0.091	A
		2	**1**		656				656	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	24		978	0.025	24	0.0	0.0	3.788	A
			2	1,2,3	807		978	0.825	804	1.9	4.7	19.046	C
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1752	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		452				452	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	425		1289	0.330	425	0.3	0.4	4.023	A
		2	**1**	(1,2,3)	425	11.01			425	0.0	0.0	0.252	A
	Exit	**1**	**1**		802	11.01			802	0.0	0.0	0.147	A
		2	**1**		802				802	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	23		978	0.024	23	0.0	0.0	3.669	A
			2	1,2,3	805		978	0.823	807	4.7	4.4	20.594	C
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1750	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		451				451	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	425		1289	0.330	425	0.4	0.4	3.978	A
		2	**1**	(1,2,3)	424	11.01			425	0.0	0.0	0.255	A
	Exit	**1**	**1**		804	11.01			805	0.0	0.0	0.141	A
		2	**1**		805				805	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	16		1006	0.016	16	0.0	0.0	3.619	A
			2	1,2,3	657		1006	0.653	659	4.4	1.8	11.361	B
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1859	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		363				363	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	341		1289	0.265	343	0.4	0.3	3.717	A
		2	1	(1,2,3)	341	8.99			341	0.0	0.0	0.165	A
	Exit	1	1		655	8.99			655	0.0	0.0	0.120	A
		2	1		655				655	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	14		1021	0.013	14	0.0	0.0	3.562	A
			2	1,2,3	557		1021	0.545	556	1.8	1.2	7.647	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1935	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		315				315	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	297		1289	0.231	297	0.3	0.3	3.620	A
		2	1	(1,2,3)	297	7.53			297	0.0	0.0	0.122	A
	Exit	1	1		552	7.53			552	0.0	0.0	0.098	A
		2	1		552				552	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	1.21	0.00	0.11	3.01	4.02
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.30	0.00	0.00	0.74	1.07
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	1.93	0.00	0.68	4.72	6.09
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.33	0.00	0.00	0.82	1.33
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.03	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	4.65	0.00	2.54	11.21	13.72
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.38	0.00	0.00	0.85	1.42
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.04	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	4.41	0.00	2.30	10.38	14.38
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.43	0.00	0.00	0.94	1.58
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	1.81	0.00	0.68	4.17	5.52
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.32	0.00	0.00	0.80	1.26
		2	1	0.04	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	1.17	0.00	0.26	2.77	3.59
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.27	0.00	0.00	0.65	0.93
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Reassigned Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	4.74	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2021 Reassigned Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	755	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	387	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

	To			
		1	**2**	**3**
From	**1**	0	682	73
	2	0	0	0
	3	0	387	0

Vehicle Mix

Heavy Vehicle Percentages

	To			
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	5.00	1.0	3.0	A	693	1040
2	0.00	0.0	~1	A	0	0
3	4.24	0.5	1.7	A	352	527

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	564	141	288		562	0	0.0	0.7	3.947	A
2	0	0	53		0	797	0.0	0.0	0.000	A
3	288	72	0	7.53	288	53	0.0	0.5	3.824	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	679	170	352		679	0	0.7	0.8	4.423	A
2	0	0	67		0	963	0.0	0.0	0.000	A
3	351	88	0	8.99	350	67	0.5	0.4	3.964	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	835	209	416		838	0	0.8	0.9	4.995	A
2	0	0	80		0	1186	0.0	0.0	0.000	A
3	426	107	0	11.01	427	79	0.4	0.5	4.244	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	831	208	420		833	0	0.9	1.0	4.953	A
2	0	0	76		0	1183	0.0	0.0	0.000	A
3	425	106	0	11.01	427	76	0.5	0.4	4.083	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	675	169	328		676	0	1.0	0.7	4.314	A
2	0	0	64		0	940	0.0	0.0	0.000	A
3	329	82	0	8.99	329	64	0.4	0.4	3.839	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	574	144	288		573	0	0.7	0.7	4.031	A
2	0	0	57		0	807	0.0	0.0	0.000	A
3	290	72	0	7.53	291	57	0.4	0.2	3.652	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.72	0.00	0.04	1.45	1.84
2	0.00	0.00	0.00	0.00	0.00
3	0.46	0.00	0.00	0.99	1.55

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.80	0.00	0.00	1.84	2.49
2	0.00	0.00	0.00	0.00	0.00
3	0.40	0.00	0.00	0.88	1.33

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.90	0.00	0.22	1.76	2.65
2	0.00	0.00	0.00	0.00	0.00
3	0.51	0.00	0.00	1.33	1.75

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.00	0.00	0.25	2.27	2.98
2	0.00	0.00	0.00	0.00	0.00
3	0.43	0.00	0.00	0.95	1.56

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.73	0.00	0.04	1.56	1.93
2	0.00	0.00	0.00	0.00	0.00
3	0.37	0.00	0.00	0.78	0.96

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.66	0.00	0.00	1.38	1.77
2	0.00	0.00	0.00	0.00	0.00
3	0.24	0.00	0.00	0.58	0.98

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	262		1024	0.255	261	0.0	0.3	3.845	A
			2	1,2,3	303		1024	0.296	302	0.0	0.4	4.037	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2299	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		797				797	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	288		1289	0.224	288	0.0	0.4	3.670	A
		2	**1**	(1,2,3)	288	7.53			288	0.0	0.0	0.149	A
	Exit	**1**	**1**		53	7.53			53	0.0	0.0	0.064	A
		2	**1**		53				53	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	317		1002	0.317	319	0.3	0.3	4.299	A
			2	1,2,3	362		1002	0.361	361	0.4	0.5	4.531	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2289	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		963				963	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	351		1289	0.272	350	0.4	0.4	3.812	A
		2	**1**	(1,2,3)	351	8.99			351	0.0	0.0	0.155	A
	Exit	**1**	**1**		67	8.99			67	0.0	0.0	0.059	A
		2	**1**		67				67	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	397		980	0.405	399	0.3	0.4	4.926	A
			2	1,2,3	438		980	0.447	440	0.5	0.5	5.058	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2280	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1186				1186	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	426		1289	0.331	427	0.4	0.5	4.016	A
		2	**1**	(1,2,3)	426	11.01			426	0.0	0.0	0.229	A
	Exit	**1**	**1**		80	11.01			79	0.0	0.0	0.102	A
		2	**1**		79				79	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	399		979	0.408	400	0.4	0.5	4.822	A
			2	1,2,3	431		979	0.441	433	0.5	0.5	5.073	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2283	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1183				1183	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	424		1289	0.329	427	0.5	0.4	3.869	A
		2	**1**	(1,2,3)	425	11.01			424	0.0	0.1	0.212	A
	Exit	**1**	**1**		76	11.01			76	0.0	0.0	0.072	A
		2	**1**		76				76	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	316		1010	0.313	317	0.5	0.3	4.246	A
			2	1,2,3	360		1010	0.356	359	0.5	0.4	4.374	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2291	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		940				940	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	329		1289	0.255	329	0.4	0.4	3.665	A
		2	1	(1,2,3)	329	8.99			329	0.1	0.0	0.175	A
	Exit	1	1		64	8.99			64	0.0	0.0	0.065	A
		2	1		64				64	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	273		1024	0.266	272	0.3	0.4	3.942	A
			2	1,2,3	301		1024	0.294	301	0.4	0.3	4.109	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2296	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		807				807	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	290		1289	0.225	291	0.4	0.2	3.537	A
		2	1	(1,2,3)	290	7.53			290	0.0	0.0	0.114	A
	Exit	1	1		57	7.53			57	0.0	0.0	0.040	A
		2	1		57				57	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.32	0.00	0.00	0.70	0.89
			2	0.41	0.00	0.00	0.89	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.44	0.00	0.00	0.99	1.55
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.28	0.00	0.00	0.68	0.98
			2	0.52	0.00	0.00	1.09	1.60
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.40	0.00	0.00	0.88	1.33
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.42	0.00	0.00	2.00	2.00
			2	0.49	0.00	0.00	0.93	1.42
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.49	0.00	0.00	1.30	1.69
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.50	0.00	0.00	0.99	1.62
			2	0.50	0.00	0.00	1.19	1.70
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.36	0.00	0.00	0.85	1.33
		2	1	0.07	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.30	0.00	0.00	0.69	0.88
			2	0.44	0.00	0.00	0.87	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.36	0.00	0.00	0.76	0.93
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.37	0.00	0.00	0.77	0.93
			2	0.30	0.00	0.00	0.72	0.95
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.24	0.00	0.00	0.58	0.98
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2036 Base Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	8.54	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2036 Base Traffic	AM	ONE HOUR	05:30	07:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	1186	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	608	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	0	1071	115
	2	0	0	0
	3	0	608	0

Vehicle Mix

Heavy Vehicle Percentages

	To			
		1	**2**	**3**
From	**1**	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	9.83	3.8	11.8	A	1096	1644
2	0.00	0.0	~1	A	0	0
3	5.99	1.2	3.7	A	557	835

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	888	222	447		887	0	0.0	1.2	4.907	A
2	0	0	85		0	1259	0.0	0.0	0.000	A
3	457	114	0	7.53	457	85	0.0	0.5	4.342	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1089	272	545		1083	0	1.2	2.1	6.198	A
2	0	0	106		0	1517	0.0	0.0	0.000	A
3	543	136	0	8.99	540	106	0.5	0.8	4.979	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1316	329	656		1317	0	2.1	3.6	9.131	A
2	0	0	127		0	1850	0.0	0.0	0.000	A
3	662	165	0	11.01	660	127	0.8	1.2	5.894	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1325	331	669		1318	0	3.6	3.8	9.831	A
2	0	0	127		0	1859	0.0	0.0	0.000	A
3	666	166	0	11.01	669	127	1.2	1.1	5.992	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1068	267	545		1068	0	3.8	1.9	6.562	A
2	0	0	105		0	1515	0.0	0.0	0.000	A
3	553	138	0	8.99	552	105	1.1	0.8	5.044	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	890	223	447		887	0	1.9	1.4	5.159	A
2	0	0	86		0	1261	0.0	0.0	0.000	A
3	459	115	0	7.53	460	86	0.8	0.5	4.342	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.22	0.00	0.46	2.58	3.21
2	0.00	0.00	0.00	0.00	0.00
3	0.55	0.00	0.00	1.34	1.89

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.11	0.00	0.99	4.69	5.89
2	0.00	0.00	0.00	0.00	0.00
3	0.82	0.00	0.00	1.79	2.46

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	3.55	0.00	2.23	7.07	10.25
2	0.00	0.00	0.00	0.00	0.00
3	1.19	0.00	0.19	2.79	3.66

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	3.77	0.00	2.03	8.25	11.75
2	0.00	0.00	0.00	0.00	0.00
3	1.07	0.00	0.18	2.42	3.66

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.86	0.00	0.86	4.30	4.88
2	0.00	0.00	0.00	0.00	0.00
3	0.82	0.00	0.00	1.79	3.38

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.45	0.00	0.64	2.84	3.66
2	0.00	0.00	0.00	0.00	0.00
3	0.48	0.00	0.00	1.23	2.04

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	425		969	0.439	426	0.0	0.5	4.751	A
			2	1,2,3	462		969	0.477	462	0.0	0.7	5.048	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2276	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1259				1259	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	457		1289	0.355	457	0.0	0.5	4.065	A
		2	**1**	(1,2,3)	457	7.53			457	0.0	0.0	0.276	A
	Exit	**1**	**1**		85	7.53			85	0.0	0.0	0.072	A
		2	**1**		85				85	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	528		935	0.564	526	0.5	1.0	5.997	A
			2	1,2,3	561		935	0.600	558	0.7	1.1	6.388	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2261	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1517				1517	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	543		1289	0.421	540	0.5	0.8	4.511	A
		2	**1**	(1,2,3)	543	8.99			543	0.0	0.1	0.466	A
	Exit	**1**	**1**		106	8.99			106	0.0	0.0	0.078	A
		2	**1**		106				106	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	643		897	0.717	643	1.0	1.8	8.876	A
			2	1,2,3	673		897	0.750	674	1.1	1.8	9.375	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2245	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1850				1850	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	661		1289	0.513	660	0.8	1.0	4.999	A
		2	**1**	(1,2,3)	662	11.01			661	0.1	0.2	0.894	A
	Exit	**1**	**1**		127	11.01			127	0.0	0.0	0.099	A
		2	**1**		127				127	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	649		892	0.728	647	1.8	1.8	9.588	A
			2	1,2,3	676		892	0.757	671	1.8	2.0	10.064	B
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2245	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1859				1859	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	666		1289	0.517	669	1.0	0.9	5.033	A
		2	**1**	(1,2,3)	666	11.01			666	0.2	0.2	0.958	A
	Exit	**1**	**1**		127	11.01			127	0.0	0.0	0.111	A
		2	**1**		127				127	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	523		935	0.559	522	1.8	0.9	6.278	A
			2	1,2,3	545		935	0.583	546	2.0	1.0	6.833	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2262	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1515				1515	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	553		1289	0.429	552	0.9	0.7	4.553	A
		2	1	(1,2,3)	553	8.99			553	0.2	0.1	0.491	A
	Exit	1	1		105	8.99			105	0.0	0.0	0.099	A
		2	1		105				105	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	424		969	0.437	422	0.9	0.6	5.025	A
			2	1,2,3	466		969	0.481	464	1.0	0.8	5.281	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2275	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1261				1261	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	459		1289	0.356	460	0.7	0.4	4.097	A
		2	1	(1,2,3)	459	7.53			459	0.1	0.1	0.252	A
	Exit	1	1		86	7.53			86	0.0	0.0	0.069	A
		2	1		86				86	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.53	0.00	0.00	0.97	1.52
			2	0.70	0.00	0.00	1.52	1.92
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.51	0.00	0.00	1.25	1.88
		2	1	0.04	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.01	0.00	0.25	2.06	3.21
			2	1.10	0.00	0.36	2.35	3.04
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.77	0.00	0.00	1.79	3.00
		2	1	0.05	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.77	0.00	0.86	3.50	5.04
			2	1.79	0.00	0.97	3.41	5.05
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.98	0.00	0.13	3.00	3.00
		2	1	0.21	0.00	0.00	0.00	0.91
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.78	0.00	0.71	4.08	5.41
			2	1.98	0.00	1.09	3.90	5.71
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.87	0.00	0.12	3.00	3.00
		2	1	0.21	0.00	0.00	0.15	1.05
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.88	0.00	0.14	2.03	2.54
			2	0.98	0.00	0.34	1.87	2.53
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.69	0.00	0.00	1.79	3.00
		2	1	0.13	0.00	0.00	0.00	0.38
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.64	0.00	0.00	1.12	1.79
			2	0.81	0.00	0.13	1.66	2.16
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.43	0.00	0.00	1.05	1.84
		2	1	0.05	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 With Dev Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	7.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D4	2021 With Dev Traffic	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D2+D6

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	882	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	489	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	269	365	248
	2	0	0	0
	3	51	438	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	8.29	2.2	6.3	A	814	1221
2	0.00	0.0	~1	A	0	0
3	5.36	1.0	3.2	A	451	676

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	665	166	329		664	234	0.0	1.1	5.289	A
2	0	0	384		0	613	0.0	0.0	0.000	A
3	370	92	198	7.53	369	186	0.0	0.4	4.016	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	795	199	394		792	288	1.1	1.4	6.268	A
2	0	0	470		0	723	0.0	0.0	0.000	A
3	444	111	244	8.99	445	226	0.4	0.4	4.553	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	978	244	472		979	359	1.4	2.2	8.053	A
2	0	0	577		0	886	0.0	0.0	0.000	A
3	547	137	300	11.01	544	277	0.4	1.0	5.028	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	971	243	473		975	352	2.2	2.1	8.290	A
2	0	0	565		0	882	0.0	0.0	0.000	A
3	533	133	295	11.01	530	270	1.0	0.9	5.364	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	803	201	388		804	290	2.1	1.4	6.355	A
2	0	0	470		0	723	0.0	0.0	0.000	A
3	436	109	245	8.99	435	225	0.9	0.6	4.541	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	671	168	336		671	240	1.4	0.9	5.443	A
2	0	0	397		0	611	0.0	0.0	0.000	A
3	374	93	203	7.53	374	194	0.6	0.5	4.137	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.08	0.00	0.28	2.41	3.94
2	0.00	0.00	0.00	0.00	0.00
3	0.36	0.00	0.00	0.81	1.07

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.44	0.00	0.29	3.73	5.11
2	0.00	0.00	0.00	0.00	0.00
3	0.43	0.00	0.00	0.95	1.55

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.25	0.00	1.43	5.01	5.86
2	0.00	0.00	0.00	0.00	0.00
3	0.95	0.00	0.05	2.12	3.09

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.15	0.00	1.08	4.03	6.28
2	0.00	0.00	0.00	0.00	0.00
3	0.93	0.00	0.00	2.43	3.22

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.37	0.00	0.50	2.86	3.79
2	0.00	0.00	0.00	0.00	0.00
3	0.58	0.00	0.00	1.54	2.07

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.91	0.00	0.19	1.83	2.44
2	0.00	0.00	0.00	0.00	0.00
3	0.49	0.00	0.00	1.11	1.94

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	190		1010	0.188	188	0.0	0.2	3.913	A
			2	1,2,3	476		1010	0.471	475	0.0	0.9	5.815	A
	Exit	**1**	**1**		234				234	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2058	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		613				613	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	25		1212	0.020	24	0.0	0.0	3.088	A
			2	1,2	345		1212	0.285	345	0.0	0.3	3.877	A
		2	**1**	(1,2,3)	370	7.53			370	0.0	0.0	0.191	A
	Exit	**1**	**1**		186	7.53			186	0.0	0.0	0.084	A
		2	**1**		186				186	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	226		987	0.229	226	0.2	0.3	4.303	A
			2	1,2,3	569		987	0.576	567	0.9	1.2	7.061	A
	Exit	**1**	**1**		288				288	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1995	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		723				723	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	30		1194	0.025	30	0.0	0.0	3.178	A
			2	1,2	415		1194	0.347	415	0.3	0.4	4.363	A
		2	**1**	(1,2,3)	444	8.99			445	0.0	0.0	0.270	A
	Exit	**1**	**1**		226	8.99			226	0.0	0.0	0.088	A
		2	**1**		226				226	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	306		960	0.319	306	0.3	0.4	4.950	A
			2	1,2,3	671		960	0.699	673	1.2	1.8	9.440	A
	Exit	**1**	**1**		359				359	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1916	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		886				886	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	42		1172	0.035	41	0.0	0.0	3.067	A
			2	1,2	504		1172	0.430	502	0.4	0.8	4.734	A
		2	**1**	(1,2,3)	547	11.01			546	0.0	0.1	0.412	A
	Exit	**1**	**1**		277	11.01			277	0.0	0.0	0.089	A
		2	**1**		277				277	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	308		960	0.321	308	0.4	0.5	4.947	A
			2	1,2,3	663		960	0.691	667	1.8	1.7	9.827	A
	Exit	**1**	**1**		352				352	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1925	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		882				882	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	39		1175	0.033	39	0.0	0.1	3.109	A
			2	1,2	494		1175	0.420	491	0.8	0.8	4.936	A
		2	**1**	(1,2,3)	533	11.01			533	0.1	0.1	0.563	A
	Exit	**1**	**1**		270	11.01			270	0.0	0.0	0.113	A
		2	**1**		270				270	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	236		989	0.238	236	0.5	0.3	4.340	A
			2	1,2,3	568		989	0.574	568	1.7	1.1	7.195	A
	Exit	1	1		290				290	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1995	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		723				723	0.0	0.0	0.000	A
3	Entry	1	1	1	31		1194	0.026	31	0.1	0.0	3.205	A
			2	1,2	405		1194	0.339	404	0.8	0.5	4.368	A
		2	1	(1,2,3)	436	8.99			436	0.1	0.0	0.259	A
	Exit	1	1		225	8.99			225	0.0	0.0	0.087	A
		2	1		225				225	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	183		1008	0.182	184	0.3	0.2	4.062	A
			2	1,2,3	487		1008	0.484	488	1.1	0.7	5.964	A
	Exit	1	1		240				240	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2048	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		611				611	0.0	0.0	0.000	A
3	Entry	1	1	1	24		1210	0.019	24	0.0	0.0	3.022	A
			2	1,2	350		1210	0.290	350	0.5	0.5	4.048	A
		2	1	(1,2,3)	374	7.53			374	0.0	0.0	0.156	A
	Exit	1	1		194	7.53			194	0.0	0.0	0.071	A
		2	1		194				194	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.23	0.00	0.00	0.58	0.86
			2	0.85	0.00	0.08	1.82	2.62
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	1.00
			2	0.30	0.00	0.00	0.74	0.94
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.27	0.00	0.00	0.67	0.95
			2	1.17	0.00	0.11	2.79	4.39
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.40	0.00	0.00	0.95	1.50
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.43	0.00	0.00	0.89	1.39
			2	1.82	0.00	0.86	4.21	5.14
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.80	0.00	0.00	3.00	3.00
		2	1	0.11	0.00	0.00	0.00	0.26
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.47	0.00	0.00	1.01	1.71
			2	1.68	0.00	0.66	3.47	4.78
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.07	0.00	0.00	0.00	1.00
			2	0.78	0.00	0.00	3.00	3.00
		2	1	0.09	0.00	0.00	0.00	0.08
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.27	0.00	0.00	0.69	0.95
			2	1.09	0.00	0.21	2.42	2.91
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.52	0.00	0.00	1.36	3.00
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.18	0.00	0.00	0.45	0.74
			2	0.72	0.00	0.00	1.67	2.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.47	0.00	0.00	1.01	1.86
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2036 With Dev Traffic, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	14.45	B

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D5	2036 With Dev Traffic	AM	ONE HOUR	05:30	07:00	15	✓	Simple	D3+D6

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	1313	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	710	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	269	754	290
	2	0	0	0
	3	51	659	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	17.72	7.5	19.2	C	1205	1808
2	0.00	0.0	~1	A	0	0
3	8.40	1.9	6.3	A	651	976

Main Results for each time segment

05:30 - 05:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	983	246	496		984	237	0.0	1.7	6.374	A
2	0	0	420		0	1060	0.0	0.0	0.000	A
3	533	133	200	7.53	533	220	0.0	0.7	4.945	A

05:45 - 06:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1186	297	590		1182	292	1.7	3.1	8.839	A
2	0	0	509		0	1267	0.0	0.0	0.000	A
3	638	160	247	8.99	639	261	0.7	1.0	5.833	A

06:00 - 06:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1453	363	709		1453	358	3.1	6.9	16.129	C
2	0	0	627		0	1544	0.0	0.0	0.000	A
3	772	193	302	11.01	773	324	1.0	1.7	7.947	A

06:15 - 06:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1448	362	723		1444	346	6.9	7.5	17.720	C
2	0	0	610		0	1562	0.0	0.0	0.000	A
3	783	196	291	11.01	783	319	1.7	1.9	8.396	A

06:30 - 06:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1169	292	593		1169	291	7.5	3.1	10.228	B
2	0	0	502		0	1263	0.0	0.0	0.000	A
3	641	160	245	8.99	641	257	1.9	1.0	6.315	A

06:45 - 07:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	991	248	493		990	245	3.1	2.0	6.835	A
2	0	0	421		0	1066	0.0	0.0	0.000	A
3	538	134	204	7.53	537	216	1.0	0.8	5.089	A

Queue Variation Results for each time segment

05:30 - 05:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.71	0.00	0.81	3.70	4.92
2	0.00	0.00	0.00	0.00	0.00
3	0.71	0.00	0.00	1.69	2.40

05:45 - 06:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	3.12	0.00	1.89	6.64	7.92
2	0.00	0.00	0.00	0.00	0.00
3	0.99	0.00	0.00	2.43	3.51

06:00 - 06:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	6.93	0.00	4.52	13.83	18.54
2	0.00	0.00	0.00	0.00	0.00
3	1.72	0.00	0.59	4.28	5.79

06:15 - 06:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	7.54	0.00	5.19	15.72	19.23
2	0.00	0.00	0.00	0.00	0.00
3	1.85	0.00	0.63	4.49	6.27

06:30 - 06:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	3.13	0.00	1.85	6.59	8.53
2	0.00	0.00	0.00	0.00	0.00
3	1.00	0.00	0.00	2.24	3.36

06:45 - 07:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.02	0.00	0.91	4.49	6.02
2	0.00	0.00	0.00	0.00	0.00
3	0.76	0.00	0.00	1.73	2.26

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	379		952	0.398	379	0.0	0.5	5.094	A
			2	1,2,3	604		952	0.634	605	0.0	1.2	7.165	A
	Exit	**1**	**1**		237				237	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2031	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1060				1060	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	26		1211	0.021	26	0.0	0.0	3.067	A
			2	1,2	507		1211	0.418	507	0.0	0.6	4.603	A
		2	**1**	(1,2,3)	533	7.53			533	0.0	0.1	0.415	A
	Exit	**1**	**1**		220	7.53			220	0.0	0.0	0.095	A
		2	**1**		220				220	0.0	0.0	0.000	A

05:45 - 06:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	484		920	0.526	483	0.5	1.0	6.865	A
			2	1,2,3	702		920	0.763	699	1.2	2.1	10.197	B
	Exit	**1**	**1**		292				292	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1966	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1267				1267	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	32		1193	0.027	32	0.0	0.0	3.037	A
			2	1,2	606		1193	0.508	606	0.6	0.8	5.176	A
		2	**1**	(1,2,3)	638	8.99			638	0.1	0.1	0.766	A
	Exit	**1**	**1**		261	8.99			261	0.0	0.0	0.080	A
		2	**1**		261				261	0.0	0.0	0.000	A

06:00 - 06:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	650		878	0.740	649	1.0	2.4	12.131	B
			2	1,2,3	803		878	0.914	805	2.1	4.5	19.312	C
	Exit	**1**	**1**		358				358	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1880	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1544				1544	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	45		1172	0.038	45	0.0	0.0	3.259	A
			2	1,2	727		1172	0.621	728	0.8	1.2	6.087	A
		2	**1**	(1,2,3)	772	11.01			772	0.1	0.5	2.022	A
	Exit	**1**	**1**		324	11.01			324	0.0	0.0	0.116	A
		2	**1**		324				324	0.0	0.0	0.000	A

06:15 - 06:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	650		874	0.744	649	2.4	2.6	13.677	B
			2	1,2,3	798		874	0.913	795	4.5	4.9	20.987	C
	Exit	**1**	**1**		346				346	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		1892	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1562				1562	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	45		1176	0.039	45	0.0	0.0	3.178	A
			2	1,2	738		1176	0.627	738	1.2	1.3	6.170	A
		2	**1**	(1,2,3)	783	11.01			783	0.5	0.5	2.396	A
	Exit	**1**	**1**		319	11.01			319	0.0	0.0	0.137	A
		2	**1**		319				319	0.0	0.0	0.000	A

06:30 - 06:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	473		919	0.515	473	2.6	1.0	7.888	A
			2	1,2,3	696		919	0.757	696	4.9	2.1	11.860	B
	Exit	1	1		291				291	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1972	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1263				1263	0.0	0.0	0.000	A
3	Entry	1	1	1	34		1194	0.029	34	0.0	0.0	3.142	A
			2	1,2	607		1194	0.508	607	1.3	0.8	5.371	A
		2	1	(1,2,3)	641	8.99			641	0.5	0.1	1.071	A
	Exit	1	1		257	8.99			257	0.0	0.0	0.112	A
		2	1		257				257	0.0	0.0	0.000	A

06:45 - 07:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	382		953	0.401	381	1.0	0.6	5.402	A
			2	1,2,3	609		953	0.639	609	2.1	1.4	7.739	A
	Exit	1	1		245				245	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2031	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1066				1066	0.0	0.0	0.000	A
3	Entry	1	1	1	29		1210	0.024	28	0.0	0.0	2.936	A
			2	1,2	510		1210	0.422	509	0.8	0.7	4.727	A
		2	1	(1,2,3)	538	7.53			539	0.1	0.0	0.461	A
	Exit	1	1		216	7.53			216	0.0	0.0	0.083	A
		2	1		216				216	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

05:30 - 05:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.54	0.00	0.00	1.19	1.88
			2	1.17	0.00	0.36	2.57	3.52
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	0.64	0.00	0.00	1.65	3.00
		2	1	0.05	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

05:45 - 06:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.98	0.00	0.20	2.06	2.78
			2	2.14	0.00	1.13	4.49	5.64
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.84	0.00	0.00	3.00	3.00
		2	1	0.13	0.00	0.00	0.00	0.47
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:00 - 06:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	2.39	0.00	0.98	5.56	8.02
			2	4.53	0.00	3.02	9.21	11.43
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.05	0.00	0.00	0.00	0.00
			2	1.21	0.00	0.48	3.00	3.00
		2	1	0.46	0.00	0.00	1.36	2.91
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:15 - 06:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	2.60	0.00	1.01	6.28	8.04
			2	4.94	0.00	3.29	10.30	12.43
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	1.30	0.00	0.58	3.00	3.00
		2	1	0.53	0.00	0.00	1.45	3.19
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:30 - 06:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.02	0.00	0.17	2.17	3.02
			2	2.10	0.00	1.08	4.28	5.79
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.83	0.00	0.00	3.00	3.00
		2	1	0.15	0.00	0.00	0.00	0.43
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

06:45 - 07:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.65	0.00	0.00	1.41	1.94
			2	1.37	0.00	0.46	3.14	4.15
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.70	0.00	0.00	1.69	3.00
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Base Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	21.02	C

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2021 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	842	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	312	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

	To			
		1	**2**	**3**
From	**1**	0	38	804
	2	0	0	0
	3	0	312	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	27.34	7.5	23.0	D	770	1154
2	0.00	0.0	~1	A	0	0
3	3.95	0.4	2.0	A	285	427

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	627	157	236		628	0	0.0	1.3	7.571	A
2	0	0	599		0	264	0.0	0.0	0.000	A
3	235	59	0	7.53	235	599	0.0	0.2	3.491	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	754	189	277		761	0	1.3	2.0	11.292	B
2	0	0	725		0	317	0.0	0.0	0.000	A
3	282	70	0	8.99	282	725	0.2	0.2	3.659	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	925	231	338		909	0	2.0	7.5	24.325	C
2	0	0	865		0	387	0.0	0.0	0.000	A
3	344	86	0	11.01	344	865	0.2	0.3	3.923	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	920	230	333		925	0	7.5	6.9	27.336	D
2	0	0	882		0	378	0.0	0.0	0.000	A
3	335	84	0	11.01	336	883	0.3	0.4	3.950	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	756	189	277		761	0	6.9	2.3	13.739	B
2	0	0	728		0	309	0.0	0.0	0.000	A
3	276	69	0	8.99	276	728	0.4	0.3	3.654	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	636	159	235		637	0	2.3	1.4	8.134	A
2	0	0	610		0	265	0.0	0.0	0.000	A
3	238	59	0	7.53	238	610	0.3	0.2	3.492	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.34	0.00	0.30	3.10	4.60
2	0.00	0.00	0.00	0.00	0.00
3	0.21	0.00	0.00	0.50	0.88

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.96	0.00	0.82	4.50	5.60
2	0.00	0.00	0.00	0.00	0.00
3	0.23	0.00	0.00	0.63	2.00

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	7.48	0.00	5.21	16.50	21.67
2	0.00	0.00	0.00	0.00	0.00
3	0.34	0.00	0.00	0.78	1.38

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	6.93	0.00	3.60	18.33	23.00
2	0.00	0.00	0.00	0.00	0.00
3	0.39	0.00	0.00	0.88	1.40

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.28	0.00	0.96	5.43	7.14
2	0.00	0.00	0.00	0.00	0.00
3	0.32	0.00	0.00	0.88	1.47

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.44	0.00	0.43	3.18	4.60
2	0.00	0.00	0.00	0.00	0.00
3	0.23	0.00	0.00	0.56	0.89

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	23		1042	0.022	23	0.0	0.0	3.616	A
			2	1,2,3	604		1042	0.580	605	0.0	1.3	7.718	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1900	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		264				264	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	235		1289	0.182	235	0.0	0.2	3.378	A
		2	1	(1,2,3)	235	7.53			235	0.0	0.0	0.113	A
	Exit	1	1		599	7.53			599	0.0	0.0	0.101	A
		2	1		599				599	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	30		1028	0.029	30	0.0	0.0	3.550	A
			2	1,2,3	724		1028	0.705	731	1.3	1.9	11.602	B
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1808	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		317				317	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	282		1289	0.218	282	0.2	0.2	3.544	A
		2	1	(1,2,3)	282	8.99			282	0.0	0.0	0.113	A
	Exit	1	1		725	8.99			725	0.0	0.0	0.106	A
		2	1		725				725	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	40		1007	0.040	40	0.0	0.0	3.700	A
			2	1,2,3	885		1007	0.879	869	1.9	7.5	25.237	D
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1706	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		387				387	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	344		1289	0.267	344	0.2	0.3	3.757	A
		2	1	(1,2,3)	344	11.01			344	0.0	0.0	0.166	A
	Exit	1	1		865	11.01			865	0.0	0.0	0.142	A
		2	1		865				865	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	41		1009	0.040	41	0.0	0.1	3.703	A
			2	1,2,3	879		1009	0.872	884	7.5	6.9	28.399	D
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1693	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		378				378	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	335		1289	0.260	336	0.3	0.4	3.754	A
		2	1	(1,2,3)	335	11.01			335	0.0	0.0	0.196	A
	Exit	1	1		882	11.01			883	0.0	0.0	0.159	A
		2	1		883				883	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	29		1028	0.028	29	0.1	0.0	3.571	A
			2	1,2,3	727		1028	0.708	732	6.9	2.3	14.148	B
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1806	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		309				309	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	276		1289	0.215	276	0.4	0.3	3.522	A
		2	1	(1,2,3)	276	8.99			276	0.0	0.0	0.132	A
	Exit	1	1		728	8.99			728	0.0	0.0	0.129	A
		2	1		728				728	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	22		1043	0.021	22	0.0	0.0	3.558	A
			2	1,2,3	614		1043	0.589	615	2.3	1.4	8.302	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		1893	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		265				265	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	238		1289	0.184	238	0.3	0.2	3.397	A
		2	1	(1,2,3)	238	7.53			238	0.0	0.0	0.094	A
	Exit	1	1		610	7.53			610	0.0	0.0	0.091	A
		2	1		610				610	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.01	0.00	0.00	0.00	0.00
			2	1.33	0.00	0.29	3.10	4.50
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.21	0.00	0.00	0.50	0.88
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	1.92	0.00	0.76	4.50	5.60
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.23	0.00	0.00	0.61	2.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.03	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	7.45	0.00	5.08	16.50	21.67
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.31	0.00	0.00	0.75	1.29
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.04	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.07	0.00	0.00	0.00	0.18
			2	6.86	0.00	3.57	18.33	23.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.37	0.00	0.00	0.88	1.40
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	2.25	0.00	0.94	5.43	7.14
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.32	0.00	0.00	0.88	1.47
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	1.41	0.00	0.38	3.18	4.60
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.23	0.00	0.00	0.56	0.89
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 Reassigned Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	4.67	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2021 Reassigned Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	842	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	312	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	0	735	107
	2	0	0	0
	3	0	312	0

Vehicle Mix

Heavy Vehicle Percentages

	To			
		1	**2**	**3**
From	**1**	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	4.98	1.5	3.5	A	772	1158
2	0.00	0.0	~1	A	0	0
3	3.85	0.4	1.6	A	287	430

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	636	159	242		635	0	0.0	0.9	3.980	A
2	0	0	83		0	794	0.0	0.0	0.000	A
3	242	60	0	7.53	243	83	0.0	0.1	3.406	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	763	191	279		764	0	0.9	0.9	4.378	A
2	0	0	101		0	942	0.0	0.0	0.000	A
3	278	69	0	8.99	279	101	0.1	0.3	3.695	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	931	233	336		929	0	0.9	1.5	4.981	A
2	0	0	115		0	1155	0.0	0.0	0.000	A
3	341	85	0	11.01	341	115	0.3	0.3	3.851	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	914	228	347		916	0	1.5	1.2	4.964	A
2	0	0	117		0	1147	0.0	0.0	0.000	A
3	348	87	0	11.01	347	117	0.3	0.4	3.836	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	763	191	279		762	0	1.2	1.1	4.455	A
2	0	0	104		0	937	0.0	0.0	0.000	A
3	279	70	0	8.99	279	104	0.4	0.2	3.597	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	624	156	232		624	0	1.1	0.6	4.019	A
2	0	0	78		0	780	0.0	0.0	0.000	A
3	233	58	0	7.53	234	78	0.2	0.2	3.490	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.85	0.00	0.15	1.74	2.49
2	0.00	0.00	0.00	0.00	0.00
3	0.13	0.00	0.00	0.17	0.63

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.89	0.00	0.00	1.98	3.24
2	0.00	0.00	0.00	0.00	0.00
3	0.31	0.00	0.00	0.75	0.99

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.47	0.00	0.68	2.76	3.39
2	0.00	0.00	0.00	0.00	0.00
3	0.30	0.00	0.00	0.79	1.33

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.16	0.00	0.41	2.38	3.49
2	0.00	0.00	0.00	0.00	0.00
3	0.44	0.00	0.00	1.09	1.60

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.07	0.00	0.26	2.18	3.19
2	0.00	0.00	0.00	0.00	0.00
3	0.21	0.00	0.00	0.52	0.82

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.64	0.00	0.00	1.32	2.32
2	0.00	0.00	0.00	0.00	0.00
3	0.17	0.00	0.00	0.39	0.73

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	298		1040	0.287	297	0.0	0.4	3.847	A
			2	1,2,3	338		1040	0.325	338	0.0	0.5	4.094	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2277	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		794				794	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	242		1289	0.188	243	0.0	0.1	3.318	A
		2	1	(1,2,3)	242	7.53			242	0.0	0.0	0.088	A
	Exit	1	1		83	7.53			83	0.0	0.0	0.046	A
		2	1		83				83	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	348		1027	0.339	349	0.4	0.4	4.268	A
			2	1,2,3	414		1027	0.403	415	0.5	0.5	4.473	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2264	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		942				942	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	278		1289	0.216	279	0.1	0.3	3.561	A
		2	1	(1,2,3)	278	8.99			278	0.0	0.0	0.134	A
	Exit	1	1		101	8.99			101	0.0	0.0	0.070	A
		2	1		101				101	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	439		1008	0.436	439	0.4	0.7	4.845	A
			2	1,2,3	491		1008	0.488	490	0.5	0.8	5.102	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2254	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1155				1155	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	341		1289	0.264	341	0.3	0.3	3.691	A
		2	1	(1,2,3)	341	11.01			341	0.0	0.0	0.160	A
	Exit	1	1		115	11.01			115	0.0	0.0	0.061	A
		2	1		115				115	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	434		1004	0.432	436	0.7	0.5	4.764	A
			2	1,2,3	480		1004	0.478	481	0.8	0.7	5.142	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2253	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1147				1147	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	349		1289	0.271	347	0.3	0.4	3.682	A
		2	1	(1,2,3)	348	11.01			349	0.0	0.0	0.154	A
	Exit	1	1		117	11.01			117	0.0	0.0	0.099	A
		2	1		117				117	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	359		1027	0.349	359	0.5	0.4	4.298	A
			2	1,2,3	405		1027	0.394	403	0.7	0.7	4.591	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2262	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		937				937	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	279		1289	0.216	279	0.4	0.2	3.482	A
		2	1	(1,2,3)	279	8.99			279	0.0	0.0	0.115	A
	Exit	1	1		104	8.99			104	0.0	0.0	0.060	A
		2	1		104				104	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	290		1044	0.278	289	0.4	0.3	3.930	A
			2	1,2,3	334		1044	0.320	336	0.7	0.3	4.096	A
	Exit	1	1		0				0	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2281	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		780				780	0.0	0.0	0.000	A
3	Entry	1	1	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	233		1289	0.181	234	0.2	0.2	3.405	A
		2	1	(1,2,3)	233	7.53			233	0.0	0.0	0.085	A
	Exit	1	1		78	7.53			78	0.0	0.0	0.052	A
		2	1		78				78	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.40	0.00	0.00	0.80	0.97
			2	0.46	0.00	0.00	0.90	1.33
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.13	0.00	0.00	0.17	0.63
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.40	0.00	0.00	0.90	1.59
			2	0.50	0.00	0.00	0.99	1.62
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.31	0.00	0.00	0.75	0.99
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.66	0.00	0.01	1.19	1.70
			2	0.80	0.00	0.19	1.61	3.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.29	0.00	0.00	0.74	1.19
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.50	0.00	0.00	0.89	1.24
			2	0.66	0.00	0.00	1.49	1.85
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.43	0.00	0.00	0.99	1.55
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.42	0.00	0.00	0.99	1.55
			2	0.65	0.00	0.00	1.43	1.75
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.21	0.00	0.00	0.52	0.82
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.35	0.00	0.00	0.79	0.99
			2	0.30	0.00	0.00	0.75	2.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.17	0.00	0.00	0.39	0.73
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2036 Base Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	9.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2036 Base Traffic	PM	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	1322	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	490	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	0	1154	168
	2	0	0	0
	3	0	490	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	**2**	**3**
From	**1**	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	10.64	4.5	14.1	B	1212	1818
2	0.00	0.0	~1	A	0	0
3	4.99	0.8	2.8	A	449	674

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	988	247	364		987	0	0.0	1.6	5.160	A
2	0	0	126		0	1227	0.0	0.0	0.000	A
3	367	92	0	7.53	366	126	0.0	0.5	4.031	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1189	297	435		1192	0	1.6	2.1	6.472	A
2	0	0	153		0	1482	0.0	0.0	0.000	A
3	442	110	0	8.99	443	153	0.5	0.5	4.469	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1461	365	529		1455	0	2.1	4.5	10.219	B
2	0	0	184		0	1812	0.0	0.0	0.000	A
3	540	135	0	11.01	540	184	0.5	0.8	4.909	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1444	361	533		1441	0	4.5	4.4	10.639	B
2	0	0	184		0	1789	0.0	0.0	0.000	A
3	533	133	0	11.01	532	184	0.8	0.8	4.993	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1189	297	439		1187	0	4.4	2.3	6.839	A
2	0	0	149		0	1481	0.0	0.0	0.000	A
3	443	111	0	8.99	444	149	0.8	0.5	4.386	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1000	250	359		1001	0	2.3	1.5	5.354	A
2	0	0	129		0	1241	0.0	0.0	0.000	A
3	370	92	0	7.53	369	129	0.5	0.5	4.001	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.61	0.00	0.72	3.07	3.74
2	0.00	0.00	0.00	0.00	0.00
3	0.49	0.00	0.00	1.18	1.90

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.13	0.00	1.23	4.29	6.02
2	0.00	0.00	0.00	0.00	0.00
3	0.50	0.00	0.00	1.08	1.83

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	4.48	0.00	2.60	9.76	14.08
2	0.00	0.00	0.00	0.00	0.00
3	0.76	0.00	0.00	1.76	2.68

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	4.41	0.00	2.39	9.55	13.29
2	0.00	0.00	0.00	0.00	0.00
3	0.81	0.00	0.00	2.13	2.84

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.28	0.00	1.35	4.85	6.35
2	0.00	0.00	0.00	0.00	0.00
3	0.54	0.00	0.00	1.40	1.86

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.47	0.00	0.57	3.27	4.19
2	0.00	0.00	0.00	0.00	0.00
3	0.45	0.00	0.00	0.99	1.68

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	463		998	0.464	462	0.0	0.8	5.017	A
			2	1,2,3	525		998	0.526	525	0.0	0.8	5.287	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2246	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1227				1227	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	367		1289	0.284	366	0.0	0.5	3.823	A
		2	**1**	(1,2,3)	367	7.53			367	0.0	0.0	0.208	A
	Exit	**1**	**1**		126	7.53			126	0.0	0.0	0.075	A
		2	**1**		126				126	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	563		973	0.578	564	0.8	1.0	6.346	A
			2	1,2,3	626		973	0.644	627	0.8	1.1	6.585	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2227	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1482				1482	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	442		1289	0.343	443	0.5	0.5	4.168	A
		2	**1**	(1,2,3)	442	8.99			442	0.0	0.0	0.300	A
	Exit	**1**	**1**		153	8.99			153	0.0	0.0	0.072	A
		2	**1**		153				153	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	712		941	0.757	709	1.0	2.1	9.917	A
			2	1,2,3	749		941	0.797	746	1.1	2.3	10.506	B
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2204	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1812				1812	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	540		1289	0.419	540	0.5	0.7	4.430	A
		2	**1**	(1,2,3)	540	11.01			540	0.0	0.1	0.477	A
	Exit	**1**	**1**		184	11.01			184	0.0	0.0	0.113	A
		2	**1**		184				184	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	696		939	0.741	694	2.1	2.1	10.422	B
			2	1,2,3	748		939	0.797	748	2.3	2.3	10.843	B
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2204	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1789				1789	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	533		1289	0.414	532	0.7	0.7	4.469	A
		2	**1**	(1,2,3)	533	11.01			533	0.1	0.1	0.522	A
	Exit	**1**	**1**		184	11.01			184	0.0	0.0	0.099	A
		2	**1**		184				184	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	566		972	0.583	566	2.1	1.0	6.660	A
			2	1,2,3	623		972	0.641	621	2.3	1.2	7.003	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2229	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1481				1481	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	443		1289	0.344	444	0.7	0.5	4.111	A
		2	**1**	(1,2,3)	443	8.99			443	0.1	0.0	0.280	A
	Exit	**1**	**1**		149	8.99			149	0.0	0.0	0.086	A
		2	**1**		149				149	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	474		999	0.474	474	1.0	0.7	5.182	A
			2	1,2,3	526		999	0.527	527	1.2	0.8	5.508	A
	Exit	**1**	**1**		0				0	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2244	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1241				1241	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	0		1289	0.000	0	0.0	0.0	0.000	A
			2	1,2	369		1289	0.287	369	0.5	0.4	3.829	A
		2	**1**	(1,2,3)	370	7.53			369	0.0	0.0	0.173	A
	Exit	**1**	**1**		129	7.53			129	0.0	0.0	0.069	A
		2	**1**		129				129	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Entry**	**1**	**1**	0.76	0.00	0.00	1.64	2.02
			2	0.85	0.00	0.20	1.66	1.98
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
			2	0.47	0.00	0.00	1.14	1.89
		2	**1**	0.02	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	**Entry**	**1**	**1**	1.00	0.00	0.24	2.02	3.02
			2	1.14	0.00	0.46	2.18	2.90
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
2	**Entry**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
3	**Entry**	**1**	**1**	0.00	0.00	0.00	0.00	0.00
			2	0.48	0.00	0.00	1.07	1.79
		2	**1**	0.02	0.00	0.00	0.00	0.00
	Exit	**1**	**1**	0.00	0.00	0.00	0.00	0.00
		2	**1**	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	2.14	0.00	0.90	4.88	6.88
			2	2.34	0.00	1.23	5.16	6.77
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.70	0.00	0.00	1.75	3.00
		2	1	0.06	0.00	0.00	0.00	0.10
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	2.08	0.00	0.86	4.54	6.72
			2	2.33	0.00	1.11	5.12	7.05
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.72	0.00	0.00	3.00	3.00
		2	1	0.10	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.04	0.00	0.32	2.09	2.94
			2	1.25	0.00	0.54	2.49	3.02
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.52	0.00	0.00	1.34	1.82
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.70	0.00	0.01	1.49	1.88
			2	0.76	0.00	0.03	1.57	2.23
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.43	0.00	0.00	0.99	1.68
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2021 With Dev Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	5.73	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D10	2021 With Dev Traffic	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D12+D8

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	969	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	414	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	135	639	195
	2	0	0	0
	3	51	363	0

Vehicle Mix

Heavy Vehicle Percentages

	To			
		1	**2**	**3**
From	**1**	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	6.36	1.9	5.0	A	892	1339
2	0.00	0.0	~1	A	0	0
3	4.26	0.6	3.0	A	381	572

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	729	182	272		729	140	0.0	0.9	4.469	A
2	0	0	247		0	759	0.0	0.0	0.000	A
3	317	79	100	7.53	317	147	0.0	0.4	3.672	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	864	216	331		864	176	0.9	1.3	5.055	A
2	0	0	297		0	895	0.0	0.0	0.000	A
3	381	95	125	8.99	379	171	0.4	0.4	3.816	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1069	267	391		1072	211	1.3	1.6	6.117	A
2	0	0	367		0	1101	0.0	0.0	0.000	A
3	454	114	153	11.01	453	213	0.4	0.5	4.142	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1091	273	399		1090	207	1.6	1.9	6.361	A
2	0	0	372		0	1115	0.0	0.0	0.000	A
3	452	113	152	11.01	453	221	0.5	0.6	4.265	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	880	220	321		880	166	1.9	1.2	5.188	A
2	0	0	294		0	909	0.0	0.0	0.000	A
3	365	91	124	8.99	365	170	0.6	0.4	4.024	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	721	180	275		719	143	1.2	1.1	4.584	A
2	0	0	244		0	748	0.0	0.0	0.000	A
3	317	79	100	7.53	316	144	0.4	0.3	3.671	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	0.88	0.00	0.17	1.76	2.32
2	0.00	0.00	0.00	0.00	0.00
3	0.41	0.00	0.00	0.86	3.00

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.26	0.00	0.49	2.48	3.59
2	0.00	0.00	0.00	0.00	0.00
3	0.40	0.00	0.00	0.94	1.79

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.61	0.00	0.87	3.32	4.32
2	0.00	0.00	0.00	0.00	0.00
3	0.53	0.00	0.00	1.11	1.74

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.86	0.00	0.90	3.90	4.98
2	0.00	0.00	0.00	0.00	0.00
3	0.57	0.00	0.00	1.32	1.88

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.21	0.00	0.50	2.45	2.90
2	0.00	0.00	0.00	0.00	0.00
3	0.45	0.00	0.00	0.88	2.00

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.06	0.00	0.28	2.27	2.98
2	0.00	0.00	0.00	0.00	0.00
3	0.29	0.00	0.00	0.76	1.39

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	287		1030	0.279	287	0.0	0.4	3.954	A
			2	1,2,3	442		1030	0.429	442	0.0	0.5	4.800	A
	Exit	**1**	**1**		140				140	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2158	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		759				759	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	24		1250	0.019	24	0.0	0.0	2.874	A
			2	1,2	293		1250	0.234	293	0.0	0.4	3.606	A
		2	**1**	(1,2,3)	317	7.53			317	0.0	0.0	0.122	A
	Exit	**1**	**1**		147	7.53			147	0.0	0.0	0.097	A
		2	**1**		147				147	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	348		1009	0.345	347	0.4	0.5	4.435	A
			2	1,2,3	516		1009	0.511	516	0.5	0.8	5.472	A
	Exit	**1**	**1**		176				176	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2121	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		895				895	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	34		1240	0.027	34	0.0	0.0	2.950	A
			2	1,2	347		1240	0.280	346	0.4	0.3	3.767	A
		2	**1**	(1,2,3)	381	8.99			381	0.0	0.0	0.114	A
	Exit	**1**	**1**		171	8.99			171	0.0	0.0	0.074	A
		2	**1**		171				171	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	444		988	0.449	443	0.5	0.7	5.249	A
			2	1,2,3	625		988	0.632	629	0.8	1.0	6.744	A
	Exit	**1**	**1**		211				211	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2070	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1101				1101	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	38		1229	0.031	38	0.0	0.0	2.996	A
			2	1,2	416		1229	0.338	415	0.3	0.4	4.034	A
		2	**1**	(1,2,3)	454	11.01			454	0.0	0.1	0.190	A
	Exit	**1**	**1**		214	11.01			213	0.0	0.0	0.060	A
		2	**1**		213				213	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	458		986	0.465	458	0.7	0.7	5.434	A
			2	1,2,3	633		986	0.642	632	1.0	1.2	7.018	A
	Exit	**1**	**1**		207				207	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2066	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1115				1115	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	37		1230	0.030	37	0.0	0.0	2.917	A
			2	1,2	415		1230	0.337	415	0.4	0.5	4.134	A
		2	**1**	(1,2,3)	452	11.01			452	0.1	0.0	0.232	A
	Exit	**1**	**1**		221	11.01			221	0.0	0.0	0.098	A
		2	**1**		221				221	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	355		1013	0.350	354	0.7	0.4	4.575	A
			2	1,2,3	526		1013	0.519	526	1.2	0.8	5.596	A
	Exit	1	1		166				166	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2123	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		909				909	0.0	0.0	0.000	A
3	Entry	1	1	1	26		1241	0.021	26	0.0	0.0	3.062	A
			2	1,2	338		1241	0.273	339	0.5	0.4	3.952	A
		2	1	(1,2,3)	365	8.99			365	0.0	0.0	0.140	A
	Exit	1	1		170	8.99			170	0.0	0.0	0.119	A
		2	1		170				170	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	283		1029	0.275	281	0.4	0.4	4.140	A
			2	1,2,3	438		1029	0.426	438	0.8	0.7	4.872	A
	Exit	1	1		143				143	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2160	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		748				748	0.0	0.0	0.000	A
3	Entry	1	1	1	26		1250	0.021	27	0.0	0.0	2.885	A
			2	1,2	291		1250	0.233	289	0.4	0.3	3.621	A
		2	1	(1,2,3)	317	7.53			317	0.0	0.0	0.109	A
	Exit	1	1		144	7.53			144	0.0	0.0	0.065	A
		2	1		144				144	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.36	0.00	0.00	0.83	2.00
			2	0.52	0.00	0.00	1.19	1.70
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.36	0.00	0.00	0.82	3.00
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.48	0.00	0.00	0.93	1.42
			2	0.78	0.00	0.00	1.66	2.32
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.35	0.00	0.00	0.87	1.59
		2	1	0.01	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.66	0.00	0.00	1.49	3.00
			2	0.95	0.00	0.30	1.77	2.32
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.45	0.00	0.00	0.99	1.71
		2	1	0.06	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.67	0.00	0.00	1.64	1.98
			2	1.19	0.00	0.39	2.61	3.33
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.50	0.00	0.00	1.32	1.88
		2	1	0.04	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.45	0.00	0.00	0.90	1.33
			2	0.76	0.00	0.07	1.61	1.99
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.42	0.00	0.00	0.86	2.00
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.01	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.38	0.00	0.00	0.80	0.98
			2	0.68	0.00	0.00	1.65	2.42
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.00	0.00	0.00	0.00	0.00
			2	0.29	0.00	0.00	0.76	1.39
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

2036 With Dev Traffic, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	1,2,3	14.24	B

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically	Relationship type	Relationship
D11	2036 With Dev Traffic	PM	ONE HOUR	16:45	18:15	15	✓	Simple	D12+D9

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		ONE HOUR	✓	1449	100.000
2		ONE HOUR	✓	0	100.000
3		ONE HOUR	✓	592	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
1		
2		
3	Global	10.00

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	**2**	**3**
From	**1**	135	1058	256
	2	0	0	0
	3	51	541	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
1	17.76	8.7	24.5	C	1331	1996
2	0.00	0.0	~1	A	0	0
3	5.64	1.1	3.9	A	543	815

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1083	271	410		1084	140	0.0	1.8	5.909	A
2	0	0	292		0	1204	0.0	0.0	0.000	A
3	450	113	100	7.53	452	192	0.0	0.4	4.271	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1291	323	476		1289	167	1.8	3.0	7.831	A
2	0	0	341		0	1435	0.0	0.0	0.000	A
3	535	134	120	8.99	534	221	0.4	0.8	4.746	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1609	402	579		1598	208	3.0	8.2	15.536	C
2	0	0	434		0	1758	0.0	0.0	0.000	A
3	652	163	151	11.01	651	283	0.8	1.1	5.609	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1612	403	585		1600	204	8.2	8.7	17.756	C
2	0	0	435		0	1750	0.0	0.0	0.000	A
3	642	161	148	11.01	641	286	1.1	1.1	5.636	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1302	325	491		1308	169	8.7	2.8	9.066	A
2	0	0	350		0	1452	0.0	0.0	0.000	A
3	539	135	122	8.99	541	229	1.1	0.6	4.795	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	1086	272	398		1088	144	2.8	2.0	6.306	A
2	0	0	299		0	1189	0.0	0.0	0.000	A
3	440	110	103	7.53	440	195	0.6	0.6	4.243	A

Queue Variation Results for each time segment

16:45 - 17:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.81	0.00	0.80	3.73	5.35
2	0.00	0.00	0.00	0.00	0.00
3	0.44	0.00	0.00	0.98	1.58

17:00 - 17:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	3.05	0.00	1.89	6.40	8.53
2	0.00	0.00	0.00	0.00	0.00
3	0.80	0.00	0.00	1.92	2.65

17:15 - 17:30

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	8.15	0.08	5.50	17.05	24.10
2	0.00	0.00	0.00	0.00	0.00
3	1.05	0.00	0.07	2.71	3.90

17:30 - 17:45

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	8.68	0.00	6.07	20.73	24.53
2	0.00	0.00	0.00	0.00	0.00
3	1.07	0.00	0.05	2.81	3.58

17:45 - 18:00

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	2.78	0.00	1.73	5.32	6.52
2	0.00	0.00	0.00	0.00	0.00
3	0.65	0.00	0.00	1.61	2.23

18:00 - 18:15

Arm	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	1.99	0.00	1.11	4.02	5.01
2	0.00	0.00	0.00	0.00	0.00
3	0.55	0.00	0.00	1.38	2.01

Lane Results

Lane Level notation: Lane Level 1 is always closest to the junction.

Lanes: Main Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	477		982	0.486	477	0.0	0.8	5.372	A
			2	1,2,3	606		982	0.617	607	0.0	1.1	6.324	A
	Exit	**1**	**1**		140				140	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2125	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1204				1204	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	27		1250	0.021	27	0.0	0.0	2.939	A
			2	1,2	424		1250	0.339	425	0.0	0.4	4.102	A
		2	**1**	(1,2,3)	450	7.53			450	0.0	0.0	0.236	A
	Exit	**1**	**1**		192	7.53			192	0.0	0.0	0.079	A
		2	**1**		192				192	0.0	0.0	0.000	A

17:00 - 17:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	585		959	0.610	584	0.8	1.3	7.088	A
			2	1,2,3	705		959	0.735	705	1.1	1.8	8.448	A
	Exit	**1**	**1**		167				167	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2089	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1435				1435	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	32		1242	0.026	32	0.0	0.0	2.919	A
			2	1,2	502		1242	0.404	501	0.4	0.7	4.455	A
		2	**1**	(1,2,3)	535	8.99			535	0.0	0.1	0.383	A
	Exit	**1**	**1**		220	8.99			221	0.0	0.0	0.078	A
		2	**1**		221				221	0.0	0.0	0.000	A

17:15 - 17:30

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	768		924	0.831	763	1.3	3.7	14.457	B
			2	1,2,3	841		924	0.911	836	1.8	4.5	16.512	C
	Exit	**1**	**1**		208				208	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2021	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1758				1758	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	42		1230	0.034	42	0.0	0.0	3.038	A
			2	1,2	609		1230	0.495	609	0.7	0.8	4.960	A
		2	**1**	(1,2,3)	652	11.01			651	0.1	0.2	0.765	A
	Exit	**1**	**1**		283	11.01			283	0.0	0.0	0.105	A
		2	**1**		283				283	0.0	0.0	0.000	A

17:30 - 17:45

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	**Entry**	**1**	**1**	2	774		921	0.840	767	3.7	3.9	16.534	C
			2	1,2,3	838		921	0.910	833	4.5	4.7	18.884	C
	Exit	**1**	**1**		204				204	0.0	0.0	0.000	A
2	**Entry**	**1**	**1**	3	0		2021	0.000	0	0.0	0.0	0.000	A
	Exit	**1**	**1**		1750				1750	0.0	0.0	0.000	A
3	**Entry**	**1**	**1**	1	40		1231	0.033	40	0.0	0.0	2.965	A
			2	1,2	602		1231	0.489	601	0.8	0.9	5.001	A
		2	**1**	(1,2,3)	642	11.01			642	0.2	0.1	0.763	A
	Exit	**1**	**1**		286	11.01			286	0.0	0.0	0.117	A
		2	**1**		286				286	0.0	0.0	0.000	A

17:45 - 18:00

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	596		954	0.625	599	3.9	1.1	8.207	A
			2	1,2,3	706		954	0.740	709	4.7	1.7	9.794	A
	Exit	1	1		169				169	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2082	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1452				1452	0.0	0.0	0.000	A
3	Entry	1	1	1	33		1242	0.026	33	0.0	0.0	2.915	A
			2	1,2	507		1242	0.408	509	0.9	0.6	4.491	A
		2	1	(1,2,3)	539	8.99			540	0.1	0.0	0.404	A
	Exit	1	1		229	8.99			229	0.0	0.0	0.108	A
		2	1		229				229	0.0	0.0	0.000	A

18:00 - 18:15

Arm	Side	Lane level	Lane	Destination arms	Total Demand (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
1	Entry	1	1	2	478		986	0.485	479	1.1	0.7	5.689	A
			2	1,2,3	608		986	0.617	608	1.7	1.2	6.793	A
	Exit	1	1		144				144	0.0	0.0	0.000	A
2	Entry	1	1	3	0		2120	0.000	0	0.0	0.0	0.000	A
	Exit	1	1		1189				1189	0.0	0.0	0.000	A
3	Entry	1	1	1	26		1249	0.020	26	0.0	0.0	2.792	A
			2	1,2	414		1249	0.332	414	0.6	0.5	4.115	A
		2	1	(1,2,3)	440	7.53			440	0.0	0.0	0.209	A
	Exit	1	1		195	7.53			195	0.0	0.0	0.082	A
		2	1		195				195	0.0	0.0	0.000	A

Lanes: Queue Variation Results for each time segment

16:45 - 17:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.75	0.00	0.00	1.70	2.31
			2	1.05	0.00	0.28	2.15	2.94
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.03	0.00	0.00	0.00	0.00
			2	0.41	0.00	0.00	0.95	1.54
		2	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:00 - 17:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.28	0.00	0.39	2.82	3.79
			2	1.76	0.00	0.83	3.72	4.65
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.69	0.00	0.00	1.83	3.00
		2	1	0.07	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:15 - 17:30

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	3.66	0.00	2.00	7.89	11.53
			2	4.49	0.00	2.86	9.28	12.70
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.04	0.00	0.00	0.00	0.00
			2	0.81	0.00	0.00	3.00	3.00
		2	1	0.20	0.00	0.00	0.00	1.39
	Exit	1	1	0.02	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:30 - 17:45

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	3.94	0.00	2.07	9.65	11.42
			2	4.74	0.00	3.31	10.53	12.85
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.92	0.00	0.05	3.00	3.00
		2	1	0.13	0.00	0.00	0.00	0.65
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

17:45 - 18:00

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	1.10	0.00	0.35	2.17	2.79
			2	1.68	0.00	0.92	3.33	3.95
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.59	0.00	0.00	1.55	3.00
		2	1	0.03	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

18:00 - 18:15

Arm	Side	Lane level	Lane	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)
1	Entry	1	1	0.75	0.00	0.00	1.74	2.34
			2	1.24	0.00	0.53	2.49	3.12
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
2	Entry	1	1	0.00	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
3	Entry	1	1	0.02	0.00	0.00	0.00	0.00
			2	0.52	0.00	0.00	1.33	1.95
		2	1	0.02	0.00	0.00	0.00	0.00
	Exit	1	1	0.00	0.00	0.00	0.00	0.00
		2	1	0.00	0.00	0.00	0.00	0.00

14.0 MATERIAL ASSETS

14.1 INTRODUCTION

This chapter evaluates the impacts, if any, which the proposed development may have on Material Assets as defined in the EPA Draft EIA Report Guidelines 2017 and EPA Draft Advice Notes for EIS 2015.

14.2 METHODOLOGY

The EPA Draft EIA Report Guidelines 2017 state that material assets are taken to mean built services and infrastructure, roads and traffic and waste management. The EPA Draft Advice Notes for EIS 2015 also give the following examples of material assets; assimilative capacity of air, ownership and access and tourism. In this EIA Report, the impacts on some of the material assets described above have already been considered in the following chapters of this EIA Report:

- Chapter 5 Population and Human Health;
- Chapter 9 Air Quality & Climate;
- Chapter 13 Traffic & Transportation; and
- Chapter 15 Waste Management.

This chapter assesses ownership and access, built services and infrastructure, which have not already been addressed elsewhere in this EIA Report. The subsequent sections address built services and infrastructure. The potential impacts on built services and infrastructure, if any, are assessed in terms of the following:

- Power and Electrical Supply;
- Telecommunications;
- Surface water infrastructure;
- Foul drainage infrastructure; and
- Water supply.

14.3 OWNERSHIP AND ACCESS

The sites of the proposed development as described in Chapter 2: Description of the Proposed Development are owned by Dublin Port Company and will be leased by the Office of Public Works. A letter of consent, regarding development on the lands from the owner is included in Appendix 14.1

Access to the Bond Drive Extension sites is via a new access gate to the south east of the site and egress is via a gate to the south west of the site. There is a secondary access/egress gate to the Bond Drive Extension sites at the southwest corner for staff car parking. During the construction phase, in the Bond Drive Extension Site, entrance to the site will be at the south centre and egress will be at the southeast of the site. Access to the Yard 3 & 4 sites is via a new access gate to the northeast of the site and egress is via an existing gate to the southeast of the site. During the construction phase in the Yard 3 & 4 site, entrance will be at the southeast of the site and egress will be at the northeast of the site. The sites will be fully secured with a 3m high security fence, CCTV and surveillance systems. There is good visibility on approach to all access points as detailed in Chapter 13 Traffic and Transportation.

14.4 RECEIVING ENVIRONMENT

The proposed drainage infrastructure has been described in Chapter 2 (Description of the Development) and Chapter 7 (Hydrology).

The existing built services and infrastructure in the vicinity of the site are summarised below.

14.4.1 Power and Electrical Supply

The proposed development lands are currently serviced with electricity from the existing electrical transmission infrastructure located in Dublin Port.

14.4.2 Telecommunications

A new fibre optic cable distribution network will be required for the proposed development site.

14.4.3 Surface Water Infrastructure

There is a Dublin Port Company 525mm surface water sewer within Bond Drive which runs along the Southern Boundary of the proposed Bond Drive Extension Development site. There is a Dublin Port Company surface water sewer within Promenade Road which runs along the Southern Boundary of the proposed Yard 3 & 4 Development site. There is an existing 300mm surface water drain which crosses the Yard 3 & 4 site. Discharges will be through on site interceptors prior to discharge to the Port infrastructure. Discharge of stormwater from the Port is to Dublin Bay following further attenuation and treatment.

14.4.4 Foul Drainage Infrastructure

There is a Dublin Port Company 150mm foul sewer within Bond Drive which runs along the Southern Boundary of the proposed Bond Drive Extension Development site. There is a Dublin Port Company 225mm foul sewer within Promenade Road which runs along the Southern Boundary of the proposed Yard 3 & 4 development site. Both of these sewers ultimately discharge to WWTP at Ringsend.

14.4.5 Water Supply

Watermain records indicate that there is a 150dia watermain within the Bond Drive road along the Southern boundary of the Bond Drive development site with several existing 18mm diameter connections entering the Bond Drive site and one 18mm connection entering the Northern portion of the Yard 3 & 4 site. Watermain records indicate that there is a 150dia watermain within Bond Drive, and Promenade Road to the West and South respectively of the Yard 3 & 4 development site.

14.5 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

14.5.1 Power and Electrical Supply

As stated in section 14.4.1, the power supply for the proposed development will be provided via the existing power connection on site.

In the event of a loss of power supply i.e. temporary grid blackout, diesel powered back-up generators will be provided to maintain power supply. These generators are designed to automatically activate and provide power to the proposed development pending restoration of mains power. It is proposed to install 1 no. back-up generator per site.

All back-up generators will come complete with an integral storage tank. The tanks will be filled by tankers at the location of generator.

14.5.2 Telecommunications

A new fibre optic cable distribution network will be required for the proposed development site. New secure fibre connections will be installed by IGCIO as part of the works.

14.5.3 Surface Water Infrastructure

Rainwater runoff from building roofs, yards and the proposed access roads will be collected in new and existing storm water networks and discharged at a restricted rate to the relevant existing surface water sewer. Any flows over the allowable discharge rate will be attenuated on site. The attenuation storage provided will comprise of underground storage tanks. Bond Drive Extension site will require total attenuation of 1970m^3 while Yard 3 & 4 site will require total attenuation of 1000m^3.

The drainage design for the proposed developments includes 4no Class 1 bypass petrol interceptors. Bond Drive Extension site will require 3no interceptors in addition to the two number existing on site. Yard 3 & 4 will require 1no on site. The interceptors will be located prior to the discharge point for each site to ensure the quality of surface water discharging from the site.

For the Bond Drive Extension Development site, the attenuated storm water will be discharged by gravity at a controlled rate of 2.35 l/s at the Western end discharge point and 2.35 l/s from the two existing connections which will be maintained, and 11.8l/s at the Eastern end discharge point. There will be a total attenuated discharge from the proposed drainage network of 18.9/s. The discharge rate is in line with the equivalent runoff rate for the existing site.

The site will discharge to the existing storm water system along the Bond Drive Road via connections to the existing Dublin Port surface water drainage network.

For the Yard 3 & 4 Development site, the attenuated storm water will be discharged by Gravity at a controlled rate of 8.45/s (the equivalent runoff rate for the site) to the existing storm water system along the Promenade Road via a connection to the existing Dublin Port surface water drainage network.

All materials used on the proposed surface water network will be suitable for use in a marine environment.

14.5.4 Foul Drainage Infrastructure

Domestic effluent arising from occupation of the proposed Bond Drive Extension development will be collected in a new foul drainage network within the site and discharged to the existing Dublin Port foul sewer infrastructure located in Bond Drive Road. Domestic effluent arising from occupation of the proposed Yard 3 & 4 development will be collected in a new foul drainage network within the site and discharged to the existing Dublin Port foul sewer infrastructure located in Bond Drive Road and within Promenade Road. The wastewater discharged from the site will ultimately discharge to the municipal Wastewater Treatment Plant (WWTP) at Ringsend.

In addition, rainfall which passes through the back-up generator exhaust stacks will discharge to a Class 2 petrol interceptor before connecting to the main foul drainage network.

The proposed development will generate a modest increase in wastewater discharges compared with the existing land usage. Peak and average demand is 1.35 litres per second (l/s) and .225 litres per second (l/s) respectively for Yard 3 & 4 proposed development. Peak and average demand is 0.68 litres per second (l/s) and 0.113 litres per second (l/s) respectively for Bond Drive Extension proposed development. Discussions with Irish Water will be undertaken and completed to validate capacity of the receiving system.

All materials used on the proposed foul network will be suitable for use in a marine environment.

14.5.5 Water Supply

Water is required for, cleaning, general potable supply for drinking and sanitary facilities. This will be sourced from mains water supply. The design requires a peak water demand of up to 1.5l/s for Yard 3 & 4 proposed development, and up to 0.75l/s for Bond Drive Extension proposed development which is similar to the existing water demand from the existing site uses. Discussions with Irish Water will be undertaken and completed to validate capacity of the receiving system.

14.6 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

14.6.1 Construction Phase

Power and Electrical Supply
During construction, contractors will require power for heating and lighting of the site and their onsite accommodation. In addition, some on site equipment/plant will require power.

A mobile construction compound will be established, which will move across the site in line with construction phasing. Power will be provided via the existing electrical infrastructure on site. The power requirements for the construction phase will be relatively minor and therefore the power demand for the construction phase would have a potential short term imperceptible impact.

Telecommunications
Telecommunications including fibre required during the construction phase will be provided via a mobile connection.

The proposed development will connect directly to a new fibre optic cable distribution network being installed by the OGCIO. The connections will be via a physical fibre connection and a second connection via antenna for resilience.

There are no potential impacts associated with telecommunications for the proposed development for the construction phase.

Surface Water Infrastructure
The surface water connection works are within the verge outside the proposed site boundary, it anticipated that this would have minimal potential offsite impact.

During the lifespan of the development, there is the potential for degradation or damage to the drainage network due to the marine landscape the site is located in. Appropriate grade materials will be used which are suitable for this environment.

During construction, run-off of surface water containing silt will be contained on site and treated (using temporary on-site settlement ponds/tanks) to ensure adequate silt removal prior to discharge to the existing surface water sewer.

Foul Drainage Infrastructure
Welfare facilities (canteens, toilets etc.) will be required for the construction crew. Portable toilets will be provided onsite for construction staff.

During the lifespan of the development, there is the potential for degradation or damage to the drainage network due to the marine landscape the site is located in. Appropriate grade materials will be used which are suitable for this environment.

The connection to the existing 300mm foul sewer are within the verge outside the proposed site boundary, it anticipated that this would have any minimal potential offsite impact.

There are no potential impacts associated with wastewater management for the proposed development for the construction phase.

Water Supply
The contractor’s operations during the constructions stage have the potential to generate water demand. Welfare facilities (canteens, toilets etc.) will be required for the construction staff. A temporary connection to the mains water supply will be established for the construction phase. The demand during the construction phase is not expected to be significant enough to affect existing pressures.

The proposed developments will be connected to existing watermains that currently serves the site. As the connection works are entirely within proposed site boundaries, it not anticipated that this would have any perceptible offsite impact.

14.6.2 Operational Phase

Power and Electrical Supply
At the time of application it was confirmed by the utility provider that there is sufficient power available from the existing area network for the proposed development.

Telecommunications
A new fibre optic cable distribution network will be required for the proposed development site. New secure fibre connections will be installed by IGCIO as part of the works.

Surface Water Infrastructure

Surface water runoff from the proposed Bond Drive Extension development will be attenuated prior to discharge to the existing public sewer along Bond Drive Road. Surface water runoff from the proposed Yard 3 & 4 development will be attenuated prior to discharge to the existing public sewer along Bond Drive Road and along Promenade Road. There is a potential for increased surface water run-off from development of the green/brownfield areas of the existing sites. This will be managed through the use of a controlled discharge rate. The allowable discharge rate for Bond Drive Extension and Yard 3 & 4 are 18.9/s and 8.45/s respectively, which is the equivalent greenfield runoff rate for the sites. Interceptors are included on the stormwater outflow from the parking and internal road areas. As such the proposed development will have an imperceptible impact in terms of off-site flooding or water quality.

The design proposals and discharge flows have been confirmed with Dublin Port.

Foul Drainage Infrastructure

Foul sewerage from the proposed Bond Drive development will discharge to the 150mm foul sewer in Bond Drive Road. Foul sewerage from the proposed Yard 3 & 4 development will discharge to the 150mm foul sewer in Bond Drive Road, and to the 225mm foul sewer in Promenade Road. Based on the change of use of the proposed development areas, the increase in load to the public network is limited.

Water Supply

The water supply will be sourced from mains water supply via the existing 150mm watermain that serves both the proposed development sites. Peak water demand of up to 1.5l/s is required for Yard 3 & 4 proposed development, and up to 0.75l/s for Bond Drive Extension proposed development. This flow rate is consistent with the existing water demand use on the proposed development site.

14.7 REMEDIAL AND MITIGATION MEASURES

14.7.1 Construction Phase

Construction of the proposed development will require connections to water supply and drainage infrastructure, power and telecommunications. These connections will be made to local infrastructure direct adjacent to the site boundaries. The works outside of the site boundaries associated with these infrastructure connections will be limited to the local excavations, and re-instatement and have insignificant impact on the external receiving environment.

Ongoing consultation with DCC, Dublin Port Company, Irish Water, Eirgrid, ESB and other relevant service providers within the locality and compliance with any requirements or guidelines they may have will ensure a smooth construction schedule without disruption to local and business community. As such, no remedial or mitigation measures are required in relation to power supply for the construction phase.

Power and Electricity Supply

The power demand for the construction phase will be will be provided by an existing power supply on the site. Other works which may extend locally external to the site will be limited to the removal of any redundant electrical supplies and the making safe of redundant connections. As such, no remedial or mitigation measures are required in relation to power supply for the construction phase.

Telecommunications

The telecommunications will be provided by way of a mobile connection. As this involves no offsite work, it not anticipated that this would have any potential offsite impact. No remedial or mitigation measures are required in relation to telecommunications.

Surface Water Infrastructure

The works contractor will be obliged to put best practice measures in place to ensure that there are no interruptions to service in existing surface water sewers. It is not anticipated that there will be any interruptions to service in existing surface water sewers, but should interruptions be anticipated, they will be agreed in advance.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration (where existing water in the ground enters the surface water infrastructure) and ex-filtration (where water in the surface water infrastructure escapes into the ground).

Surface water discharge will be restricted to greenfield run-off rate for the site.

Foul Drainage Infrastructure

The foul drainage connection works are within the local roadway immediate adjacent to the proposed site boundary. The connection to this foul drainage infrastructure is very localised and it is anticipated that this would have minimal impact on the external area.

The works contractor will be obliged to put a number of measures in place to ensure that there is no impact on the foul drainage infrastructure during the construction works e.g. portable toilets will be provided for construction staff.

Foul drainage for the proposed development will be in accordance with the Building Regulations Technical Guidance Document H for design and construction.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

Water Supply

Welfare facilities (canteens, toilets etc.) will be required for the construction staff. A temporary connection will be put in place for the construction phase. The water connection works are within the verge outside the proposed site boundary, it anticipated that this would have minimal potential offsite impact.

The works contractor will be obliged to put best practice measures in place to ensure that there are no interruptions to service from the existing watermain. It is not anticipated that there will be any interruptions to service from the existing water main, but should interruptions be anticipated, they will be agreed in advance.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

14.7.2 Operational Phase

Power and Electricity Supply

At the time of application it was confirmed by the utility provider that there is sufficient power available from the existing area network for the proposed development.

Telecommunications
New secure fibre connections will be installed by IGCIO as part of the works. This will include a new physical fibre and an antennae connection. Once installed the impact of these fibres is insignificant during the operation phase. Therefore, no remedial or mitigation measures are required in relation to telecommunications.

Surface Water Infrastructure
The surface water drainage system for the proposed development incorporates runoff control in the form of attenuation, which will restrict discharge from the Bond Drive Extension development to the allowable rate of 18.9l/s and from the Yard 3 & 4 site development to the allowable rate of 8.45l/s. The attenuation storage within the Bond Drive Extension development will be provided via underground storage tanks (c. 1970m^3 total capacity). The attenuation storage within the Yard 3 & 4 development will be provided via an underground storage tank (c. 1000m^3 capacity). In addition, pervious paving will be installed at the site under car parking areas. These Sustainable Drainage Systems (SuDS) measures will prevent an increase in flooding offsite as a result of this development. The allowable greenfield runoff rate 5.1l/s/ha has been established by Arup.

Class 1 bypass petrol interceptors are incorporated in the stormwater drainage from each of the car park areas, to remove any hydrocarbons from the surface water runoff before it enters the attenuation storage.

Foul Drainage Infrastructure
Foul drainage for the proposed development will be in accordance with the relevant standards for design and construction, including the Irish Water Code of Practice for Wastewater Infrastructure, The Building Regulations Technical Guidance Document (TGD) 'Part H' & the Regional Code of Practice for Drainage Works.

The Applicant has engaged with Dublin Port to ensure the wastewater requirements for the development can be accommodated.

Water Supply
The Applicant has engaged with Dublin Port to ensure the water requirements for the development can be met from existing connections.

14.8 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

14.8.1 Construction Phase

Predicted Impact – Construction Phase
The implementation of mitigation measures detailed in Section 14.7.1 will ensure that the predicted impacts on the material assets will be ***short-term***, ***neutral*** and ***imperceptible*** for the construction phase.

14.8.2 Operational Phase

Predicted Impact – Operational Phase
The implementation of mitigation measures detailed in Section 14.7.2 will ensure that the predicted impacts on the material assets will be ***long-term***, ***neutral*** and ***not significant.***

14.9 RESIDUAL IMPACTS

The overall predicted impact of the proposed development can be classed as ***long-term*** and ***not significant*** with respect to material assets.

14.10 CUMULATIVE IMPACT ASSESSMENT

Chapter 14 considers the environmental effects as a result of the proposed development. The following considers the cumulative impacts of the proposed development and other proposed development in the surrounding area in relation to Material Assets.

14.10.1 Construction Phase

The proposed developments and permitted developments have engaged with Dublin Port, DCC and utility providers to ensure that there is sufficient capacity to cater for the increase in water, wastewater and electricity requirements construction of the proposed development taking into account existing and permitted developments.

The construction of the proposed development and other surrounding proposed and permitted developments require site clearance, excavations and levelling which will generate a requirement for soil removal and/or import. However, provided mitigation measures set out in the EIA Reports for these developments are implemented, the cumulative impact will be **short-term** and **imperceptible**.

14.10.2 Operational Phase

The proposed developments and permitted developments have engaged with Dublin Port, DCC and utility providers to ensure that there is sufficient capacity to cater for the increase in water, wastewater and electricity requirements for the proposed development taking into account existing and permitted developments.

The cumulative impacts associated with material assets will be ***long-term*** and ***imperceptible***.

APPENDIX 14.1

Letter from Dublin Port Company

COMHLACHT CHALAFORT
ÁTHA CLIATH
DUBLIN PORT COMPANY

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Port Centre, Alexandra Road, Dublin, D01 H4C6
T: +353 (0) 1 887 6000
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Samir Eldin
Office of Public Works
Head Office,
Jonathan Swift Street,
Trim,
C15 NX36

Dear Samir

Submission of EIAR to develop lands for HGV parking and associated facilities in Dublin Port

On behalf of the Dublin Port Company we confirm that the Office of Public Works have our consent to submit the above EIAR for development works on lands within the Dublin Port Estate to An Bord Pleanála

The application and development works will be at the applicant's expense.

Yours Sincerely

Cormac Kennedy
Head of Property
Dublin Port Company

Stiúrthóirí/Directors: M. Brophy, H. Collins, G. Darling, M. Hand, K. Nolan, L. Williams, E. O'Reilly (Bainistíochta/Managing)
Rúnaí/Secretary: M. Sheary Cláraithe in Éirinn le Dliteanas Teoranta uimh./Registered in Ireland with Limited Liability No. 262367 Uimh. CBL/VAT No. IE8262367G

15.0 WASTE MANAGEMENT

15.1 INTRODUCTION

This chapter has been prepared to address the issues associated with waste management during the construction and operational phases of the proposed development.

A site-specific Construction & Demolition Waste Management Plan (C&D WMP) has been prepared to deal with waste generation during the construction phase of the proposed development and is included as Appendix 15.1. The C&D WMP has been prepared in accordance with the '*Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects'* document produced by the National Construction and Demolition Waste Council (NCDWC) in conjunction with the Department of the Environment, Heritage and Local Government in July 2006.

15.2 METHODOLOGY

The assessment of the impacts of the proposed development arising from the generation of waste materials, was carried out taking into account the methodology specified in relevant guidance documents (as set out in Section 15.2.1), along with an extensive document review to assist in identifying current and future requirements for waste management including national and regional waste policy, waste strategies, management plans, legislative requirements and relevant reports. A summary of the documents reviewed, and the relevant legislation is provided in the references in Section 15.10 and in Appendix 15.1 (C&D WMP).

This Chapter is based on the proposed development, as described in Chapter 2 (Description of the Development) and considers the following aspects:

- Legislative context;
- Construction phase (including site preparation, excavation and levelling); and
- Operational phase.

A desk study was carried out which includes the following tasks:

- Review of applicable policy and legislation which creates the legal framework for resource and waste management in Ireland;
- Description of the typical waste materials that will be generated during the construction and operational phases; and
- Identification of mitigation measures to prevent waste generation and promote management of waste in accordance with the waste hierarchy.

Estimates of waste generation during the construction and operational phases of the proposed development have been calculated. The waste types and estimated quantities are based on published data by the EPA in *National Waste Reports*, data recorded from similar previous developments, Irish and US EPA waste generation research, other available research sources.

Mitigation measures are proposed to minimise the effect of the proposed development on the environment during the construction and operational phases, to promote efficient waste segregation and to reduce the quantity of waste requiring disposal. This information is presented in Section 15.6.

A detailed review of the existing ground conditions on a regional, local and site-specific scale are presented in Chapter 8 Land, Soils, Geology and Hydrogeology. Chapter 6 of the EIA Report also discusses the environmental quality of soils which will have to be excavated to facilitate construction of the proposed development.

15.2.1 Legislation and Guidance

Waste management in Ireland is subject to EU, national and regional waste legislation which defines how waste materials must be managed, transported and treated. The overarching EU legislation is the Waste Framework Directive (2008/98/EC) which is transposed into national legislation in Ireland. The cornerstone of Irish waste legislation is the Waste Management Act 1996 (as amended).

In addition, the Irish government issues regular policy documents which outline measures aimed to improve waste management practices in Ireland and help the country to achieve EU targets in respect of recycling and disposal of waste. The most recent policy document *A Resource Opportunity – Waste Management Policy in Ireland* was published in 2012 and stresses the environmental and economic benefits of better waste management, particularly in relation to waste prevention.

The strategy for the management of waste from the construction phase is carried out in line with the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* published by the Department of Environment, Heritage and Local Government (DoEHLG) in 2006. The guidance document published by FÁS and the Construction Industry Federation (CIF) *Construction and Demolition Waste Management: A handbook for Contractors and Site Managers* were also consulted in the preparation of this assessment.

There are currently no Irish guidelines on the assessment of operational waste generation and guidance is taken from industry guidelines, British Standards and other relevant studies and reports including BS 5906:2005 Waste Management in Buildings – Code of Practice, the Eastern-Midland Region Waste Management Plan 2015 – 2021, the EPA National Waste Database Reports 1998 – 2012 and the EPA National Waste Statistics Web Resource.

15.3 RECEIVING ENVIRONMENT

The proposed development is located within the Local Authority area of Dublin City Council (DCC).

In terms of waste management, the receiving environment is largely defined by DCC as the local authority responsible for setting and administering waste management activities in the area. This is governed by the requirements set out in the *Eastern-Midlands Region (EMR) Waste Management Plan 2015 – 2021*. The waste management plan sets the following targets for waste management in the region:

- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of *"70% preparing for reuse, recycling and other recovery of construction and demolition waste"* (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

The National Waste Statistics update published by the EPA in October 2018 identifies that Ireland's current progress against this C&D waste target is at 68% and our progress against 'Preparing for reuse and recycling of 50% by weight of household derived paper, metal, plastic & glass (includes metal and plastic estimates from household WEEE)' is at 45%. Both of these targets are required to be met by 12 December 2020 in accordance with the requirements of the Waste Framework Directive.

The Dublin City Development Plan 2016 – 2022 sets policies and objectives for their local areas which reflect those set out in the regional waste management plan.

In terms of physical waste infrastructure, DCC no longer operate any municipal waste landfill. However, there are numerous waste permitted and licensed facilities located in the Eastern-Midlands Waste Region for management of waste from the construction industry as well as municipal sources. These include soil recovery facilities, inert C&D waste facilities, hazardous waste treatment facilities, municipal waste landfills, material recovery facilities, waste transfer stations and waste-to-energy facilities.

15.4 CHARACTERISTICS OF THE DEVELOPMENT

The proposed development is described in detail in Chapter 2 (Description of the Proposed Development) of this EIA Report. The aspects relevant to this chapter are described in the following sections.

15.4.1 Demolition Phase

Demolition will be carried out as part of the proposed development. The gross floor area of structures to be demolished is 1,004m$^{2.}$ i.e. 155m^2 of Yard 4 and 849m^2 of Yard 3. Demolition activities are anticipated to generate approximately 602.4m^3 of waste. The approximate break-down for indicative reuse (offsite), recycling and disposal targets of demolition waste is presented in Table 4.1.

Table 15.1 Estimated off-site reuse, recycle and disposal rates for demolition waste

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	6.0	0	0.0	85	5.1	15	0.9
Concrete, Bricks, Tiles, Ceramics	397.6	30	119.3	65	258.4	5	19.9
Plasterboard	24.1	0	0.0	60	14.5	10	2.4
Metal	102.4	5	5.1	80	81.9	15	15.4
Timber	72.3	10	7.2	60	81.9	30	21.7
Total	**602.4**		**131.6**		**403.3**		**60.2**

The appointed contractor will be required to prepare a detailed demolition management plan prior to work commencing which should refine the above estimated waste figures.

15.4.2 Construction Phase

Site preparation, pile foundation excavations and other enabling works required to facilitate construction of foundations, access roads and the installation of services will generate c. 32,208m^3 of made ground and soils and stones.

It is currently anticipated that the excavated material will not be required and/or suitable for reuse on-site and will be removed off-site as a waste. Removal and reuse/recycling/recovery/disposal of the material will be carried out in accordance with the *Waste Management Act 1996* (as amended), the *Waste Management (Collection Permit) Regulations 2007* (as amended) and the *Waste Management (Facility Permit & Registration) Regulations 2007* (as amended). The volume of waste requiring recovery/disposal will dictate whether a Certificate of Registration (COR), permit or licence is required by the receiving facility.

Any excavated material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material, will be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous'* using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will also be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria for Polycyclic Automatic Hydrocarbons (PAHs) and other landfill specific acceptance criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.Soils/stones that are not required and/or suitable for reuse on-site, may be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the event of hazardous material being encountered, be transported for treatment/recovery or exported abroad for disposal in suitable facilities.

During the construction phase, waste produced will include surplus steel and metal materials and broken/off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated.

Waste will also be generated from construction workers e.g. organic/food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

Further detail on the waste materials likely to be generated during the excavation and construction works are presented in the project-specific C&D WMP included as Appendix 15.1. The C&D WMP provides an estimate of the main waste types likely to be generated during the construction phase of the proposed development and these are summarised in Table 15.2.

Table 15.2 Estimated off-site reuse, recycling and disposal estimates for construction waste

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D Waste	46	10	5	80	37	10	5
Timber	39	40	16	55	22	5	2
Plasterboard	14	30	4	60	8	10	1
Metals	11	5	1	90	10	5	1
Concrete	8	30	3	65	5	5	0
Other (includes cabling, ducting, conduits, packaging and plastics)	21	20	4	60	13	20	4
Total	**140**	-	**32**	**-**	**95**	**-**	**13**

It should be noted that until final materials and detailed construction methodologies have been confirmed it is difficult to predict with a high level of accuracy the construction waste that will be generated from the construction of the proposed development as the exact materials and quantities may be subject to some degree of change and variation during the construction process. However, the above estimates are considered to be the worst-case scenario.

The appointed contractor(s) will be required to prepare a detailed Construction Environmental Management Plan (CEMP) prior to commencement of construction which may refine the above waste estimates.

15.4.3 Operational Phase

An Operational Waste Management Plan (OWMP) will be developed prior to commencement. The plan will seek to ensure the facility contributes to the targets outlined in the EMR Waste Management Plan 2015 – 2021. Mitigation measures proposed to manage impacts arising from wastes generated during the operation of the proposed development are summarised below.

Segregation of Waste Materials Onsite

All waste materials will be segregated into appropriate categories and will be stored in appropriate bins or other suitable receptacles in a designated, easily accessible areas of the site.

Table 15.2 below summarises the anticipated management strategy to be used for typical wastes to be generated at the proposed development.

Table 15.2 Anticipated Onsite Waste Management

Waste Type	Hazard Y/N	On-site Storage/Treatment Method (anticipated)	Method of Treatment or Disposal (offsite)
Packaging Waste	N	Segregated bins/skips	Recycle
Office Waste	N	Segregated bins/skips	Recycle
General Non-Hazardous Waste	N	Segregated bins/skips	Recovery
Empty Containers	N	Segregated bins/skips	Disposal to landfill

Canteen/Kitchen Waste	N	Segregated bins for compost, mixed recyclable and general waste	Compost food waste. Recycle mixed dry recyclable waste. Recovery of other general waste
Non-hazardous WEEE	N	Segregated bins for waste electric and electronic equipment	Recovery
Landscaping waste	N	Composting bins	Composting
Waste Oil	Y	Oil drum in external waste storage area	Recovery
Waste sludge from oil separator	Y	Storage tank connected to oil separator	Recovery or disposal
(Wet) Batteries	Y	Specialised container in waste storage area	Return to supplier
(Dry) Batteries	Y	Specialised container in waste storage area	Recovery

Management of Wastes Moving Offsite

All waste leaving site will be recycled or recovered, with the exception of those waste streams where appropriate recycling facilities are currently not available.

All waste leaving the site will be transported by suitably permitted contractors and taken to suitably licensed or permitted facilities. All waste leaving the site will be recorded and copies of relevant documentation maintained.

Hazardous Waste

Hazardous waste may be generated from batteries, contaminated chemical drums and other packaging. If the packaging contains residues of or if it is contaminated by dangerous substances, it may be classed as a hazardous waste (depending on the volume and concentration of contaminants). If the drums are found to be unsuitable for re-use, they will be classed as a waste. Any waste classed as hazardous will be stored in a designated area (suitably bunded, where required) and will be removed off site by a licensed hazardous waste contractor(s).

Waste sludge collected from the full retention and bypass interceptors and the hydrodynamic solid separator will be pumped out/removed as required by a suitably permitted/licenced contractor.

15.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

This section details the potential waste impacts associated with the proposed development.

15.5.1 Construction Phase

The proposed development will generate a range of non-hazardous and hazardous waste materials during the demolition and construction phases. Demolition and construction activities will generate quantities of waste from surplus made ground, soils/stones and waste from oversupply of materials, incorrect materials delivered, or materials are cut to size on-site. General housekeeping and packaging will also generate waste materials as well as typical municipal wastes generated by construction employees including food waste.

Waste materials will be required to be temporarily stored on site pending collection by a waste contractor. Dedicated areas for waste skips and bins will be identified in the construction compound and across the site, as required. The dedicated waste storage areas will be easily accessible to waste collection vehicles.

If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the development and on adjacent developments. The knock-on effect of litter issues is the presence of vermin within the development and the surrounding areas.

All waste contractors collecting waste from the site must hold a valid collection permit to transport waste which is issued by the National Waste Collection Permit Office (NWCPO). It is essential that all waste materials are dealt with in accordance with regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices.

Demolition and construction wastes will be taken to suitably registered/permitted/licenced waste facilities for processing and segregation, recycling, recover and/or disposal. There are numerous licensed waste facilities in the Dublin and Meath regions which can accept hazardous and non-hazardous waste materials and acceptance of waste from the proposed development would be in line with daily activities at these facilities. At present, there is sufficient capacity for the acceptance of construction waste materials at facilities in the region and, where possible, waste will be segregated into recyclable and recoverable materials. The majority of construction materials are either recyclable or recoverable.

Recovery and recycling of construction waste has a positive impact on sustainable resource consumption, for example where waste timber is mulched into a landscaping product or waste concrete is recycled for use in new pavements. The use of recycled materials, where suitable, reduces the consumption of natural resources.

There is a quantity of made ground and soil and stone which will need to be excavated to facilitate the proposed development (i.e. 32,208m^3). Any surplus excavated material will need to be removed off-site. Visual and olfactory inspections of the excavated material will be required to ensure that any potentially contaminated materials are identified, segregated, classified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site.

Reuse of excavated material offsite, where feasible, will reduce consumption of natural quarry resources.

The opportunities for waste materials to be reused off-site will provide positive impacts in the resourcing of materials for other developments and reduce the requirement for raw material extraction.

The potential effect of construction waste generated from the proposed development is considered to be ***short-term, negative*** and ***not significant.***

15.5.2 Operational Phase

The nature of the development means that the generation of waste materials during the operational phase is an unavoidable impact. Networks of waste collection, treatment, recovery and disposal infrastructure are in place in the region to manage waste efficiently from this type of development. Waste which is not suitable for recycling is typically sent for energy recovery. There are also facilities in the region for segregation of municipal recyclables which is typically exported for conversion into recycled products (e.g. paper mills and glass recycling).

Dedicated waste storage areas are provided for storage of waste pending collection by nominated waste contractors.

If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the development and on adjacent developments. The knock-on effect of litter issues is the presence of vermin within the development and the surrounding areas.

Waste collection vehicles will be required to service the development on a regular basis to remove waste.

All waste contractors collecting waste from the site must hold a valid collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO) and waste will only be brought to suitably registered/permitted/licenced facilities. It is essential that all waste materials are dealt with in accordance with regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices.

The potential impact of operational waste generation from the development is considered to be ***long-term, negative*** and ***not significant***.

15.5.3 Do Nothing Scenario

If the proposed development was not to go ahead there would be no additional construction or operational waste generation at the site**.**

15.6 REMEDIAL AND MITIGATION MEASURES

This section outlines the measures that will be employed in order to reduce the amount of waste produced, manage the wastes generated responsibly and handle the waste in such a manner as to minimise the effects on the environment.

15.6.1 Construction Phase

A site specific C&D WMP has been prepared in line with the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* guidance document issued by the Department of Environment Heritage and Local Government (DoEHLG). Adherence to the high-level strategy presented in this C&D WMP will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the demolition and construction phases of the proposed development. Prior to commencement of demolition and construction, the contractor(s) will be required to refine/update this document to detail specific measures to minimise waste generation and resource consumption and provide DCC with details of the proposed waste contractors and destinations of each waste stream.

The project engineers, Arup, have estimated that 32,208m^3 of made ground and soils/stones will be generated from the excavations required to facilitate construction. It is currently anticipated that all this material will be exported off site. It will be reused or recovered off-site insofar as is reasonably practicable. Where there is no suitable reuse or recovery option available, it will be disposed of at an authorised facility.

In addition, the following mitigation measures will be implemented:

- Building materials will be chosen with an aim to ‘design out waste’;
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated:

  - Concrete rubble (including ceramics, tiles and bricks);
  - Plasterboard;
  - Metals;
  - Glass; and
  - Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks/bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be temporarily stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);
- A waste manager will be appointed by the main contractor(s) to ensure effective management of waste during the excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

These mitigation measures will ensure that the waste arising from the construction phase of the development is dealt with in compliance with the provisions of the *Waste Management Act 1996*, as amended, associated Regulations, the *Litter Pollution Act 1997 to 2009* and the *EMR Waste Management Plan (2015 - 2021)*. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved and will encourage sustainable consumption of resources.

15.6.2 Operational Phase

An Operational Waste Management Plan (OWMP) will be developed prior to commencement.

All waste materials will be segregated into appropriate categories and will be temporarily stored in appropriate bins or other suitable receptacles in a designated, easily accessible areas of the site.

In addition, the following mitigation measures will be implemented:

- On-site segregation of all waste materials into appropriate categories including (but not limited to):
  - Dry Mixed Recyclables;
  - Organic food/green waste;
  - Mixed Non-Recyclable Waste;
  - Batteries (non-hazardous and hazardous);
  - Waste electrical and electronic equipment (WEEE) including computers, printers and other ICT equipment; and
  - Cleaning chemicals (solvents, pesticides, paints, adhesives, resins, detergents, etc.).
- All waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily accessible locations. Bins will be clearly

labelled with the approved waste type to ensure there is no cross contamination of waste materials;

- All waste collected from the development will be reused, recycled or recovered where possible, with the exception of those waste streams where appropriate facilities are currently not available;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

These mitigation measures will ensure the waste arising from the development is dealt with in compliance with the provisions of the *Waste Management Act 1996*, as amended, associated Regulations, the *Litter Pollution Act 1997* and the *EMR Waste Management Plan (2015 - 2021)*. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.

15.7 PREDICTED IMPACTS OF THE DEVELOPMENT

This section describes the predicted impact of the proposed development following the implementation of the remedial and mitigation measures.

15.7.1 Construction Phase

A carefully planned approach to waste management as set out in Section 15.6.1 and adherence to the C&D WMP during the construction and demolition phase will ensure that the impact on the environment will be ***short-term, neutral*** and ***imperceptible***.

15.7.2 Operational Phase

During the operational phase, a structured approach to waste management as set out in Section 15.6.2 will promote resource efficiency and waste minimisation. Provided the mitigation measures are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted impact of the operational phase on the environment will be ***long-term, neutral*** and ***imperceptible***.

15.8 RESIDUAL IMPACTS

Adherence to the mitigation measures outlined in Section 15.6.1 and 15.6.2 will ensure that there are no significant impacts on resource or waste management from the proposed development. The management of waste during the construction phase in accordance with the C&D Waste Management Plan and during the operational phase in accordance with the mitigation measures in Section 15.6.2 will meet the requirements of regional and national waste legislation and promote the management of waste in line with the priorities of the waste hierarchy. The residual impact will be ***neutral*** and ***imperceptible***.

Interactions are addressed in Chapter 16 of this EIA Report.

15.9 CUMULATIVE IMPACTS

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (including other Brexit related developments at nearby sites T7, T9 T10 and Yard 2, the MP2 project, the Alexandra Basin Redevelopment, and the Greenway project.

Brexit related facilities that were developed in 2019 at the nearby sites of T7, T9 and

T10 were considered. These were granted consent under Ministerial Orders (Ministerial Order S.I. No. 57/2019 for T7, Ministerial Order S.I. No. 57/2019 for T9 and Ministerial Order S.I. No. 285/2019 for T10) and were screened for AA and EIA. Similarly, Brexit related development at Yard 2 (deemed exempt from the requirement of planning permission) was also considered. Yard 2 was screened for AA and EIA. Please refer to Drawing A20001_EIAR-01-002_Port Sites_A1 for full details of these sites.

No further construction works are proposed at the T7 and T9 sites. Minor internal alterations are planned for T10 and a 185m2 extension to cater for animal inspection is planned for Yard 2. No major infrastructural work is required at these sites and the proposed minor works are considered temporary and imperceptible (following EPA Guidelines 2017)

There is no predicted significant cumulative impact associated with the construction or operational phase of these projects.

In a worst-case scenario, all developments could be developed concurrently or overlap in the Construction Phase in the area. Due to the high number of waste contractors the DCC region there would be sufficient contractors available to handle waste generated from all sites simultaneously, if required. Similar waste materials are likely to be generated by all of the developments.

The commercial/industrial developments in the area and this proposed development will generate similar waste types during their operational phases. Authorised waste contractors will be required to collect waste materials segregated, at a minimum, into recyclables, organic waste, non-recyclables and hazardous. An increased density of development in the area will improve the efficiencies of commercial waste collections in the area.

15.10 REFERENCES

- Department of Environment, Heritage and Local Government, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006).
- Environmental Protection Agency (EPA), *National Waste Database Reports 1998 – 2012*.
- Waste Management Act 1996 (No. 10 of 1996) as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended.
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended.
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended.
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended.
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended.
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended.
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009)

  as amended.
  - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
  - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended.
  - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended.
  - European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)
  - European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
  - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015)
- Protection of the Environment Act 2003, (No. 27 of 2003) as amended.
- Litter Pollution Act 1997 (S.I. No. 12 of 1997) as amended
- Department of Environment, Communities and Local Government (DoECLG), *A Resource Opportunity - Waste Management Policy in Ireland* (2012).
- FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and Site Managers* (2002).
- BS 5906:2005 Waste Management in Buildings – Code of Practice
- Eastern-Midlands Region Waste Management Plan 2015 – 2021 (2015).
- Environmental Protection Agency (EPA), *National Waste Statistics Web Resource – Progress to EU Targets* (October 2018)
- Dublin City Council (DCC)*, Dublin City Develoment Plan 2016-2022 (2015)*
- EPA, *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015)
- Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

APPENDIX 15.1

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

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APPENDIX 15.1

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

PROPOSED BREXIT INFRASTRUCTURE AT DUBLIN PORT, DUBLIN 3

Technical Report Prepared By

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Our Reference

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Date	30/04/2020	30/04/2020

CONTENTS

1.0 INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Construction and Demolition (C&D) Waste Management Plan (WMP) for a proposed Brexit Infrastructure at Bond Drive Extension and Promenade Road, Dublin Port, Dublin 3.

The purpose of this C&D WMP is to provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with current legal and industry standards including the *Waste Management Acts 1996-2011* and associated Regulations [1], *Protection of the Environment Act 2003* as amended [2], *Litter Pollution Act 1997* as amended [3] and the *Eastern-Midlands Region Waste Management Plan 2015-2021* [4]. In particular, this C&D WMP aims to ensure maximum recycling, re-use and recovery of waste with diversion from landfill, where possible. It also seeks to provide guidance on the appropriate collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil or water resources).

In the preparation of the C&D WMP consideration has been given to the requirements of National and Regional waste policy, legislation and other guidelines (referred to in Section 2.0). However, in determining the structure and content of the document, the following two publications have been referenced in particular:

- Department of the Environment, Heritage and Local Government (DoEHLG), *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006) [5].
- FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and Site Managers,* (2002) [6].

These Guidance Documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

2.0 OVERVIEW OF WASTE MANAGEMENT IN IRELAND

2.1 National Level

The Government issued a policy statement in September 1998 titled as *'Changing Our Ways'* [7] which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland [7]. The target for C&D waste in this Strategy was to recycle at least 50% of C&D waste within a five-year period (by 2003), with a progressive increase to at least 82% over fifteen years (by 2013) [7].

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction Industry, released a report titled *Recycling of Construction and Demolition Waste* [8] concerning the development and implementation of a voluntary construction industry programme to meet the governments objectives for the recovery of construction and demolition waste.

A number of additional National and Regional Waste Policies, Strategies and Reports have been issued in previous years including:

- Department of the Environment, Heritage and Local Government (DoEHLG), *Preventing and Recycling Waste - Delivering Change* (2002);

- DoEHLG, *Making Ireland's Development Sustainable – Review, Assessment and Future Action, World Summit on Sustainable Development* (2002);
- DoEHLG, *Taking Stock and Moving Forward* (2004);
- DoEHLG, *National Strategy on Biodegradable* Waste (2006); and
- DoEHLG, *A Resource Opportunity* (2012).

The most recent national policy document was published in July 2012, entitled *A Resource Opportunity - Waste Management Policy in Ireland* [9]. This document stresses the environmental and economic benefits of better waste management, particularly in relation to waste prevention. The document sets out a number of actions in relation to C&D waste - it commits to undertake a review of specific producer responsibility requirements for C&D projects over a certain threshold.

The National Construction and Demolition Waste Council (NCDWC) was launched in June 2002, as one of the recommendations of the Forum for the Construction Industry, in the Task Force B4 final report. The NCDWC subsequently produced *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* in July 2006 in conjunction with the Department of the Environment, Heritage and Local Government (DoEHLG).

The guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted construction and demolition wastes;
- Procedures to prevent and minimise wastes;
- Options for reuse/recycling/recovery/disposal of construction and demolition wastes;
- Provision of training for Waste Manager and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of proposed consultation with relevant bodies i.e. waste recycling companies, Dublin City Council, etc.

2.2 Regional Level

The proposed development is located in the Local Authority area of Dublin City Council (DCC).

The Eastern-Midlands Region (EMR) Waste Management Plan 2015 – 2021 is the current regional waste management plan for the DCC area. The plan does not set specific targets for construction and demolition (C&D) waste, however, the Waste Framework Directive (WFD) sets a target for Member States of "70% preparing for reuse, recycling and other recovery of construction and demolition waste (excluding natural soils and stones and hazardous wastes)" to be achieved by 2020, which is highlighted in the regional plan. Other mandatory targets set in the Plan include:

- A 1% reduction per annum in the quantity of household waste generated over the period of the plan;
- Achieve a reuse/recycling rate of 50% of municipal waste by 2020; and
- Reduce to 0% the direct disposal of residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

Municipal landfill charges in Ireland are based on the weight of waste disposed. Landfill charges in the region are approximately €130-150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012*.

The *Dublin City Development Plan 2016 – 2022*[10] sets out a number of policies and objectives for Dublin City in line with the objectives of the regional waste management plan. The plan identifies the development of recycling in order to minimise the use of landfill as the main objective of the City Council. Waste policies and objectives with a particular relevance to the proposed development are:

Policies:

- *SI19: To support the principles of good waste management and the implementation of best international practice in relation to waste management in order for Dublin City and the region to become self-reliant in terms of waste management.*
- *SI20: To prevent and minimise waste and to encourage and support material sorting and recycling.*
- *SI21: To minimise the amount of waste which cannot be prevented and ensure it is managed and treated without causing environmental pollution.*

Objectives:

- *SIO17: To promote the re-use of building materials, recycling of demolition material and the use of materials from renewable sources. In all developments in excess of 10 housing units and commercial developments in excess of 1000 sqm, a materials source and management plan showing type of materials/proportion of re-use/recycled materials to be used shall be implemented by the developer.*
- *SIO18: To implement the current Litter Management Plan through enforcement of the litter laws, street cleaning and education and awareness campaigns.*
- *SIO19: To implement the Eastern-Midlands Waste Management Plan 2015-2021 and achieve the plan targets and objectives.*

2.3 Legislative Requirements

The primary legislative instruments that govern waste management in Ireland and applicable to the project are:

- Waste Management Act 1996 (No. 10 of 1996) as amended. Sub-ordinate legislation includes:
  - European Communities (Waste Directive) Regulations 2011 (SI 126 of 2011) as amended
  - Waste Management (Collection Permit) Regulations (S.I No. 820 of 2007) as amended
  - Waste Management (Facility Permit and Registration) Regulations 2007, (S.I No. 821 of 2007) as amended
  - Waste Management (Licensing) Regulations 2004 (S.I. No. 395 of 2004) as amended
  - Waste Management (Packaging) Regulations 2014 (S.I. 282 of 2014) as amended
  - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
  - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)

  - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
  - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
  - Waste Management (Food Waste) Regulations 2009 (S.I. 508 of 2009), as amended
  - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
  - Waste Management (Hazardous Waste) Regulations, 1998 (S.I. No. 163 of 1998) as amended
  - Waste Management (Shipments of Waste) Regulations, 2007 (S.I. No. 419 of 2007) as amended
  - Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998)
  - European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)
  - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended.
- Environmental Protection Act 1992 (No. 7 of 1992) as amended.
- Litter Pollution Act 1997 (No. 12 of 1997) as amended.
- Planning and Development Act 2000 (No. 30 of 2000) as amended.

These Acts and subordinate Regulations enable the transposition of relevant European Union Policy and Directives into Irish law.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Acts 1996 – 2011 and subsequent Irish legislation, is the principle of *"Duty of Care"*. This implies that the waste producer is responsible for waste from the time it is generated through until its legal reuse, recycling, recovery and/or disposal (including its method of reuse, recycling, recovery and/or disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, waste contractors will be employed to physically transport waste to the final waste reuse, recycling, recovery and/or disposal site. Following on from this is the concept of *"Polluter Pays"* whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the appointed construction contractor is legally compliant with respect to waste transportation, reuse, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and reuse/recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended, or a waste or Industrial Emissions (IE) licence granted by the EPA. The COR/permit/licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

3.0 DESCRIPTION OF THE PROJECT

3.1 Location, Size and Scale of the Development

The proposed development consists of Brexit Infrastructure at Bond Drive Extension and Promenade Road, Dublin Port, Dublin 3.

A detailed description of the proposed development is provided in Chapter 2 (Description of the Proposed Development) of the EIA Report. A description of the characteristics of the proposed development relevant to waste are described in Section 14.4 of Chapter 14 (Waste Management).

3.2 Overview of the Non-Hazardous Wastes to be produced

There will be waste materials generated from the demolition of the existing structures, hardstanding areas, as well as from the further excavation and removal of the building foundations. The volume of waste generated from demolition will be more difficult to segregate than waste generated from the construction phase, as many of the building materials will be bonded together or integrated i.e. plasterboard on timber ceiling joists, steel embedded in concrete etc.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services will generate c. 32,208m^3 of excavated material (as advised by the project engineers, Arup). It is anticipated that all excavated material will be brought off site as a waste.

The main buildings at the site will be constructed from structural steel. It is expected that throughout the construction phase, waste will be produced from surplus steel and metal materials and broken/off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

Waste will also be generated from construction workers e.g. organic/food waste, dry mixed recyclables (wastepaper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

3.3 Potentially Hazardous Waste

3.3.1 Contaminated Soil

Any excavated material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material, will be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous'* using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will also be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

Excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated in accordance with the above procedure.

Further details on the soil quality at the site is provided in Chapter 5 (Land, Soils, Geology and Hydrogeology).

3.3.2 Fuel/Oils

As fuels and oils are classed as hazardous materials, any on-site storage of fuel/oil, all storage tanks and all draw-off points will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and the site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil waste generated at the site.

3.3.3 Japanese Knot Weed and Other Invasive Plant Species

An invasive species survey was undertaken at the proposed development site by Moore Group Environmental Services. The report dated 4th March 2020, states that there are two records of Japanese Knotweed (*Fallopia japonica*) in the survey area. Both stands of this Third Schedule species have been previously identified and have been cordoned off accordingly in the temporary site compound at the most eastern site on Bond Road. The Japanese Knotweed is presently being managed as part of the Dublin Port Internal Roads and Greenway development currently under construction.

The report also states that Butterfly bushes (*Buddleia)* were found to be abundant along the seaward boundary of the entire site boundary. There were occasional small plants within the site of low concern. The report concludes that the Butterfly bushes are of low concern and the access track plants can be avoided. Single plants in the development area can be removed with construction waste or buried on site.

3.3.4 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances, if generated will be stored in designated areas. They will generally be present in small volumes only, if generated, and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, WEEE (containing hazardous components), printer toner/cartridges, and batteries (Lead, Ni-Cd or Mercury) may be generated from during C&D activities or temporary site offices. These wastes (if encountered) will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

3.4 Main Construction and Demolition Waste Categories

The main non-hazardous and hazardous waste streams that may typically be generated by the construction activities at the proposed site are presented in Table 3.1. The List of Waste code (also referred to as the European Waste code or EWC) for each waste stream is also shown.

Table 3.1. Typical waste types generated, and List of Waste Codes

Waste Material	**LoW/EWC Code**
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Treated wood, glass, plastic, containing hazardous substances	17-02-04*
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Gypsum-based construction material	17 08 01* & 02
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Insulation materials	17 06 04
Insulation containing asbestos and asbestos-containing construction materials and other insulation containing hazardous substances	17-06-01*, 03* & 05*
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

** individual waste type may contain hazardous materials*

4.0 ESTIMATED WASTE ARISINGS

4.1 Demolition Waste Generation

Demolition works at the site will involve the demolition of the existing structures and hard standing areas on site. The gross floor area of structures to be demolished is 1,004m^2. i.e. 155m^2 of Yard 4 and 849m^2 of Yard 3.

Demolition figures published by the EPA in the *'National Waste Reports'* [14] and data from previous projects have been used to estimate the approximate break-down for indicative reuse (offsite), recycling and disposal targets of demolition waste. This breakdown is shown in Table 4.1.

Table 0.1 Estimated off-site reuse, recycle and disposal rates for demolition waste

Waste Type	**Tonnes**	**Reuse/Recovery**		**Recycle**		**Disposal**	
		%	**Tonnes**	**%**	**Tonnes**	**%**	**Tonnes**
Glass	6.0	0	0.0	85	5.1	15	0.9
Concrete, Bricks, Tiles, Ceramics	397.6	30	119.3	65	258.4	5	19.9
Plasterboard	24.1	0	0.0	60	14.5	10	2.4
Metal	102.4	5	5.1	80	81.9	15	15.4
Timber	72.3	10	7.2	60	81.9	30	21.7
Total	**602.4**		**131.6**		**403.3**		**60.2**

The appointed demolition contractor will be required to prepare a detailed demolition management plan prior to work commencing which should refine the above estimated waste figures.

4.2 Construction Waste Generation

Table 4.2 shows the breakdown of construction waste types produced on a typical site based on data from EPA *National Waste Reports* [13].

Table 4.2. Breakdown of waste materials generated on a typical Irish construction site *(Source: EPA National Waste Reports)*

Waste Types	**%**
Mixed C&D	33
Timber	28
Plasterboard	10
Metals	8
Concrete	6
Other	15
Total	**100**

An assessment has been undertaken to estimate the quantity of construction waste likely to be generated from the proposed data storage facility development.

Table 4.3 presents the estimated construction waste quantities based on the gross floor area of the buildings to be constructed and includes indicative targets for off-site reuse, recycling and recovery.

Table 4.3. Estimated on and off-site reuse, recycling and disposal rates for construction waste (based on floor size)

Waste Type	**Tonnes**	**Reuse/Recovery**		**Recycle**		**Disposal**	
		%	**Tonnes**	**%**	**Tonnes**	**%**	**Tonnes**
Mixed C&D Waste	46	10	5	80	37	10	5
Timber	39	40	16	55	22	5	2
Plasterboard	14	30	4	60	8	10	1
Metals	11	5	1	90	10	5	1
Concrete	8	30	3	65	5	5	0
Other (includes cabling, ducting, conduits, packaging and plastics)	21	20	4	60	13	20	4
Total	**140**	-	**32**	**-**	**95**	**-**	**13**

In addition, as noted in Section 3.2, the quantity of excavated material that will be generated has been estimated by Arup to be c. 32,208m^3 of made ground and soils and stones. It is anticipated that all excavated material will be brought off site as a waste for appropriate reuse/recovery/disposal offsite.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

The appointed contractor(s) will be required to prepare a detailed Construction Environmental Management Plan (CEMP) prior to commencement of construction which may refine the above waste estimates.

All waste arising during the construction phase will be transported off-site by an approved waste contractor holding a current waste collection permit. All waste arising requiring reuse, recycling, recovery or disposal off-site will be brought to facilities holding the appropriate COR, permit or licence, as required.

4.3 Proposed Waste Management Options

4.3.1 Waste Management Options for Excavated Materials

The Waste Management Hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. Any excavations carried out will be required to facilitate construction works so the preferred option of prevention and/or minimisation will not be applicable.

The project engineers, Arup, have estimated that c. 32,208m^3 of made ground and soils and stones will be generated. It is proposed that all excavated material will be removed from site as a waste.

All removal and reuse/recycling/ recovery/disposal of excavated material arising will be carried out in accordance with the *Waste Management Acts 1996 – 2011* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. The volume of waste removed will dictate whether a COR, permit or licence is required by the receiving waste facility. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

Any potentially contaminated material encountered will be segregated from clean/inert material and tested and classified for disposal as set out in Section 3.3.1. Any material subsequently classified as hazardous, this material will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

4.3.2 Waste Management Options for other Construction Wastes

Waste materials generated will be segregated on-site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring reuse, recycling, recovery or disposal off-site will be transferred to a facility holding the appropriate COR, permit or licence, as required.

Mixed C&D waste (classified under the List of Waste code 17 09 04) is permitted for acceptance at a number of waste facilities in the region including Integrated Material Solutions landfill in north Dublin and a number of waste transfer stations.

Written records will be maintained by the contractor detailing the waste arising throughout the construction phase, the classification of each waste type, the contact details and waste collection permit number of all waste contractors who collect waste from the site and the end destination details for all waste removed and disposed offsite.

Dedicated storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc., as required. The containers used for storing hazardous liquids will be appropriately bunded or will be stored on suitably sized spill pallets.

The management of the main construction waste streams are detailed as follows:

Silt & Sludge
During the construction phase, silt and petrochemical interception should be carried out on runoff and pumped water from site works, where required. Sludge and silt will then be collected by a suitably licensed contractor and removed offsite.

Concrete Blocks, Bricks, Tiles & Ceramics
The majority of concrete blocks, bricks, tiles and ceramics generated as part of the construction and demolition works are expected to be clean, inert material and should be recycled, where possible.

Hard Plastic
As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

Timber
Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc., will be disposed of in a separate skip and recycled off-site.

Metal
Metal will be segregated and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

Plasterboard
There are currently a number of recycling services for plasterboard in Ireland. Plasterboard from the demolition and construction phases will be stored in a separate skip, pending collection for recycling. The site manager will ensure that oversupply of new plasterboard is carefully monitored to minimise waste.

Glass
Glass materials will be segregated for recycling, where possible.

Waste Electrical and Electronic Equipment (WEEE)
Any WEEE will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling.

Biodegradable/Green Waste
Any green waste generated will be transferred off site for appropriate reuse and/or recovery.

Other Recyclables
Where any other recyclable wastes such as cardboard and soft plastic are generated at the site compound, these will be segregated at source into dedicated receptacles and removed off-site.

Non-Recyclable Waste
C&D waste which is not suitable for reuse or recovery will be placed in separate receptacles in the site compound. Prior to removal from site, the non-recyclable waste receptacle will be examined by a member of the waste team (see Section 6.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

Other Hazardous Wastes
On-site storage of any hazardous wastes produced e.g. contaminated soil during excavations or waste fuels at the site compound will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately.

It should be noted that it is not possible to provide information on the specific destinations of each waste stream at this stage of the project. Prior to commencement of construction and removal of any construction waste offsite, details of the proposed destination of each waste stream will be provided to DCC for approval.

4.4 Tracking and Documentation Procedures for Off-Site Waste

All waste will be documented prior to leaving the site. Waste will be weighed by the waste contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the contractor.

All movement of waste and the use of waste contractors will be undertaken in accordance with the *Waste Management Acts 1996 – 2011* as amended, *Waste Management (Collection Permit) Regulations 2007* as amended and *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project Waste Manager (see Section 6.0) will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority COR, waste permit or EPA Waste/IE Licence for that site will be provided to the nominated project Waste Manager. If the waste is being shipped abroad, a copy of the TFS document will be obtained from DCC (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

All information will be entered in a waste management recording system to be maintained on site.

4.5 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is provided below. The total cost of construction waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

5.0 Reuse

By reusing materials on site, there will be a reduction in the transport and offsite recycling/recovery/disposal costs associated with the requirement for a waste contractor to take the material away to landfill.

Clean and inert excavated material which cannot be reused on site may be used as capping material for landfill sites, or for the reinstatement of quarries, etc. as previously discussed. This material is often taken free of charge for such purposes, reducing final waste disposal costs.

5.1 Recycling

Salvageable metals will earn a rebate which can be offset against the costs of collection and transportation of the skips. Clean uncontaminated cardboard and certain hard plastics can also be recycled. Waste contractors will typically charge less to take segregated wastes, such as recyclable waste, from a site than mixed waste streams.

5.2 Disposal

Landfill charges in the Eastern-Midlands region are currently at around €130-150 per tonne (which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*. In addition to disposal costs, waste contractors will also charge a fee for provision and collection of skips.

Collection of segregated construction waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a registered, permitted or licensed facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill.

6.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the Waste Manager to ensure commitment, operational efficiency and accountability during the construction phase of the project.

6.1 Waste Manager Training and Responsibilities

The nominated Waste Manager will be given responsibility and authority to select a waste team if required, i.e. members of the site crew that will aid him/her in the organisation, operation and recording of the waste management system implemented on site. The Waste Manager will have overall responsibility to oversee, record and provide feedback to the Project Manager on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to subcontractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The Waste Manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on site. The Waste Manager will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on site and be knowledgeable in how to implement this C&D WMP.

6.2 Site Crew Training

Training of the site crew is the responsibility of the Waste Manager and, as such, a waste training program should be organised. A basic awareness course will be held for all site crew to outline the C&DWMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction and health and safety awareness. This basic course will describe the materials to be segregated, the storage methods and the location of the waste storage areas.

7.0 RECORD KEEPING

Records will be kept for all waste material which leaves the site, either for reuse on another site, recycling, recovery or disposal. A recording system will be put in place to record the construction waste arisings on site. A copy of the Waste Collection Permits, COR, Waste Facility Permits and Waste/IED Licences will be maintained on site at all times.

The Waste Manager or delegate will record the following;

- Waste taken for reuse off-site;
- Waste taken for recycling;
- Waste taken for disposal; and
- Reclaimed waste materials brought on-site for reuse.

For each movement of waste on or off-site, a signed docket will be obtained by the Waste Manager from the waste contractor, detailing the weight and type of the material and the source and destination of the material. This will be carried out for each material type. This system will also be linked with the delivery records. In this way, the percentage of construction waste generated for each material can be determined.

The system will allow the comparison of these figures with the targets established for the recovery, reuse and recycling of construction waste presented earlier and to highlight the successes or failures against these targets.

8.0 OUTLINE WASTE AUDIT PROCEDURE

8.1 Responsibility for Waste Audit

The appointed Waste Manager will be responsible for auditing the site during the construction and demolition phases of the project.

8.2 Review of Records and Identification of Corrective Actions

A review of all the records for the waste generated and transported on or off-site should be undertaken at the end of the project. If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained.

Upon completion of the construction phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total reuse, recycling, recovery and disposal figures for the proposed development.

9.0 CONSULTATION WITH RELEVANT BODIES

9.1 Local Authority

Once the main contractor has been appointed and prior to removal of any waste materials offsite, details of the proposed destination of each waste stream will be provided to DCC for their approval.

DCC will also be consulted, as required, throughout the construction phase in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

9.2 Waste Contractors

Companies that specialise in C&D waste management will be contacted to determine their suitability for engagement. Where a waste contractor is engaged, each company will be audited in order to ensure that relevant and up-to-date waste collection permits and facility COR/permits/licences are held.

10.0 REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended 2001 (No. 36 of 2001), 2003 (No. 27 of 2003) and 2011 (No. 20 of 2011). Subordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended 2011 (S.I. No. 323 of 2011)
    - Waste Management (Collection Permit) Regulations 2007 (S.I No. 820 of 2007) as amended 2008 (S.I. No. 87 of 2008) and 2016 (S.I. No. 24 of 2016)
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821 of 2007) as amended 2008 (S.I. No. 86 of 2008), 2014 (S.I. No. 310 and S.I. No. 546 of 2014) and 2015 (S.I. No. 198 of 2015)
    - Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended 2004 (S.I. No. 395 of 2004) and 2010 (S.I. No. 350 of 2010)
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended 1998 (S.I. No. 164 of 1998), 2001 (S.I. No. 356 of 2002) and 2011 (S.I. No. 126 and No. 192 of 2011)
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 190 of 2015)
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended 2015 (S.I. No. 542 of 2015)
    - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended 2014 (S.I. No. 349 of 2014) and 2015 (S.I. No. 347 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended 2000 (S.I. No. 73 of 2000)
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended by European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
    - The European Communities (Trans frontier Shipment of Hazardous Waste) Regulations 1988 (S.I. No. 248 of 1988) ○ European Union (Properties of Waste Which Render It Hazardous) Regulations 2015 (S.I. No. 233 of 2015)
2. Environmental Protection Act 1992 (Act No. 7 of 1992) as amended by the Protection of the Environment Act 2003 (Act No. 27 and S.I. No. 413 of 2003) and amended by the Planning and Development Act 2000 (Act No. 30 of 2000) as amended.
3. Litter Pollution Act 1997 (Act No. 12 of 1997) as amended by the Litter Pollution Regulations 1999 (S.I. No. 359 of 1999) and Protection of the Environment Act 2003, as amended.
4. Eastern-Midlands Waste Region, *Eastern-Midlands Region Waste Management Plan 2015 – 2021* (2015).

5. Department of the Environment, Heritage and Local Government (DoEHLG), *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*, (2006).
6. FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and Site Managers*, (2002).
7. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998).
8. Forum for the Construction Industry, *Recycling of Construction and Demolition Waste* (1999).
9. Department of Environment, Communities and Local Government (DoECLG), *A Resource Opportunity - Waste Management Policy in Ireland* (2012).
10. Dublin City Council (DCC), Dublin City *Development Plan 2016-2022* (2016).
11. Environmental Protection Agency (EPA), *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015).
12. EPA, *National Waste Database Reports 1998 – 2012*.

16.0 INTERACTIONS – INTERRELATIONSHIPS BETWEEN THE ASPECTS

16.1 INTRODUCTION

This chapter of the EIA Report addresses potential interactions and inter-relationships between the environmental factors discussed in the preceding chapters. This covers both the construction and operational phases of the proposed development.

This chapter has been produced following the guidance within, the EIA Directive, the *Planning and Development Act 2000* (as amended), the EPA *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* 2017 and EPA Draft *Advice Notes for Preparing Environmental Impact Statements* 2015.

In accordance with the guidance not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

The majority of the EIA Report chapters have already included and described assessments of potential interactions between aspects, considered by the various specialists contributing to this impact assessment. The quality, magnitude and duration of potential impacts are defined in accordance with the criteria provided in the EPA 2017 Guidance as outlined in Chapter 1. This section of the assessment presents a summary and assessment of the identified interactions.

Section 171A of the Planning and Development Act requires that the interactions between the following be assessed:

- Population and human health;
- Biodiversity, with particular attention to species and habitats protected under the Habitats Directive and the Birds Directive;
- Land, soil, water, air and climate; and
- Material assets, cultural heritage and the landscape.

16.2 DISCUSSION – POSITIVE IMPACTS

The reasoning behind the interactions that are considered to have a positive effect (i.e. a change which improves the quality of the environment) is outlined in this section.

Planning and Alternatives on:

Population and Human Health

The development is of fundamental importance to the economic well-being of the State bearing in mind the volume of trade with the UK and the principal purpose of this development is to ensure that the necessary checks and controls can be carried out in the quickest way possible in order to ensure that trade continues to flow through the Port. It is predicted that there will be a ***slight positive impact*** on local business activity during the construction phase with the increased presence of construction workers using local facilities. The positive impact during the operational phase will be less with c. 128 no. full time employees anticipated on site throughout any 24 hours period. It is also anticipated that the proposed development will have indirect positive effects on employment in terms of construction material manufacture, maintenance contracts, equipment supply, landscaping etc. It is expected that the proposed development will have a ***not significant, positive*** and ***long-term*** impact on the immediate hinterland through continued employment opportunities and the associated economic and social benefits.

Landscape and Visual Impact

There are currently no landscape features on any of the proposed site areas, and the proposed development will introduce additional hedging, trees, low level ground cover and grass areas to enhance the presentation, amenity and biodiversity value of the sites where possible. Landscape effects will be ***slight,*** and ***positive***.

Material Assets & Waste on:

Hydrology

The proposed surface water drainage system includes attenuation of run-off on site, therefore there should be a significant future reduction in discharge volumes as a result of increase in attenuation within the proposed development. Oil petrol interceptors will be provided on all discharges from newly developed sites which will improve the quality of run off entering the sewer. Therefore the proposed development will have a ***slight, long-term*** and ***positive*** impact on local hydrology.

16.3 DISCUSSION – NEUTRAL IMPACTS

The reasoning behind the interactions that are considered to have a neutral effect (i.e. no effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error) is outlined in this section.

Hydrology on:

Population and Human Health

Discharge of water (following treatment) will be to storm or foul drains following agreement with the relevant authority. There are no envisioned interactions with population and human health and hydrology during construction. A Construction and Environmental Management Plan (CEMP) will be in place to ensure mitigation measures are undertaken by the contractor in terms of managing run-off water quality.

Land, Soils, Geology and Hydrogeology

There is a potential impact on soil through poorly managed surface water run-off during the construction phase of the proposed development; however, this will be managed through the implementation of a Construction and Environmental Management Plan (CEMP) to ensure management of any accidental discharges to ground. Any interactions between hydrology and land and soils will be ***short-term, imperceptible and neutral***.

Biodiversity

There will be no discharges to the Tolka estuary without treatment and as such the proposed development is predicted to have a ***neutral imperceptible*** effect on biodiversity.

Land, Soils, Geology and Hydrogeology on:

Hydrology

As there is no proposed direct discharge to surface water from this site there is no likely potential impact on the Tolka Estuary or Dublin Bay. Discharge of water (following treatment) will be to storm or foul drains following in agreement with the relevant authority. Measures will be included within the CEMP to manage run-off water during construction. The potential impact on surface water during operation (following the EPA Draft EIA Report Guidelines (2017) will be ***long term, imperceptible*** and ***neutral.***

Biodiversity

There will be no discharges to the Tolka estuary without treatment and as such the proposed development is predicted to have a ***neutral imperceptible*** effect on biodiversity.

Air Quality and Climate

There is a potential for the construction activity to impact on air quality in terms of dust generated but mitigation measures outlined in both Chapter 6 (Land, Soils, Geology & Hydrogeology) and Chapter 9 (Air Quality & Climate) of this EIA Report, implemented through the CEMP, will ensure a ***short-term*** and ***not significant***. There is no expected ongoing interaction during operation.

Landscape and Visual Impact

There will be periods of time during construction that will involve the excavation, movement and storage of soils on the site resulting in potentially unsightly soil / spoil areas. This will have a ***short-term*** and ***neutral impact***. There is no expected ongoing interaction during operation.

Archaeological, Architectural and Cultural Heritage

The proposed development is in fill and there is no likely potential to impact on unidentified archaeological features during construction works. With the mitigation measures detailed in Chapter 12 (Archaeological, Architectural and Cultural Heritage) this will ensure that the effect is ***long-term, imperceptible*** and ***neutral***.

Material Assets & Waste

As detailed in the Chapter 14 (Material Assets and Waste), c. 32,208m^3 of soil is likely to be excavated at the site for piling, foundation and drainage works etc. This soil will be reused where feasible to minimise requirement for importation of fill. Where any contaminated soil is encountered it will be removed from site for licenced disposal. Adherence to the mitigation measures and the requirements of the C&D Waste Management Plan, will ensure the effect is ***long-term, imperceptible*** and ***neutral.***

Air Quality and Climate on:

Biodiversity

There is a potential for the construction activity to impact on air quality in terms of dust generated but mitigation measures outlined in both Chapter 6 (Land, Soils, Geology & Hydrogeology) and Chapter 9 (Air Quality & Climate) of this EIA Report, implemented through the CEMP, will ensure that the impact on biodiversity is ***neutral imperceptible***. Impacts to climate during the construction phase are considered ***imperceptible***.

Air dispersion modelling was undertaken as set out in Chapter 9 (Air Quality and Climate) and the results from the modelling during the operational phase show that the emissions from the facility will comply with the relevant air quality limits. The results of the air dispersion modelling indicate that the impact of the proposed development on air quality and climate during the operational phase is considered ***long-term*** and ***insignificant.***

<u>Landscape and Visual on:</u>

Population and Human Health

In general, the proposed development will represent an intensification of the built urban edge that will be consistent with the emerging trend in the locality and with the land use zoning for the area. Given the industrial nature of land use at Dublin Port, and the nature of the proposed development, it is considered that the landscape and visual impact during operation will be ***long-term, imperceptible*** and ***neutral****.*

Biodiversity

The construction of the proposed development will involve the removal of some of the existing landscaping. However, this will be off-set and replaced by other suitable landscaping treatments and overall will have a ***long-term, imperceptible*** and ***neutral*** impact.

Archaeological, Architectural and Cultural Heritage

As stated in Chapter 12 (Archaeological, Architectural and Cultural Heritage) the site is underlain by fill with a low likelihood for disturbance of sub-surface archaeological features within the site. Appropriate measures will be implemented during construction to ensure that the effect is ***long-term, neutral*** and ***imperceptible*** through assessment and recording.

The operational phase of the development will not impact directly on any sites included in the Record of Monuments and Places.

<u>Material Assets & Waste on:</u>

Population and Human Health

The proposed development will have an impact on material assets such as surface water drainage, water supply, wastewater drainage, power supply and road infrastructure. Chapter 13 (Traffic and Transportation) and Chapter 14 (Material Assets and Waste) have assessed the capacities of the available infrastructure to accommodate the proposed development and the implementation of the mitigation measures proposed in these chapters will ensure there are no residual negative impacts on the local population. The predicted effect is therefore ***long-term, imperceptible*** and ***neutral***.

Hydrology

There is the potential for localised leaks and spills of waste during construction, which will be managed by implementation of a CEMP during construction stage. The predicted effect is therefore ***long-term, imperceptible*** and ***neutral***.

<u>Noise on:</u>

Population and Human Health
Noise modelling was undertaken to assess the impact of the proposed development of the site. The change in noise levels during operation of the proposed development is expected to be ***not significant***. The noise levels that are encountered at the nearest noise sensitive locations are predicted to be within relevant noise criteria that have been adopted here for the operation of the proposed development and associated infrastructure. These criteria have been selected with due consideration to human health, therefore, will not result in an impact on human health.

<u>Traffic & Transportation on:</u>

Population and Human Health
An increase in traffic has the potential to impact air quality and noise sensitive properties due to air and noise emissions from site activity and traffic, which has the potential to impact human health. An assessment of the additional traffic movements associated with the proposed development during the construction and operational phases was carried out. It can be determined that the additional traffic movements associated with the proposed development were found to be. ***short term, imperceptible*** and ***neutral*** for the construction phase. and ***medium term*** in duration of ***slight*** effect for the operational phase.

16.4 DISCUSSION – NEGATIVE IMPACTS

The reasoning behind the interactions that are considered to have a negative effect (i.e. a change which reduces the quality of the environment) is outlined in this section.

Air Quality and Climate
There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development. It is predicted that in 2021 the proposed development will increase CO_2 emissions by 0.0013% of the EU 2020 target. In 2036 CO_2 emissions will increase by 0.0024% of the 2030 target. Therefore, the climate impact of the proposed development is considered ***negative, long-term*** and ***imperceptible***. There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development however based on the scale and nature of construction for the proposed development and the short-term nature of the construction phase, the impact on the climate is considered to be ***short-term, negative*** and ***imperceptible***.

<u>Air Quality and Climate on:</u>

Population and Human Health
As detailed in Chapter 9 (Air Quality & Climate), best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust 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 ***negative***, ***short-term*** and ***imperceptible*** with respect to human health.

<u>Noise on:</u>

Population and Human Health
As detailed in Chapter 10 (Noise and Vibration), there will be some impact on nearby noise sensitive properties due to noise emissions from site activity and traffic. The application of noise limits and limits on the hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. In addition, due to the distance between the site and the nearest sensitive locations, vibration impacts generated during construction are expected to be negligible. Therefore, the noise and vibration impact of the construction phase of the proposed development is likely to be ***temporary*** to ***short-term*** and ***slight negative*** with respect to human health because of the temporary to short-term construction phase.

16.5 SUMMARY

In summary, the interactions between the environmental factors and impacts discussed in this EIA Report have been assessed and the majority of interactions are neutral. The worst-case scenario for traffic, air and noise during construction and operation phases are considered negative in relation to local population and local air quality. The proposed development will create a slight positive impact on local business activity during the construction phase with the increased presence of construction workers using local facilities. This will have a positive benefit on the economic development within the hinterland in which the development is located.

16.6 TABLE OF INTERACTIONS

	Planning and Development		Population & Human Health		Hydrology		Land, Soils and Hydrogeology		Biodiversity		Air Quality and Climate		Noise and Vibration		Landscape and Visual Impact		Cultural Heritage		Traffic and Transportation	Material Assets and Waste	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.		Con.	Op.
Planning and Development			+	+																	
Population & Human Health																					
Hydrology			×																		
Land, Soils and Hydrogeology					o	o			o	o	o	×	-	×	o	×	o	×			
Biodiversity											o	o	-	×							
Air Quality and Climate			-						o	o			×	×							
Noise and Vibration			-	o																	
Landscape and Visual Impact			o	o					×	o							o	×			
Cultural Heritage																					
Traffic and Transportation			o	o							-	-									
Material Assets and Waste			o	o	o	×															

Con.	Construction Phase
Op.	Operational Phase
×	No Interaction

+	Positive Interaction
o	Neutral Interaction
-	Negative Interaction