8.0 CULTURAL HERITAGE – ARCHITECTURAL HERITAGE

8.1 INTRODUCTION

8.1.1 This section, prepared by John Cronin & Associates, assesses the likely significant impacts of the *Grand Canal Dock Planning Scheme (Amending Planning Scheme No.1) 2005,* prepared by the Dublin Docklands Development Authority, on the architectural heritage of the site, its environs and the wider city.

Methodology

Desktop Survey

8.1.2 A desktop survey of the architectural heritage within the area of the proposed development site and its environs, was carried out. The *Record of Protected Structures for Dublin City* (2005), the *Inventory of the Architectural and Industrial Heritage of the Docklands Area* (1996), and the *Dublin Docklands Area Master Plan 2003* were the principal sources for identifying the architectural heritage. Further information was gained from the Irish Architectural Archive, Dublin and a review of local journals and publications.

Site Inspection

8.1.3 A site inspection was carried out of the site and its environs on 27th April 2005. The location and general condition of the Protected Structures were noted as well as the designated Conservation Areas. A photographic record was also undertaken and is presented in Appendix 8.2.

Zones of Impact

8.1.4 Due to the height of elements of the proposed development, the scope of the assessment of the likely significant impacts of the scheme on the architectural heritage must be wider than the immediate site. This section of the EIS includes an assessment of the likely impacts throughout five spatial zones, as follows:

1. Impact on the architectural heritage of the site.
2. Impact on the architectural heritage of the quays and streets bounding the site.
3. Impact on the Protected Structures and Conservation Areas from which the site is visible.
4. Impact on historic areas within the city.
5. Impact on the architectural character of the wider city.

Legal and Policy Framework for the Protection of the Architectural and Built Heritage

8.1.5 The management and protection of architectural heritage in Ireland is achieved through a framework of international conventions and national laws and policies (Department of Arts, Heritage, Gaeltacht and the Islands, 1999, 35). This is undertaken in accordance with the provisions of the *European Convention on the Protection of Architectural Heritage* (Grenada Convention, 1985).

8.1.6 At the national level, protection of the architectural or built heritage is provided for through a range of legal instruments that include the Heritage Act, 1995, the Architectural Heritage (National Inventory) and National Monuments (Misc. Provisions) Act, 1999 and the Local Government (Planning and Development) Act 2000. Section 2.1 of the Heritage Act, 1995, describes architectural heritage as *'all structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents, and, without prejudice to the generality of the foregoing, includes railways and related buildings and structures and any place comprising the remains or traces of any such railway, building or structure'.*

8.1.7 The Heritage Council was established by the Heritage Act, 1995. The Council seeks to promote the interest in, knowledge and protection of Irish heritage, including the architectural resource. The Heritage Act, 1995 also provides protection for all heritage buildings owned by a local authority from damage and destruction.

8.1.8 The Architectural Heritage Act, 1999, requires the Minister to establish a survey to identify, record and evaluate the architectural heritage of the country. The function of the National Inventory of Architectural Heritage (NIAH) is to record all built heritage structures within the Republic of Ireland. Inclusion in an NIAH inventory does not provide statutory protection; rather the document is used to advise local authorities on compilation of a Record of Protected Structures (RPS)

as required by the Local Government (Planning and Development) Act, 2000.

8.1.9 Under the Planning and Development Act, 2000, all Planning Authorities are obliged to keep a 'Record of Protected Structures' of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. As of the 1st January 2000, all structures listed for protection in current Development Plans, have become 'protected structures'. Under section 8(10)(a) of the Planning and Development Act, 2000, Planning Authorities and An Bord Pleanála are required to have regard to the protected status of such structures.

8.1.10 Since the introduction of this legislation, planning permission is required for any works to a protected structure that would affect its character. If a protected structure is endangered, planning authorities may issue a notice to the owner or occupier requiring works to be carried out. The Act contains comprehensive powers for local authorities to require the owners and occupiers to do works on a protected structure if it is endangered, or a protected structure or a townscape of special character that ought to be restored.

8.2 PROPOSED DEVELOPMENT

8.2.1 There are two principle options in the Amended Planning Scheme regarding the future development of the lands. In Option 1, the landmark building is located at the edge of the River Liffey Quay and the existing street structure is retained. In Option 2, the landmark building is again located at the quay edge. However, the two sites are amalgamated and developed as one unit, and the street structure amended.

8.2.2 In addition to the two principle design options, two variation alternative options are also considered in this section of the EIS. In Options 1(a) and 2(a) the landmark building is set back from the River Liffey Quay edge.

8.2.3 The proposed development is mixed use (residential and commercial), comprising a number of separate buildings and the creation of a number of new streets through the site. The focal point of the development is the construction of a landmark tower at the north-east corner of the site. A bridge will be constructed that will link Britain Quay with South Bank Quay.

8.2.4 For the purposes of this assessment of the impact of each of the four options on the architectural heritage, it is proposed to group the options into two groups. Options 1 and 2 are sufficiently similar in terms of scale, massing and layout to enable them to be assessed as a single proposal. It is noted that Option 1 retains the historical developments of Sir John Rogerson's and Britain Quays. In Option 2 however, the intentions regarding the historical alignment of Britain Quay are unclear. In neither option is it clear whether the traditional cobbled surface of Britain Quay will be retained and refurbished.

8.2.5 The alternative Options 1(a) and 2(a) also share many of the same physical characteristics as to enable them to be assessed as a single proposal. It is noted that the fundamental differences between group 1 (options 1 & 2) and group 2 (options 1(a) & 2(a)) are the location of the landmark tower, the layout of the buildings on the site and the street structure. It is also unclear in Option 1a and 2a as the future intentions regarding the cobbled surface of Britain Quay.

8.3 DESCRIPTION OF EXISTING ENVIRONMENT

8.3.1 The proposed development area is designated as Zone 4 in Dublin Development Authority *Grand Canal Dock Planning Scheme 2000,* (paragraph 2.2.4). It is bounded on the southern side by Green Street East, on the western side by Benson Street, on the northern side by the River Liffey and on the eastern side by the confluence of the River Liffey, the River Dodder and the Grand Canal Dock, and includes a large part of the water body surrounding it to the north and east (the confluence of the Liffey, the Dodder and the Grand Canal).

8.3.2 The proposed development site contains two primary structures, (a) Sir John Rogerson's Quay and (b) the hailing station, both of which are protected structures. Otherwise, the main portion of the site is currently vacant and has been cleared of all buildings and structures.

Protected Structures

8.3.3 There are two protected structures on the site of the proposed development as follows:

1. Hailing station, Britain Quay / Sir John Rogerson's Quay.
2. Sir John Rogerson's Quay (Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery).

8.3.4 In total, there are eight protected structures (see Table 8.1 and Figure 8.1) located within the proposed development site and in the

immediate environs of the site, as listed in the Record of Protected Structures, which is included in the Dublin City Development Plan 2005-2011.

Table 8.1: Protected structures in the immediate environs of the proposed development

RPS Ref.	Number	Address	Description
983 (also 3311)		Britain Quay/Green Street East, Dublin 2	Two-storey stone warehouse
984 (also 3310)		Britain Quay/Sir John Rogerson's, Quay, Dublin 2	Hailing Station
3302		Grand Canal Basin, Dublin 4	The triple sea locks at the river entrance to Grand Canal Docks
3313		Grand Canal Docks, area including Grand Canal Quay, Dublin 4	Former lock-keeper's cottage at Britain Quay
3318 (also 3557)		Hanover Quay, Dublin 2	Three-gabled warehouses fronting Hanover Quay
3558	20	Hanover Quay, Dublin 2	Malt house
7710		Sir John Rogerson's Quay, Dublin	Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery
5948		North Wall Quay	Former goods depot (The Point)

8.3.5 In addition to the two protected structures within the site of the proposed development, the principal protected structures, which are located on streets which bound the site are as follows:

1. Two-storey former warehouse, south-east corner of Green Street East.
2. Former lock keeper's cottage, Britain Quay.
3. Three-gabled warehouses, fronting Hanover Quay and the corner of Britain Quay.

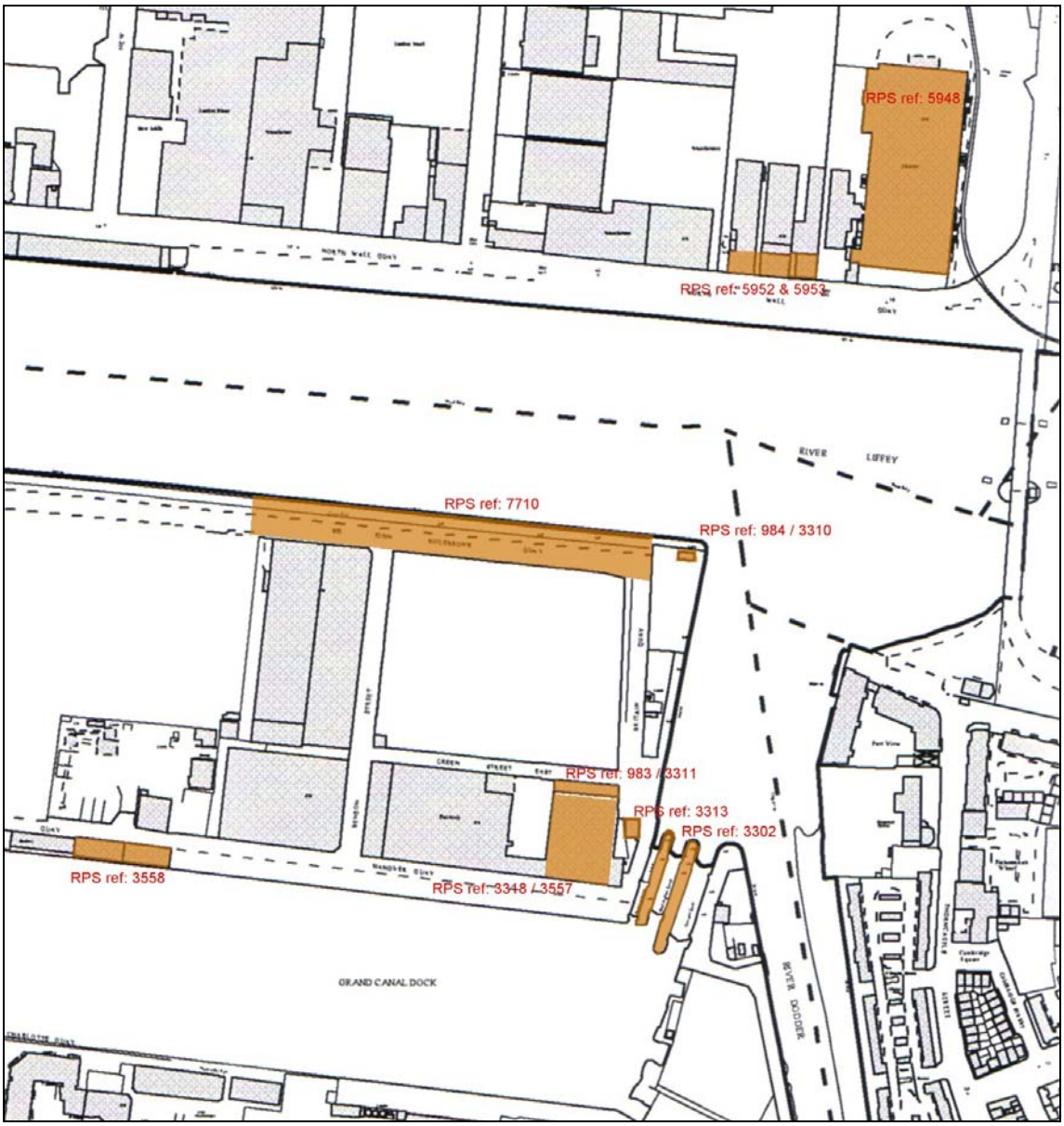

Figure 8.1: Protected structures in the vicinity of the site

Stone Setts

8.3.6 Sir John Rogerson's Quay, Britain Quay and the eastern end of Green Street East are surfaced with stone setts. Those on Sir John Rogerson's Quay, which have been recently restored and enhanced, are included in the Record of Protected Structures. The stone setts on Sir John Rogerson's Quay form a surface 25 metres wide from the site boundary to the quay edge. While those on Britain Quay and the eastern side of Green Street East are not included in the RPS, they are listed in Appendix 8 to the Development Plan 2005-2011. In none of the proposed development options is it clear whether the traditional

cobbled surface of Britain Quay will be retained and refurbished. This issue needs to be clarified as the cobbled street/quays are the only historical link with the past and without them the prevailing urban landscape character will be almost entirely set by the recent and future redevelopment of the area. Appendix 8 sets out the streets on which it is an objective of the City Council to retain, restore or introduce stone setts. The inclusion of the stone setts in either the RPS or Appendix 8 requires that they be retained in situ, and conserved and enhanced where appropriate.

Conservation Areas

8.3.7 Parts of the river and the campshires to the north and south of the river have been designated as Conservation Areas. There are two distinct Conservation Areas, which are visible from the site of the proposed development and are denoted by the Z2 and Z8 land use zoning objectives in the Dublin City Development Plan 2005-2011 (delineated in the Plan by red hatching on the land use zoning maps).

8.3.8 Land use zoning objective Z2 seeks *"to protect and/or improve the amenities of residential conservation areas".* Land use zoning objective Z8 seeks *"to protect the existing architectural and civic design character, to allow only for limited expansion consistent with the conservation objective. To allow primarily residential and compatible office and institutional uses".*

Views from other Protected Structures and Historic Precincts Within the City

8.3.9 Directly across the river from the site is the Point Depot, a detached sixteen-bay, two-storey railway point depot, built *c.* 1878, with its distinctive brick and limestone façade (a protected structure). The site also faces a number of other red-brick Victorian buildings on the North Wall Quay, a number of which are protected structures, with the wall along the North Wall Quay screening many buildings from view.

8.3.10 Given the height of the proposed development, and in particular the landmark tower, it will also be visible from areas of the city outside of the docklands, on both the north and south sides of the city.

8.4 PREDICTED IMPACTS OF THE DEVELOPMENT

8.4.1 The assessment of the predicted impacts are grouped into Group 1 (Options 1 & 2) and Group 2 (Options 1(a) & 2(a)). Group 2 is the alternative option.

Group 1 (Options 1 & 2)

Construction Phase

8.4.2 The construction phase will involve the demolition of the Hailing Station, a protected structure. It is proposed that the landmark tower will be constructed on the site of the hailing station. This will result in a severe permanent negative impact on this element of the architectural heritage. Apart from this direct impact, it is considered that the only other likely impact of the proposed development during the construction is the damage that could be caused to the stone setts on any of the four streets and quays which bound the development site, due to the use of heavy construction machinery or the storage of construction materials. However, these setts have already experienced very heavy dockland traffic over the past two centuries and it is likely that they are robust enough to withstand the construction traffic associated with the proposed development. Nevertheless, precautions should be taken during the construction phase to ensure their protection (see Mitigation Section below). Clarification is required regarding the future of the traditional cobbled surface of Britain Quay. This should be retained and refurbished as appropriate.

Operational Phase

<u>Impact on the Architectural Heritage of the Site</u>

8.4.3 As mentioned in section 8.4.2, the construction of the landmark tower will necessitate the removal of the hailing station, a protected structure, which will result in a severe permanent negative impact on this element of the architectural heritage. Otherwise, the proposed development will not have a negative impact on the architectural heritage on the site during the operational phase.

<u>Impact on the Architectural Heritage of the Quays and Streets Bounding the Site</u>

8.4.4 The predicted impact on the remaining three protected structures in the immediate environs of the site (two-storey former warehouse, south-east corner of Green Street East; former lock keeper's cottage, Britain Quay; and three-gabled warehouses, fronting Hanover Quay and the corner of Britain Quay) will not be significant. Although the three structures will be retained in-situ, the proposed development will result in a negative impact on the original setting of these buildings, particularly the warehouse building on Green Street East. However, as the immediate setting of these buildings includes a quayside, it would

have been the case that with the coming and going of large bulky ships on a regular basis, the context of these buildings would have been changing on an almost daily basis. Also, given that much of the area around these building has in recent time been largely derelict, it is considered that the severity of the negative impact on the setting of the nearby protected structures will be slight.

8.4.5 It is considered that the operational phase of the proposed development will have a positive impact on the granite ashlar quay walls, the stone setts, mooring rings, steps, bollards, lamp standards and machinery along Sir John Rogerson's Quay, as the influx of people and new uses to the area will heighten awareness of this aspect of the city's maritime heritage and will ensure their continued conservation.

Impact on the Protected Structures and Conservation Areas from Which the Site is Visible

8.4.6 The proposed development will be visible from a number of protected structures such as the Point Depot Theatre on North Wall Quay, and most significantly, the Custom House on Custom House Quay. The Point Theatre is, at present, somewhat isolated from the remainder of the city's night-life. The proposed development will bridge the gap between the core recreational areas within the city centre and the Point Theatre, thereby extending the flow of the city's lifeblood further east along the docks. It will also result in the forging of stronger visual connections between the city and the Point Theatre, resulting in a permanent positive impact on the Point Theatre and its setting (a protected structure).

8.4.7 The principal visual impact of the proposed development will be from the Custom House. In terms of both location and function, the Custom House has traditionally marked the gateway between the City and the Docklands. However, this role has changed over the past fifty years as the heart of the City has been gradually moving eastwards with the construction of, *inter alia,* the Matt Talbot Bridge and the IFSC, in addition to further development to the east. The landmark tower will be visible from the Custom House, but it is considered that this will result in a neutral impact on the setting of the Custom House and the views from it.

8.4.8 The proposed development will be visible from the Conservation Areas that surround the site. While the development will have an impact on the setting of these conservation areas, it will not conflict with the objectives of these areas, as set out in section 8.3.7 above and Zoning Objectives Z2 and Z8 of the Dublin City Development Plan 2005-2011.

It is considered, therefore, that there will be a slight negative impact on the surrounding Conservation Areas.

Impact on Historic Areas within the City

8.4.9 The following table outlines the impact of the proposed development options on historic areas within the city. This assessment is based on the photomontages which are included within this EIS.

Table 8.2: Impact on historic areas within the City

Location of viewing point	Predicted degree of impact	
	Proposed landmark tower A (Option 1 and 2)	**Proposed landmark tower B (Option 1a and 2a)**
Custom House	Significant	Significant
North Wall Quay	Significant	Significant
London Bridge, Ringsend	Significant	Significant
Ringsend Village	Slight	Slight
Baggot Street Bridge	Slight	Slight
Trinity College	Negligible	Negligible
Dame Street (southern side)	Neutral	Neutral
Dame Street (northern side)	Slight	Slight
Merrion Square West	Neutral	Neutral
Heuston Station	Neutral	Neutral
Blessington Street	Neutral	Neutral
North Circular Road and Summer Hill Parade	Significant	Significant
South Quay	Slight	Slight

Impact of the Architectural Character of the Wider City

8.4.10 It is a policy of the Development Plan to establish the highest standards of contemporary architecture. It is considered that the proposed landmark building will have a significant positive impact on the architectural character and identity of the City, being one of the boldest and most innovative architectural designs proposed for the City in recent years. The location of the proposed tower also has significance as it is a ‘meeting of the waters’ location, being the confluence of the River Liffey, the Dodder River and the Grand Canal Dock. It is considered appropriate that this point is marked by such a landmark structure and that it will draw attention and open access to

the area, which is not presently frequented by many City dwellers or visitors.

Group 2 (Options 1(a) & 2(a))

Construction Phase

8.4.11 The most likely impact of the proposed development during the construction is the damage that could be caused to the stone setts on any of the four streets and quays which bound the development site due to the use of heavy construction machinery on them or the storage of construction materials on them. Clarification is required regarding the future of the cobbled surface of Britain Quay and how this will be affected by the development proposal. Measures need to put in place as to the protection, refurbishment and instatement of the cobbled surface.

Operational Phase

Impact on the Architectural Heritage of the Site

8.4.12 The proposed development will not have a negative impact on the architectural heritage of the site.

Impact on the Architectural Heritage of the Quays and Streets Bounding the Site

8.4.13 Same as Group 1, except that the construction of the landmark tower may not result in the demolition of the Hailing Station, a protected structure, on the corner of Sir John Rogerson's Quay and Britain Quay, as it is proposed to locate the tower a distance back from the quayside.

Impact on the Protected Structures and Conservation Areas from Which the Site is Visible

8.4.14 Same as Group 1.

Impact on Historic Areas Within the City

8.4.15 Same as Group 1.

Impact of the Architectural Character of the Wider City

8.4.16 Same as Group 1.

Impact of Bridge Linking Britain Quay to York Road and New Slipway

Construction Phase

8.4.17 It is anticipated that the construction of the bridge linking Britain Quay to York Road will, in general, have a neutral impact on the architectural heritage of the site. There is the possibility that damage could be caused to the stone setts on Sir John Rogerson's Quay due to construction traffic. Mitigation measures should be taken to prevent such damage. The construction of the new slipway will have a neutral impact on the architectural heritage of the area.

Operational phase

8.4.18 It is anticipated that the presence of the proposed bridge will have a neutral to positive impact on the architectural heritage of the area. It will not result in a direct or indirect impact on any of the Protected Structures in the area. It will improve access to the area and will, therefore, increase awareness of the architectural heritage. It will also provide head-on views of the triple locks to the Grand Canal.

8.5 MITIGATION MEASURES

8.5.1 In respect of Options 1 & 2, a photographic and drawn survey (plans, elevations and sections) should be undertaken of the Hailing Station, a protected structure, which will be removed to facilitate the construction of the landmark tower.

8.5.2 A further mitigation measure in respect of the Hailing Station would be to re-locate it close to its present location if appropriate. There is a close relationship between the Hailing Station and its location which is determined by its previous function, and to move it to a location too far from its present position would result in an irrevocable separation of the building from its setting. The dismantling and re-construction of the building is likely to be difficult to achieve without some damage to the historic fabric of the structure. However, it is an option that should be considered to ensure that this remnant of Dublin's maritime heritage is not lost. If this course of action is chosen, a method statement detailing the necessary steps to be taken in dismantling and re-constructing the building should be prepared and agreed with the Conservation Officer.

8.5.3 Clarification is required as to whether the traditional cobbled surface of Britain Quay will be retained and refurbished. The cobbled streets are the only historical link with the past and without them the prevailing

urban landscape character will be almost entirely set by the recent and future redevelopment of the area. Every effort should be made to retain and restore existing setts as they are an integral part of the architectural heritage of the area.

8.6 MONITORING

8.6.1 Monitoring will only be required during the construction phase of the proposed development, to ensure that the stone setts on the streets and quays immediately bounding the site are not damaged.

8.7 REINSTATEMENT

8.7.1 Reinstatement will be necessary in respect of the stone setts, described in the monitoring section above, if they are damaged during the construction phase of the proposed development.

9.0 LANDSCAPE AND VISUAL IMPACT

9.0 LANDSCAPE AND VISUAL IMPACT

9.1 INTRODUCTION

9.1.1 This section of the EIS is a landscape and visual impact appraisal of the proposed development site located at the mouth of Grand Canal Dock. A site visit and initial appraisal were made in April 2005 and a revised assessment of amended proposals made in July 2005.

9.1.2 An assessment was made:

a) of the extent, magnitude and significance of the visual impact of the proposed development on human receptors, and

b) of the impact of the proposed development on the intrinsic character and quality of the landscape of the site and its surroundings.

Methodology

Assessment of Impacts

9.1.3 With regard to the visual influence on human receptors, the general extent of visibility was identified. In relation to a series of key viewpoints and particular areas within the vicinity of the site it was determined whether some part of the proposed development might be visible and the degree of unmitigated impact was assessed. The extent and degree of these impacts is set out in detail in Section 9.4 of this report. A comparison assessment of the mitigated visual impact was then made based on appropriate and feasible mitigation works (in this case of limited significance as the buildings proposed vary in height significantly above street level and visual screening is either impractical or inappropriate). Finally the relative significance of these impacts was assessed.

9.1.4 The baseline situation against which the visual impact assessment has been carried out is related to existing development and to development under construction. The mitigating effect of future development up to 30m high on adjacent areas that are zoned for re-development or under construction has been taken into account in assessing visual impact.

Receptors

9.1.5 Anyone with a view of the proposed development is a 'receptor'. Generally, receptors are graded in order of sensitivity according to the extent of time they may have a view of the proposed development. In descending order of sensitivity, these are generally agreed to be:

- The occupants of residential accommodation or institutions.
- Users of public recreational open space.
- Road users (drivers, cyclists, pedestrians and passengers in private and public transport).
- Workers in their place of work (offices, shops, factories, farmland etc), shoppers and users of indoor recreation facilities or private restricted access outdoor recreation facilities.

9.1.6 However, in this particular instance, as residential, office and commercial development are relatively mixed in the immediate surroundings, impacts have been assessed only on an area basis without separating residents, road users and workers. In addition, as much of the surrounding development is under construction, receptors in such areas are relatively few and transient.

9.1.7 The degree (or magnitude) of visual impact has been assessed in four levels of impact - high, medium, low and negligible. The tables of receptors provide descriptions of the extent and significance of views from particular viewpoints or areas surrounding the site.

9.1.8 Assessment of the degree of impact is based on the extent to which the proposed development is visible in the viewer's natural cone of vision, whilst assessment of the significance of the impact is based on the extent to which the visible development changes the character of the view, the extent to which the proposals may provide alternative benefits and on the duration or regularity of the receptor's experience of the view. Other matters taken into consideration include the extent of existing screening and whether this or other features in the overall view draw the eye or act as a focus.

9.1.9 In the case of tall buildings such as proposed in this development, it is impractical to determine with absolute accuracy every particular point from which the buildings are visible. At times foreground buildings, vegetation or other forms of screening may hide the buildings from view. In addition, the possibility of views from upper-floor windows of private property has to be assessed without being able to gain access. It is therefore necessary to assess on an area

basis locations from which the visibility of the tall building will have a particular degree of impact, although according to the viewer's precise location within that area, the buildings may or may not actually be visible depending on the extent of intervening buildings, fences or vegetation.

9.1.10 Where views of the proposed buildings would fill a large part of the receptor's (viewer's) cone of vision and the buildings themselves would dominate the view, in accordance with recognised practice such views are assessed as being subject to a **high visual impact**.

9.1.11 Where the proposed buildings would be distinctly visible but would not dominate other elements in the view, such as foreground buildings or other skyline elements, then these views are assessed as being of **medium visual impact**.

9.1.12 There will be many other viewpoints from which the proposed buildings may be visible as a background skyline element or seen above or between foreground buildings in such a way that, although visible, they only constitute one small element in the receptor's overall cone of vision. Views such as these are assessed as being of **low visual impact**.

9.1.13 Whatever the degree of visual impact, for the reasons explained in 9.1.8 above, the **significance** of that impact may be assessed as of a different (greater or lesser) order.

9.1.14 The survey and appraisal was carried out with the site at its most visible, i.e. when there were few or no leaves on deciduous tree species. In other words the appraisal is of a 'worst case' situation. When trees and shrubs are in full leaf there may be some reduction in visibility and therefore impact.

9.1.15 Visual impacts may be neutral, beneficial or adverse. A **neutral impact** will neither enhance nor detract from the receptor's view although the composition of the view may have changed. A **beneficial impact** will enhance the receptor's view, although again the composition of the view may have changed. (This is most likely when derelict or unsightly land and buildings are being replaced with new development and/or materials more appropriate or sympathetic to the surroundings.) An **adverse impact** is one that detracts from the receptor's view. (This most usually occurs where the scale of new development becomes a dominating element in the view, particularly where open or attractive vistas become obstructed or foreshortened).

Impacts on Landscape Character

9.1.16 The general, character of the landscape of the site and its surroundings was also surveyed and an assessment made as to how the proposed development would impact on the structure or texture of the landscape, which is essentially urban consisting almost entirely of derelict land, buildings and hard surfaces. The cobbled quaysides are of historical importance and scheduled for retention and refurbishment as part of the Liffeyside promenades.

9.1.17 Extensive redevelopment of the area surrounding the site is under way, former dockland sites having already been cleared and construction commenced. The proposals on this site form a modest proportion of these redevelopment proposals. They will however contribute the tallest building in the immediate vicinity with the potential as a focus and reference point. The degree of change that this particular development will have on the urban landscape character of the area has been considered in the context of the much wider changes going on around the site.

9.2 PROPOSED DEVELOPMENT

9.2.1 The proposed development is described in more detail in section 2 of this EIS. Broadly, it is a mixed use scheme of residential, office, leisure and commercial development in blocks varying in height up to nine storeys with the exception of a landmark tower of 120m in height proposed at the north east corner of the site.

9.2.2 There are two principal layout proposals under consideration. Options 1 and 2 each have the landmark tower in the north east corner of the site to the north of the point at which the proposed new road bridge across the mouth of the Dodder enters the site. This bridge location is common to all development proposals considered for the site.

9.2.3 Option 1 appears to respect the historic alignment of Britain Quay, whilst option 2 ignores the original alignment of Britain Quay.

9.2.4 Both options feature a new street running diagonally across the site from south west to north east which focuses on the landmark tower.

9.2.5 Both options feature five main blocks of development running approximately north south across the site. Unlike other proposed development in the area that conforms to the Dublin Docklands Development Board's grid road and city block guidelines, these blocks do not all relate to a street frontage. In the case of option 1, the block adjacent to Benson Street and the blocks either side of

the historical alignment of Britain Quay have street frontage, whilst in option 2, only the block adjacent to Benson Street has street frontage, although in both options the ends of blocks have frontage on to Sir John Rogerson's Quay, Green Street East and the proposed diagonal street across the site.

9.2.6 Generally, the block heights in both options rise from south to north along the length of the blocks. They are six storeys in height adjacent to Green Street in both options, whilst they rise to between six and predominantly nine storeys at their northern ends in option 1 and to predominantly six and up to eight storeys at their northern ends in option 2.

9.2.7 In option 1, all block widths widen from south to north, the narrowest being 11.5m wide at its southern end, the widest (which is indicated as residential) being over 24m wide at its northern end. The majority of the blocks, whether residential, mixed use or commercial, are deep plan, varying from 17m to 24.5m in width. Apart from the Britain Quay alignment which is shown as only 10m between building frontages, the three main spaces between the blocks are trapezoidal, widening from c.9m at their narrowest to between 30m and 42m at their widest. Two of the three spaces widen towards the south.

9.2.8 In option 2, the width of the block adjacent to the mouth of the River Dodder is a constant 18m, whilst the other four blocks widen from south to north, the narrowest being 14m wide at its southern end and the widest being 23m wide at its northern end. The historic alignment of Britain Quay is not retained in this option, there being four main spaces between the blocks. Again these are all trapezoidal, widening from c.8m at their narrowest to between 25m and 39m at their widest. Two widen to the south and two to the north.

9.2.9 In both options a single storey commercial infill is proposed between the second and third blocks from the west, south of the proposed diagonal road. There are also indicative proposals in both options for single storey commercial pavilions in the widest parts of the spaces created between the blocks.

9.2.10 The extensive use of deep plan building blocks is unusual, particularly in the case of what is indicated as residential development, a substantial proportion of which is in blocks of between 16 and 24.5 m in width.

9.2.11 It appears that the trapezoidal open spaces between the main blocks of development will largely be open to public pedestrian and service vehicle access. The layout would appear to exclude the

possibility of private communal open space for the occupants of residential development.

9.2.12 In townscape terms, with the new diagonal street across the site and the approximately north south oriented deep plan blocks of varying width enclosing trapezoidal open spaces, there appears to be a clear design intent to contrast with the typical continuous frontage city block form of development found in the rest of the docklands redevelopment area. These surrounding developments have been designed in accordance with the Dublin Dockland Development Authority's published and approved guidance documentation which these proposed development options appear to eschew. The most visible effect of this contrasting layout will be evident in views along and across the Liffey.

9.2.13 Two other layout options were also considered as alternatives. In those options (1a and 2a) the building layout is more conventional with three main city blocks, each with continuous building frontage and large central courtyards. Building widths are also more conventional, being regular widths of between 12m and 20m. As in option 1, option 1a retains the historic alignment of Britain Quay. As in option 2, in option 2a the development layout appears to ignore the alignment of Britain Quay. Unlike in options 1 and 2, in options 1a and 2a the proposed landmark tower sits at the eastern edge of the site just to the south of the point at which the new bridge over the mouth of the Dodder enters the site. Apart from the landmark tower, which is the same height in all options, the building heights in options 1a and 2a vary more than options 1 and 2, rising from a more modest four storeys to nine storeys in height, the lowest in the south and central parts of the site, the highest to the north on the river frontage. In townscape terms, options 1a and 2a echo the typical city block continuous frontage layout that pertains in the remainder of the docklands redevelopment area immediately to the west and south of the site.

9.3 DESCRIPTION OF EXISTING ENVIRONMENT

The Site

9.3.1 The site is an area of largely derelict open land formerly occupied by industrial and dockland development at the mouth of the River Dodder. It is bounded to the north by the River Liffey, to the east by the River Dodder, to the south by Green Street East and to the west by Benson Street. It includes the historically important quayside areas of the eastern end of Sir John Rogerson's Quay and most of Britain Quay. The site is approximately 1.9km from Dublin city centre.

Urban Context

9.3.2 For the purposes of assessing the visual impact of the proposed development, the surroundings to the site can be divided into four main areas. These four areas cover surroundings up to c.1.80km distant from the site. In addition to assessing the visual impacts of the proposed development on receptors within these areas, a number of key viewpoints in the city centre, historically important areas and other more distant locations, were also selected for assessment. Detailed photomontages of these views are contained in Appendix 9.1.

Area 1

9.3.3 The surroundings to the south (as far as the DART railway line) and west (to Macken Street) of the site south of the Liffey consist mainly of old docklands and associated industrial development which have been, are being, or will be developed. Exceptions are two areas of low rise residential development.

9.3.4 The height of this surrounding development is such that, landmark tower apart, development on the proposed site is unlikely to be visible from the enclaves of traditional low rise residential development centred on Pearse Square, South Lotts Road and South Dock Street. Even in the case of the landmark tower, the scale of open spaces between buildings and the orientation of streets in the area is generally such that the tower will not be visible from many locations in the area. The principal area from which the proposed development will be visible is the Sir John Rogerson's Quay/City Quay riverside promenade on the southern edge of the Liffey.

Area 2

9.3.5 The area of surroundings to the south east and east is comprised of predominantly low rise residential development, local shopping centres, occasional pockets of employment and a number of parks and recreational facilities in the Ringsend, Irishtown, Bath Avenue and Sandymount districts. Apart from the area of four-storey corporation housing immediately on the east side of the River Dodder and new development on the Liffey-side to the north of it, little of this extensive area will have views of the development on the proposed site, other than of the landmark tower.

9.3.6 This is because of the fringe of taller development on Ringsend Road (recent development) and Thorncastle Street (the corporation flats and new development mentioned above) that will largely prevent views from beyond them of development on the site of up

to c.35m in height being visible. However, the landmark tower will be widely visible from this area, whether on axial views along streets, across public open space, or across back gardens in residential areas, although often only from upper floor windows.

Area 3

9.3.7 The area to the north east, east of the East Link Bridge, comprises Dublin's operational docks. Glimpses of the site, in particular the landmark tower, will be possible from various places within this area.

Area 4

9.3.8 The predominantly former docklands area to the north of the Liffey stretching from Custom House to the East Link Bridge makes up the fourth area of surroundings from which views of the proposed development will be possible. These views will be primarily from North Wall Quay on the riverside and from the bridge crossings on this stretch of the Liffey. The height of redevelopment (whether recent or still to occur) along the north side of the Liffey will largely prevent views of anything on the site other than the landmark tower being possible from any of the hinterland to the north. Even views of the landmark tower are likely to be only occasional for the same reasons as given in 9.3.4 above.

Key Viewpoints

9.3.9 Beyond these four areas, there are some more distant parts of the city where certain streets are on axes radiating from the site, or in an elevated location or views are possible across fairly large level open spaces. In such cases it was necessary to consider whether or not the landmark tower on the proposed site would be visible from these locations, particularly where these vistas might be of historical importance. All the key viewpoints addressed in the EIS for the previously approved development for the site were re-considered and those considered particularly significant or relevant were selected for reassessment. To these were added a number of other key viewpoints considered equally or more relevant in the light of the altered location for the landmark tower. In all, eighteen key viewpoints were selected. Six of these fall within the areas immediately surrounding the site, whilst the other twelve are spread through other parts of the city.

9.4 PREDICTED IMPACTS OF THE DEVELOPMENT

9.4.1 The attached tables of receptors (Tables 9.1, 9.2 and 9.3) set out

the predicted visual impact of the proposed development. Table 9.1 addresses the surroundings to the site up to c.1.80km from the site on an area basis. Table 9.2 addresses the key viewpoints referred to in the previous section. Table 9.3 addresses the cumulative impact of the landmark towers on this site and on the North Lotts site on the north side of the Liffey in four of these key views. In each case, the table briefly describes each area, lists the distance from the nearest and furthest parts of the area to the nearest proposed building on the site, describes the extent of views possible from each area and then sets out the degree of unmitigated and mitigated visual impact (Table 9.1 only) and finally summarises the significance of the visual impact and whether the significance is beneficial, neutral or adverse.

9.4.2 As regards the visual impact of the proposed development on surrounding receptors, it can be seen from Table 9.1 that generally the significance of impacts is medium to low and neutral or beneficial. It is only in views from development or public roads immediately adjacent to the site that the impacts are high. Even in these circumstances the significance of the impacts can generally be said to be beneficial as views of derelict, vandalised and grafittied land and buildings will be replaced with new high quality development and the re-introduction of daily activity where recently there has been none.

9.4.3 In the case of views from beyond the immediate surroundings of four to six storey development close to the site, it is generally only the landmark tower that will be visible on the skyline. In many cases the latter, although not a negative visual presence, will appear to be an arbitrary and isolated element in the view, much as Charlotte Tower or Bolands Mill are at present.

9.4.4 Whilst the landmark tower would in time come to identify the eastern end of the Docklands redevelopment and the East Link river crossing, the possible development of a second landmark tower of similar height on the North Lotts site immediately on the other side of the Liffey would help provide a more instantly recognisable and identifiable focus. Seen in conjunction with one another, the cumulative impact of the two towers would be of greater benefit than a single tower, as they would be immediately recognisable as a ‘gateway’ to Dublin at the eastern end of the city at the mouth of the urban section of the Liffey (see Table 9.3).

9.4.5 With regard to the key viewpoints around the city (Table 9.2), the landmark tower either does not impinge at all on key views within the historically important areas of the city such as the Georgian quarters, or else its impact is generally low and neutral. Even where the impact might be of medium significance it would not be

detrimental to the view and in many cases would be beneficial.

9.4.6 As previously explained, it is generally the landmark tower that will be the only visible element of the proposed development and only in closer views will the other parts of the proposals be visible. To what extent the differences between the two development options for the site might affect the generally identified visual impacts is set out below.

9.4.7 As regards the visual impact of the landmark tower on its own, there is no difference between the two principal options. The location of the landmark tower is the same in each and the position of the tower provides an axial focus to the tree lined promenade along Sir John Rogerson's Quay.

9.4.8 The only receptor locations in which the proposed development other than the landmark tower will be clearly visible are the views along Sir John Rogerson's Quay (and to a lesser extent the City Quay), views across the Liffey from North Wall Quay and Custom House Quay, views from all bridge crossings east of the Custom House, views from the proposed new bridge over the mouth of the Dodder and views from existing development on the east side of the Dodder north of Ringsend Bridge.

9.4.9 Except in closer views along Sir John Rogerson's Quay and across the Liffey from a section of North Wall Quay immediately to the north of the site, viewpoint angles are generally so oblique as to make any difference between the two principal options unnoticeable. Only in views from the stretch of North Wall Quay opposite the site will the different grain of urban form when compared to development to the west be readily noticeable. Even then, how significant visually the different rhythm of solid and void that they present to the Liffey will be depends on the detailed materials and texture of the building façades which are unknown at this stage. However, the difference in urban grain is unlikely to be visually significant when seen through and over a fore and middle ground of avenue trees on the promenades either side of the Liffey. The greater impact of the differing grain of the proposed development, when compared with adjacent developments, is likely to be the apparently greater openness of intervening spaces to general public pedestrian movement and the consequent reduction in private communal open space specifically for the enjoyment of occupants of the residential elements of the scheme.

9.4.10 In most other situations where that part of the proposed development other than the landmark tower is in any way visible, it will be as glimpses of small parts of or just the tops of the buildings. The differences between the two principal options in terms of

massing would not be decipherable in these instances and are therefore of no significance.

9.4.11 In the case of the other alternatives (1a and 2a) also considered, whilst the different tower location results in marginally different positions when seen from certain key viewpoints, there is no difference in terms of impact or significance compared with the tower locations in options 1 and 2. Likewise, in the case of lower level development, except in closer views there is no significant difference in impact between options 1a and 2a and options 1 and 2. Those exceptions are in closer views of the northern and southern edges of the development and of the proposed diagonal road through the site common to all options. In these cases, options 1a and 2a present a more regular street frontage on each of these edges. In the case of the northern edge facing Sir John Rogerson's Quay, the differences are unlikely to be visually significant due to the foreground of avenue tree planting on the quayside. In the case of the new diagonal road and the Green Street East frontage, in close views there will be a noticeable difference as there would be a continuous built frontage in options 1a and 2a compared with sizeable openings between building ends in options 1 and 2. However, the scale of development is not dissimilar and the differences are not in degree of impact, merely in the rhythm and grain of the built form. As a consequence, there are no significant differences between the variant options 1a and 2a and the principal options 1 and 2.

9.4.12 The new bridge across the mouth of the Dodder connecting with the north east corner of the site is only visible from the north side of the Liffey, the East Link crossing and from Ringsend Bridge and the areas immediately either side of the Dodder between that bridge and the Liffey. In all these views the bridge is a restrained, simple, and sympathetic structure and as such has little visual impact within the overall views within which it can be seen. The design of the bridge supports are similar in form and appearance to the existing rounded quay side walls at the entrance to the Dodder and therefore in keeping with their immediate surroundings. The impact of the bridge is medium to low, reducing with distance and the significance is neutral.

Intrinsic Landscape Character

9.4.13 There is little left in the vicinity of the site of what would once have given the area its character, other than the cobble paved quays. The area has been densely urban since the docks were established, with storage and warehousing buildings all round. Although one or two traditional warehouses remain, redevelopment has been, or will be, almost total in the surrounding areas west of

the Dodder.

9.4.14 It would appear that option 1 intends to retain the historical elements of Sir John Rogerson's and Britain Quays although the proposals are silent on whether Britain Quay would remain a traditionally cobbled surface. As so little of the intrinsic docklands character remains, it is of some concern that the intentions in option 2 regarding the historical alignment of Britain Quay are unclear. Those parts of the alignment not lost to buildings would run at a slight angle across what is described as a 'performance square' in the proposals, but whether its cobbled alignment would continue to be expressed within the space has not been indicated.

9.4.15 The prevailing urban landscape character will therefore be set by the recent and future redevelopment of the area. The proposed development on the site will contribute to the new scale and texture of the urban fabric of the area, although the urban grain will be coarser and more open as the building layout in options 1and 2 does not follow the built frontage form of development typical of the areas of current redevelopment to the west and south. Part of the development, the landmark tower, will be the tallest building in the area. Located on the quayside, it will become the visually identifiable focal climax to the Docklands redevelopment on the south side of the Liffey.

9.4.16 Generally, options 1a and 2a would contribute to the new scale and texture of the area in a similar way to options 1 and 2 except that seen closer to, the urban grain of these options would be much closer to the urban grain in the redevelopment occurring to the west and south of the site.

Construction Stage Impacts

9.4.17 Visually there will be two types of impact during the construction period. There will be the presence on the skyline of cranes and the incidence of vehicular traffic bringing materials and personnel to the site. The latter will be little different from the vehicular traffic currently serving the adjacent sites. In the case of the former, this is temporary and although they will be visible on the skyline from a wide area around about, the cranes will be but part of a greater number in the area and will not impinge on any key views or vistas within the City Centre.

9.5 MITIGATION MEASURES

9.5.1 The proposed development is part of the ongoing redevelopment of the Dublin Docklands which is essentially a hard urban environment. Mitigation in terms of trying to screen such buildings

of six storeys or more is neither appropriate nor feasible and none is proposed.

9.5.2 Although not a mitigation measure in the sense of reducing its impact, the landmark tower in particular will make a positive contribution to the newly evolving urban cityscape. It will do this by providing an identifiable focus to the area which simultaneously announces the eastern limit of the urban edge of the Liffey and the East Link river crossing.

9.6 CONCLUSIONS

9.6.1 In key viewpoints from historically important parts of the city centre, the proposed development, and in particular the landmark tower, is either not visible or visible in such a partial or undistracting way that it in no instance has an adverse impact. All impacts are either neutral or beneficial.

9.6.2 When seen on axis, in particular from any viewpoints along the Liffey from the Custom House eastwards, the impact of the landmark tower is beneficial, identifying the urban limit of the Liffeyside redevelopment and the location of the East Link crossing.

9.6.3 Seen on its own from other locations, in particular those from the south and south east, the landmark tower may appear as an arbitrary element on the skyline in the same way that Charlotte Tower or Bolands Mill do at present. Occasionally its impact is beneficial in that it reinforces an axial view but generally its impact is neutral.

9.6.4 Whilst the landmark tower on the site would on its own become an identifiable focal point over time in views from these locations, if a similar tower were to be built on the North Lotts site on the north side of the Liffey immediately opposite the site, the conjunction of the two towers would form an instantly recognisable and therefore beneficial geographical focus.

9.6.5 The significance of visual impacts generally is medium to low and neutral to beneficial. It is only in views from development or public roads immediately adjacent to the site that the unmitigated impacts are high. Even in these circumstances the significance of the impacts can generally be said to be beneficial as views of derelict, vandalised and grafittied land and buildings will be replaced with new high quality development and the re-introduction of daily activity where recently there has been none.

9.6.6 There is little left in the vicinity of the site of what would once have

given the area its landscape character, other than the cobble paved quays. Whilst option 1 appears to retain the historical alignment of Britain Quay, in option 2 it is partly built over but largely subsumed into an open space described as a 'performance square'. In neither option is it clear whether the traditional cobbled surface of Britain Quay will be retained and refurbished. This issue needs to be clarified as the cobbled quays/streets are the only historical link with the past and without them the prevailing urban landscape character will be almost entirely set by the recent and future redevelopment of the area.

9.6.7 As regards the two principal development options proposed, in terms of the influence on visual impact of massing generally, neither option offers a significant benefit over the other. Which option is more beneficial to its surroundings is likely to hinge on the details of how it is intended to handle the alignment of Britain Quay and the refurbishment of its surface.

9.6.8 Although there are detailed differences in the urban grain of alternatives 1a and 2a compared with options 1 and 2, the former being more in accordance with the continuous street frontage guidelines and development character of immediately surrounding areas, the impacts they would have are generally very similar to those of options 1 and 2 with no significant variations in visual impact.

Table 9.1 Visual Impact on Receptors by Area

Location	Distances (to nearest proposed building)	Descriptions of View	Un-mitigated Impact	Mitigated Impact	Signifi-cance of Impact
AREA 1					
Area of predominantly new mixed development recently built or under construction extending south to the DART railway line, west to Macken Street and bounded by South Lotts Road to the east	20-750m	Clear views from close to, only glimpse views, if any, from areas screened by intervening development. Even in development with clear views, receptors would have been aware of future intended development on the proposed site.	High to low	High to low	Medium to low, neutral to beneficial
Sir John Rogerson's Quay and City Quay	0-1270m	Views along quayside promenade will be generally of the landmark tower, except in closer views when building frontage to the Liffey will be obliquely visible.	High to low	High to low	Medium, beneficial
Area of traditional low rise housing centred on South Lotts Road and South Dock Street	350-600m	Intervening development of up to 6 storeys will generally screen views of the proposed site from view except for possible glimpses of the top of the landmark tower	Low	Low	Low, neutral
Area of 19th Century housing centred on Pearse Square	530-780m	Intervening development of up to 6 storeys will generally screen views of the proposed site from view except for possible glimpses of the top of the landmark tower.	Low	Low	Low, neutral

Location	Distances (to nearest proposed building)	Descriptions of View	Un-mitigated Impact	Mitigated Impact	Signifi-cance of Impact
AREA 2					
Area of recent development and 4-storey corporation flats (Thorncastle Street) and recent 6-storey residential development (Ringsend Road) to east, south east and south	110-400m	Clear views of site, particularly the landmark tower, in some cases only from upper floor windows, depending on intervening development. Current views of dereliction will be replaced by views of high quality new development. In case of recent development, receptors would have been aware of the future intended development on the proposed site.	High to medium	High to medium	High to medium, neutral to beneficial
Areas of predominantly low rise residential development in Ringsend, Irishtown, Bath Avenue and Sandymount areas to east and south east of site.	300-1800m	Except for landmark tower, higher intervening development generally screens site from view. Views of landmark tower will occur from upper floor windows or from streets on the axis of the tower or across open spaces (parks or areas of back gardens).	Medium to negligible	Medium to negligible	Medium to negligible, neutral
AREA 3					
Modern operational docks area east of East Link Bridge	370-1800m	Generally glimpse views, mainly of landmark tower	Occ. medium, low to negligible	Occ. medium, low to negligible	Low to negligible, beneficial

Location	Distances (to nearest proposed building)	Descriptions of View	Un-mitigated Impact	Mitigated Impact	Signifi-cance of Impact
AREA 4					
North side of the Liffey between Guild Street and East Link Bridge	140-580m	Clear views, in some cases from upper floor windows only, where avenue trees on riverside promenade block views.	High to medium	High to medium	Medium, beneficial
Hinterland behind North Wall Quay between Guild Street and East Link Bridge	200-800m	Occasional glimpse views, mainly of landmark tower, where orientation and height of intervening development allow.	Occ. medium, low	Occ. medium, low	Occ. medium, generally low, beneficial
North side of the Liffey between Custom House and Guild Street	580-1480m	More distant oblique views in which landmark tower is principal element on site that will register with receptors.	Medium to low	Medium to low	Medium to low, beneficial
Hinterland behind Custom House Quay and North Wall Quay between Custom House and Guild Street	600-1500m	Occasional glimpse views of landmark tower (probably only from upper floors) where orientation and height of intervening development allow.	Low	Low	Low, neutral

Table 9.2 Predicted Visual Impacts from Key Viewpoints

View		Visible	Distance to Site	Description of view and nature of Impact	Significance of Impact
1	Looking north east along the Grand Canal from Baggot Street Bridge, Herbert Place	Yes	1.55km	Top of the landmark tower would barely be visible slightly off axis over unsympathetic recent office development that currently closes the vista. The latter is more intrusive on the view than the top of the tower would be.	Low, neutral
2	Looking north east from the west side of College Park, Trinity College	Yes	1.65km	The top of the landmark tower may be just visible from the western edge of College Park and from the windows of buildings that flank this edge of the Park. However, it would be one of a number of barely visible elements on the skyline along with chimneys and other tops of buildings beyond the buildings that enclose the Park.	Low, neutral
3A to 3E	Looking east from several points at the western end of Dame Street in the vicinity of City Hall	Yes	2.4km	Top of the landmark tower would be visible in some of these views. Although Trinity College is at end of the vista, it is sufficiently distant not to be a noticeable axial feature and so the visibility of the tower beyond would be neither significant nor adverse, particularly with so much activity and building detail closer to the viewer, drawing the eye.	Medium, neutral
4	Looking north east from the south west corner of Merrion Square	No	1.53km	None	-
5	Looking east from Sean Heuston Bridge	No	4.02km	None	-

View		Visible	Distance to Site	Description of view and nature of Impact	Significance of Impact
6	Looking south east from the west end of Blessington Street	No	2.90km	None	-
7	Looking east from Custom House	Yes	1.52km	The extent of intervening low level re-development on either side of the Liffey and a foreground streetscape of lamp standards, etc. is such that, although the landmark tower would be visible, it would be a beneficial focal feature identifying the urban limit of the Liffey.	Medium, beneficial
8	Looking east along the River Liffey from the entrance to Spencer Dock	Yes	670m	As the former docklands area to the south side of the Liffey is progressively redeveloped and focal elements of the past disappear, the landmark tower will form a positive visual end point to the riverside redevelopment.	Medium, beneficial
9	Looking north west from adjacent to Blackrock railway station	Yes	5.5km	An example of a distant view of the Dublin skyline in which, at this distance, it is difficult to identify any particular city centre features on the skyline. The tower would help to identify the eastern limits of the city and the East Link river crossing.	Low, beneficial
10	Looking south east along Portland Row from its junction with Summerhill	Yes	1.82km	Although off axis, the landmark tower would be a focal element that gives the vista down Portland Row more meaning, restoring and re-enforcing the focal quality that St Laurence O'Toole church spire once gave this view and from which recent indifferent intervening development has detracted.	Medium, beneficial
11	Looking south east from Clontarf Road at its junction with Vernon Avenue	Yes	2.75km	It is currently difficult to identify the city centre or other key locations on the skyline. Although the tower will not be particularly noticeable, it should help to identify the location of the East Link river crossing.	Low, beneficial

View		Visible	Distance to Site	Description of view and nature of Impact	Significance of Impact
12	Looking north west along the River Dodder from London Bridge	Yes	890m	Typical of views of the landmark tower that will be possible at this distance from the surrounding residential area. Although identifying the eastern end of the urban stretch of the Liffey, it also introduces a different scale of development to the view when compared to the small scale residential character of the area.	Medium, neutral
13	Looking north west along the River Dodder from Ringsend Bridge	Yes	420m	The height of the landmark tower at such close quarters will dominate its immediate surroundings. However, it also becomes an identifiable geographical focal point for the surrounding district, whilst the tower and associated development improve the middle ground view compared with the current dereliction.	High, neutral
14	Looking north along Shelbourne Road from its junction with Pembroke Road	Yes	1.76km	Although the tower will be visible almost on axis it is sufficiently distant to be a focal element of interest without detracting from the very mixed character of existing development at the south end of Shelbourne Road.	Medium, neutral
15	Looking north west from Irishtown Road in Ringsend village	Yes	780m	Typical of views of the landmark tower that will be possible at this distance from the surrounding residential area. Although identifying the eastern end of the urban stretch of the Liffey, it also introduces a different scale of development to the view when compared to the small scale village character of the area.	Medium, neutral
16	Looking east along Pigeon House Road/R131 Toll Road	Yes	990m	The landmark tower provides a clear focus for the East Link river crossing that the toll road leads to.	Medium, beneficial

View		Visible	Distance to Site	Description of view and nature of Impact	Significance of Impact
17	Looking east along the Liffey from the north end of Matt Talbot Bridge	Yes	1.39km	As the former docklands area to the south side of the Liffey is progressively redeveloped and focal elements of the past disappear, the landmark tower will form a positive visual end point to the riverside redevelopment.	Medium, beneficial
18	Looking east along the Liffey from South City Quay in the vicinity of Lime Street	Yes	800m	The landmark tower will form a positive visual end point to the riverside redevelopment, much of it currently under construction.	Medium, beneficial

Table 9.3 Predicted Cumulative Visual Impacts of the landmark towers on the Grand Canal Dock and North Lotts sites from certain Key Viewpoints

View		Visible	Distance to towers	Description of view and ratio of Impact	Significance of Impact
7	Looking east from Custom House	Only one tower visible	1.52km	Despite the extent of intervening medium height re-development on either side of the Liffey and a foreground streetscape of lamp standards etc., the landmark tower would be visible and would be a beneficial focal feature identifying the urban limit of the Liffey, particularly as in this view, the North Lotts tower would not be visible.	Medium, beneficial
8	Looking east along the River Liffey from the entrance to Spencer Dock	Both towers visible	670 – 800m	As the former docklands area to the south side of the Liffey is progressively redeveloped and focal elements of the past disappear, the landmark towers on the Grand Canal Dock site and the North Lotts site will form a positive visual end point to the riverside redevelopment.	Medium, beneficial
13	Looking north west along the River Dodder from Ringsend Bridge	Both towers visible	420 – 720m	The height of the landmark tower at such close quarters on the Grand Canal Dock site will dominate its immediate surroundings. However, together with the proposed tower on the North lotts site to the north of the Liffey it also provides an identifiable geographical focal point for the surrounding district. The towers and the associated development on the Grand Canal Dock site also improve the middle ground view compared with the current dereliction.	High, neutral
16	Looking east along Pigeon House Road/R131 Toll Road	Both towers visible	925 - 990m	The landmark towers on the Grand Canal Dock and North Lotts sites provide an immediately recognisable framing of the East Link bridge that instantly identifies the river crossing that the toll road leads to.	Medium, beneficial

10.0 AIR QUALITY AND CLIMATE

10.0 AIR QUALITY AND CLIMATE

10.1 INTRODUCTION

10.1.1 The air quality aspects of the proposed development at Grand Canal Docks are considered.

10.1.2 The potential air quality impacts from this type of development are as follows:

- Air quality aspects during the construction phase, such as generation of dust during the demolition and site preparation phases.
- Airborne pollutants due to traffic associated with the completed development.
- Airborne pollutants due to heating boilers and other combustion sources within the completed development.
- Emissions of greenhouse gases associated with the completed development.

10.1.3 The impact on climate is considered in the context of the national climate change policy. As regards impact on microclimate, there are no special features of the environment at this existing industrial site, or inherent properties of the proposed development, which would indicate a significant local climate impact.

Published Plans and Assessments

10.1.4 Dublin Docklands Development Authority (DDDA) have prepared an Amended Planning Scheme for the subject lands.

10.1.5 Environmental aspects in terms of air quality, emissions, and energy considerations were considered in general terms in an EIS prepared by DDDA for the original Planning Scheme in 2000.

10.1.6 An EIS was also previously carried out for a proposed development at this site (Burwood House Ireland Ltd. - Mc Hugh Consultant - 2001).

10.1.7 An EIS for the proposed bridge linking Britain Quay to York Road was carried out in 2003 (Reid Associates). Opening of this bridge will alter traffic in the vicinity of the site, and this is accounted for in

the present report.

10.1.8 This present report expands upon the air quality aspects of the proposed development, based on the current design concept proposals.

10.1.9 The site is located in the north eastern corner of the Grand Canal Dock development area, bounded by Sir John Rogerson's Quay, Britain Quay, Benson Street to the west, and Green Street to the south.

10.1.10 The proposed development consists of mixed residential and commercial units, with three options in terms of commercial and residential development mix.

1. 370 residential units and 51,700 m^2 commercial space.

2. 432 residential units and 46,100 m^2 of commercial space.

3. 247 residential units and 62,770 sq. metres of commercial space.

10.1.11 The development mix affects air quality issues due to the different energy consumption requirements for residential and commercial units.

10.1.12 Options for variations in lay-out within the development have no effect on air quality impacts, and are not analysed.

Methodology

10.1.13 The air quality assessment consisted of the following elements:

- Evaluation of the existing air quality through a review of published Dublin City Council air quality data and EPA data.

- Assessment of the construction phase impact on air quality adjacent to the site, based on observations at existing construction sites in the area, and similar construction sites.

- Calculation of nitrogen oxide emissions from traffic associated with the completed development, based on the methodology of the UK "Design Manual for Road and Bridges".

- Calculation of ground level concentrations of nitrogen oxides due to heating boilers within the development (screening calculation using the German TA-Luft Gaussian dispersion model).

- Assessment of the impact of the development in terms of greenhouse gas emissions, and transboundary pollutants, taking account of the requirements of government policy contained in "National Climate Change Strategy Ireland", published in 2000, and draft strategy on transboundary pollutants.

10.1.14 The combustion pollutants assessed in detail in the report are nitrogen oxides, (nitrogen oxide, NO, and nitrogen dioxide, NO_2, collectively termed NO_x). Nitrogen oxides are the most significant pollutant generated by light vehicles and heating boilers in terms of potential exceedence of air quality assessment thresholds and standards. Consequently, if a screening assessment demonstrates negligible impact for nitrogen oxides, it can be concluded that the impact of the other combustion pollutants will also be negligible.

Air Quality Assessment Criteria

Assessment Criteria for Airborne Pollutants

10.1.15 The impact on air quality was assessed by comparison with the requirements of the Air Quality Standards Regulations 2002 (SI 271/02). These regulations assign limit values for the common pollutants associated with combustion. This report focuses on annual mean concentrations of nitrogen dioxide as the primary indicator pollutant.

10.1.16 These regulations specify limit values (as annual means and short-term averages), with a sliding implementation scale until the final limits apply in 2010. Limit values which will apply in 2010 are shown in Table 10.1

Pollutant	**Limit Value 2010**
Sulphur dioxide, SO_2	20µg/m^3
Nitrogen Dioxide, NO_2	40µg/m^3
Fine particulates PM_{10}	20 µg/m^3
Lead, Pb	0.5 µg/m^3
Benzene C_6H_6	5 µg/m^3
Carbon monoxide CO	10 mg/m^3

Table 10.1: Limit values from air quality standards regulations SI 271/02. The annual limit values for the common pollutants are shown (and 8-hr limit value for CO). There are also short-term (hourly and daily) limit values specified in the regulations

Criteria for Dust Deposition

10.1.17 There are no national or EU guidelines on acceptable dust deposition rates. The German air quality limit (TA Luft (October 2002)) of 350mg/m^2/day is taken as a guideline limit in this assessment.

Criteria for Assessment of Impact on Climate and Transboundary Pollutants

10.1.8 The net effect of the development on carbon dioxide (CO_2) emissions is assessed against the requirements of the National Climate Change Strategy. The overall emissions of nitrogen oxides are assessed with reference to draft guidelines contained in the published government discussion document on transboundary pollutants (2003).

10.2 DECRIPTION OF EXISTING ENVIRONMENT

10.2.1 The proposed development site is located in a dockland site which has historically been an industrial area. Local industrial activity has ceased, apart from a concrete works to the southeast of the site at Hanover Quay.

10.2.2 The existing air quality in the vicinity of the proposed development could reasonably be expected to be similar to values reported for urban Dublin.

10.2.3 The Environmental Protection Agency (EPA) is responsible for monitoring of national air quality standards. For air quality monitoring purposes, the country is divided into four zones:

Zone A (Dublin), Zone B(Cork), Zone C(towns >15,000), and Zone D (remainder). Monitoring in the Dublin area, is carried out by Dublin City Council.

10.2.4 The most recent EPA Report “Irelands Environment 2004” presents data and discussion on air quality in Dublin City for 2002. The most recent formal published data by Dublin City Council is for 2003/2004.

10.2.5 The existing air quality situation in Dublin City is summarised in Figure 10.1, in terms of the percentage of the annual limit which will apply in 2010. The most significant pollutants in Dublin are nitrogen oxides and fine particulate matter. The other pollutants: sulphur dioxide, lead, benzene, and carbon monoxide are already comfortably within the limit values which will apply in 2010.

10.2.6 The limit line shown in Figure 10.1 refers to the limit which will apply in 2010. Air quality limits are being introduced on a sliding scale, and all published pollutant data for zone A areas were within the indicative air quality standards which are applicable in 2005.

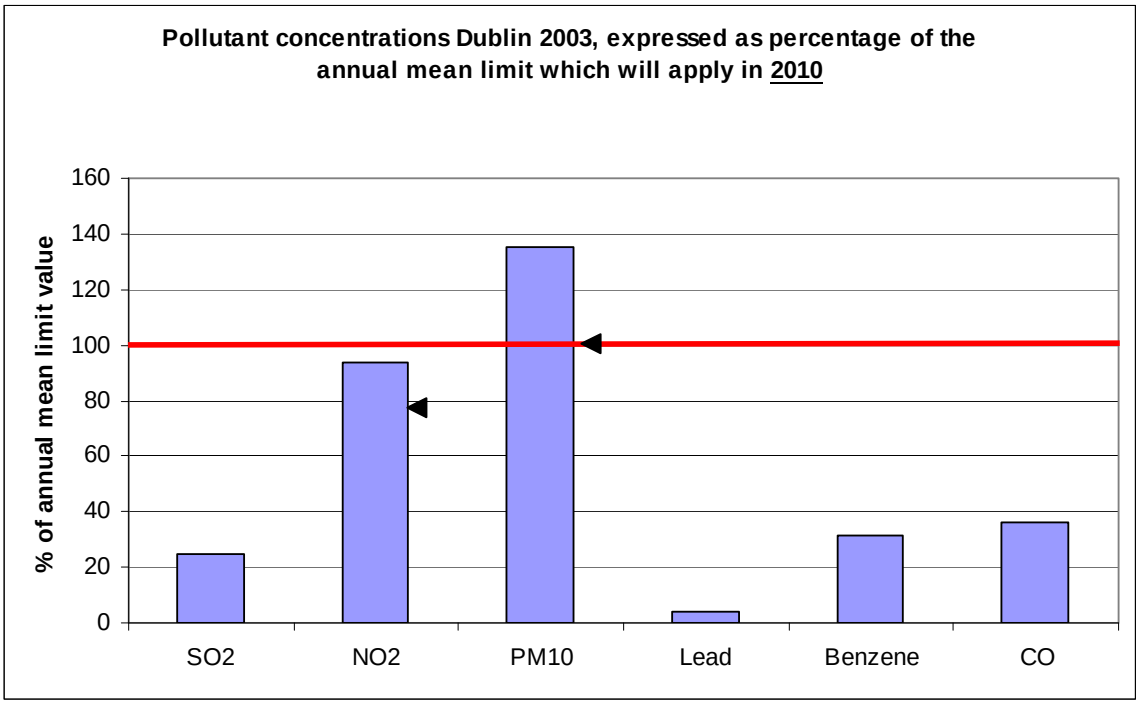

Figure 10.1: Air quality data for Dublin City centre. Annual mean concentration (Winetavern St. and Coleraine St.), expressed as percentage of annual limit*.

Note 1: Solid bars refer to mean data compiled from the DCC 2003/2004 Annual Report, which is the most recent published data.

Note 2: Black triangles refer to unpublished data for 2004, provided by DCC for the Wood Quay and Coleraine Street air quality monitoring stations (data subject to formal publication and verification).

Note 3: For carbon monoxide (CO), the maximum 8-hr mean is given.

Do-Minimum Scenario

10.2.7 In the absence of any development on the site, it could be expected that there will be a gradual reduction in air pollution in the area, as progressively stricter vehicle emissions controls come into force. For the pollutants sulphur dioxide, lead, benzene and carbon monoxide, the trends indicate that the annual limit values in 2010

will be comfortably complied with. However, it is clear from Figure 10.1, that the major challenge will be to achieve the PM_{10} limit value which will apply in 2010. The PM_{10} limit value will reduce by a factor of 2 between 2005 and 2010. Achieving a comfortable degree of compliance for nitrogen dioxide will also be a challenge.

10.2.8 Achieving significant reductions in PM_{10} and nitrogen dioxides will rely on controls on city centre traffic. The difficulties with respect to PM_{10} and nitrogen oxides have been acknowledged by the EPA:

"Emissions from road traffic are now the primary threat to the quality of air in Ireland. The pollutants of most concern in this regard are nitrogen dioxide (NO2) and fine particulate matter, expressed as PM10. Results of monitoring indicate that compliance with the stringent new PM10 and NO2 standards may present problems in some urban areas subject to heavy traffic. The EPA will advise local authorities on measures needed to ensure compliance with the standards. The introduction of such measures, in the form of air quality management plans or short-term traffic restrictions, would be a major new challenge for local authorities."

EPA, Ireland's Environment 2004

10.3 PREDICTED IMPACTS OF THE DEVELOPMENT

Construction Phase

10.3.1 The site should be inspected by a qualified hazardous waste engineer prior to any development. Any residual oils, chemicals, asbestos or other hazardous materials, should be disposed of in an approved manner.

10.3.2 A detailed survey of the soil would also be required to rule out the presence of any potentially hazardous materials which could become airborne during site preparation and excavation works.

Dust Deposition

10.3.3 Assuming that any oils, chemicals, and any potentially hazardous buried materials are removed from site, the main potential impact during the demolition and construction phase would be due to airborne dust and dust deposition outside the site boundaries.

10.3.4 For ordinary non-hazardous dust, the potential impact is in terms of its visual nuisance rather than health effects. The nuisance is associated with dust deposition on surfaces, cars, and windows of properties.

10.3.5 Due to the highly variable nature of dust generation at construction sites, there is limited benefit from predicting dust emissions by dispersion modelling. From experience at a range of construction sites, it is observed that the dust generally settles within the site itself, with little dust passing over the site boundaries.

10.3.6 Many of the dust issues associated with building sites are due more to material deposited on the haul routes, than dust generation from the site itself. Mud can be deposited on roads for several hundred metres from a site by vehicles serving the site. In dry weather, this gives rise to fine dust, which may be re-suspended by passing traffic, and can result in soiling of properties along the haul route. Ensuring that vehicles leaving the site are cleaned and implementation of a road cleaning service would minimise this problem. This road dust problem was visible at existing construction developments in the area during site visits in April 2005.

10.3.7 With good management and controls, dust deposition rates at the nearest sensitive properties could reasonably be expected to be less than 100mg/m^2/day, at which level there would be little noticeable effect. The impact is therefore likely to be minor.

Construction Vehicles

10.3.8 Combustion air pollutants are generated from construction vehicles and plant. The impact from construction vehicle emissions is estimated based on a nominal 20 truck movements per hour, which may be representative of likely vehicle movements during the demolition, site preparation, excavation and foundation phase.

10.3.9 This would result in an increase in the annual mean concentration of approximately 1 µg/m^3 NO_x at a reference distance of 20m from the haul routes to the site. This change is not considered significant, and is of limited duration.

Operational Phase

10.3.10 The completed development will generate additional emissions to the atmosphere due to associated traffic and heating boilers. Each contribution was considered individually and combined to assess the total impact in the reference year 2010.

10.3.11 The main pollutant which needs to be considered is nitrogen dioxide, as emissions of the other pollutant species will be considerably lower in magnitude.

Pollutants Due to Traffic Associated with the Development

10.3.12 The development site is located at the north-eastern corner of the Grand Canal Docks area and will not experience significant levels of road traffic. The proposed link bridge to York Road will be limited to public transport, cyclists and pedestrians. The EIS for this bridge determined that the air quality impacts of traffic in the area would be negligible.

10.3.13 The additional traffic generated by the proposed development is calculated to increase concentration of nitrogen dioxide by 0.3 $\mu g/m^3$ at distances of 20m from the road edge. This calculation is based on the Design Manual for Roads and Bridges (DMRB) air quality screening method, using data from the traffic section of the EIS. The DMRB screening calculation tends to overestimate impacts. The predicted increase of 0.3$\mu g/m^3$ is negligible. The traffic projections for the three residential/commercial mix options are similar, and therefore there is no difference between these options in terms of air quality issues due to traffic.

Emissions to Atmosphere

10.3.14 The emissions to atmosphere from space heating boilers and other combustion sources will in principle not be significantly different from other new developments within Dublin City centre of similar development density.

10.3.15 The emissions of combustion pollutants are related to the heating energy demands of the buildings. The exact heating requirements and heating systems are not known at this planning stage of the project. A screening assessment has been based on published good practice energy requirements for domestic and commercial buildings.

10.3.16 The analysis allows for the different energy demands of residential and commercial units. The overall energy demand and consequently combustion product emissions depend on the development mix between residential and commercial. Three development mix options are considered:

1. 370 residential units and 51,700 m^2 commercial space

2. 432 residential units and 46,100 m^2 of commercial space

3. 247 residential units and 62,770 sq. metres of commercial

space.

10.3.17 The energy demands of apartment residential units are assumed to be approximately 40GJ per residential unit, which represents current good practice (e.g. Woking Borough Council recommendations).

10.3.18 The energy demands of well designed commercial buildings can vary by a factor of three, depending on layout and ventilation provision. For buildings designed in accordance with good practice, the energy requirements vary from 0.4 GJ per m^2 for naturally ventilated cellular offices, to 1.25 GJ per m^2 for prestige air conditioned buildings (Scrase 2004).

10.3.19 Using the above energy intensity factors, the emission and dispersion of combustion products was modelled, to determine the ground level concentration of nitrogen dioxide, which is the most significant pollutant in terms of potential impact on air quality.

10.3.20 The screening dispersion modelling was undertaken using the German TA-Luft Gaussian dispersion model. The highest energy use option was selected as a worst case scenario (option 3, with prestige air conditioned buildings).

10.3.21 The highest predicted ground level concentration within the development site itself is 4 $\mu g/m^3$. This does not necessarily mean that there would be an increase of 4$\mu g/m^3$ above published baseline levels for Dublin City. The baseline monitoring data measured by DCC at city centre sites includes the locally generated combustion pollutants from the surrounding buildings. The development will therefore have only a slight impact on air quality in the locality, and will not compromise efforts by Dublin City Council and the EPA to achieve the limit value of 40 $\mu g/m^3$ for nitrogen dioxide by 2010.

10.3.22 At the perimeter of the site, the predicted levels are less than 0.2 $\mu g/m^3$ of NO_2. At neighbouring developments and sensitive locations beyond the site boundaries, the impact of the development will be 0.2 $\mu g/m^3$ due to boilers and 0.3 $\mu g/m^3$ due to additional traffic. This results in a combined impact of 0.5$\mu g/m^3$ of NO_2, which is a negligible impact.

10.4 PREDICTED IMPACT OF PROPOSED DEVELOPMENT ON CLIMATE

10.4.1 A development of this scale has no inherent capacity for significantly influencing climate on a local, regional or global scale. Nevertheless it is relevant to consider the development in the

context of the national climate change strategy, in terms of compliance with the stated objectives of the strategy, as the national targets can only be achieved if the cumulative impact of all such individual developments is controlled.

10.4.2 Greenhouse gases are radiatively active gases, which give rise to an increase in global temperatures. The dominant greenhouse gases in Ireland are carbon dioxide, CO_2, arising from the burning of fossil fuel, and methane from agricultural sources. The development will generate CO_2 emissions due to heating boilers, and indirect emissions due to electricity consumption (CO_2 emitted at the power plants).

Requirements of National Climate Change Strategy

10.4.3 The National Climate Change Strategy Ireland Report (2000) provides a framework for controlling greenhouse gas emissions in the most efficient and equitable manner while continuing to support economic growth. The strategy is based on the fundamental principles of sustainable development, which are set out in "Sustainable Development: A Strategy for Ireland" and takes account of the need to protect economic development and competitiveness.

10.4.4 The residential sector currently contributes 16% of current national CO_2 emissions. The national strategy is to reduce emissions from this sector by a factor of 0.9 by 2010. For residential developments, the national strategy is implemented through stricter thermal insulation requirements in the building regulations.

10.4.5 The commercial and services sector contributes approximately 7% of current national CO_2 emissions. To accommodate economic growth, the national strategy allows for a growth factor in emissions from this sector of approximately 1.5 (re. 1990 emissions) by 2010, compared with a projected growth factor of 1.7 with no control strategy in place.

10.4.6 The CO_2 emissions from the commercial building sector can be controlled through energy efficiency measures. The national strategy objectives are reasonably achievable using existing technologies. The energy requirements of commercial buildings designed in accordance with good practice, are typically 1.5 times lower than for existing commercial buildings.

10.4.7 The national strategy currently does not contain any specific quantitative guidelines on energy efficiency targets for new commercial buildings. However, guidance on this is expected to become available following implementation of the EU Directive on the Energy Performance of Buildings (2002/91/EC). The national

energy authority "Sustainable Energy Ireland" may also subsequently publish energy efficiency indicators and guidelines for the commercial sector.

10.4.8 The Planning Scheme published in 2000 by DDDA referred to high insulation standards for buildings and encouraged the use of combined heat and power (Grand Canal Dock Planning Scheme section 5.4.3). The EIS published for the overall Grand Canal Docks development in 2000, referred to an energy policy to minimise negative impacts.

10.4.9 The developer should ensure that the development is in compliance with the energy policy of the Dublin Dockland Development Authority for the integrated development of the area.

Emissions of Greenhouse Gases

10.4.10 The emissions of carbon dioxide were calculated for the three development mix options considered.

10.4.11 The calculated total emissions are presented in Figure 10.2. A proportion of these emissions occur locally, and a proportion occurs at power plants, as a consequence of the electrical power demands of the development. The calculated emissions range from approximately 1000 Tonnes of carbon per year for a development with naturally ventilated commercial buildings to just over 4000 Tonnes for a development incorporating prestige A/C buildings. The much higher carbon emission of the prestige A/C building is due mainly to the associated emissions from power plants supplying electrical power to the development.

10.4.12 Emissions of carbon dioxide can be kept within the requirements of the national climate change strategy by designing the buildings to meet current good practice with regard to energy efficiency and utilising natural ventilation as far as feasible.

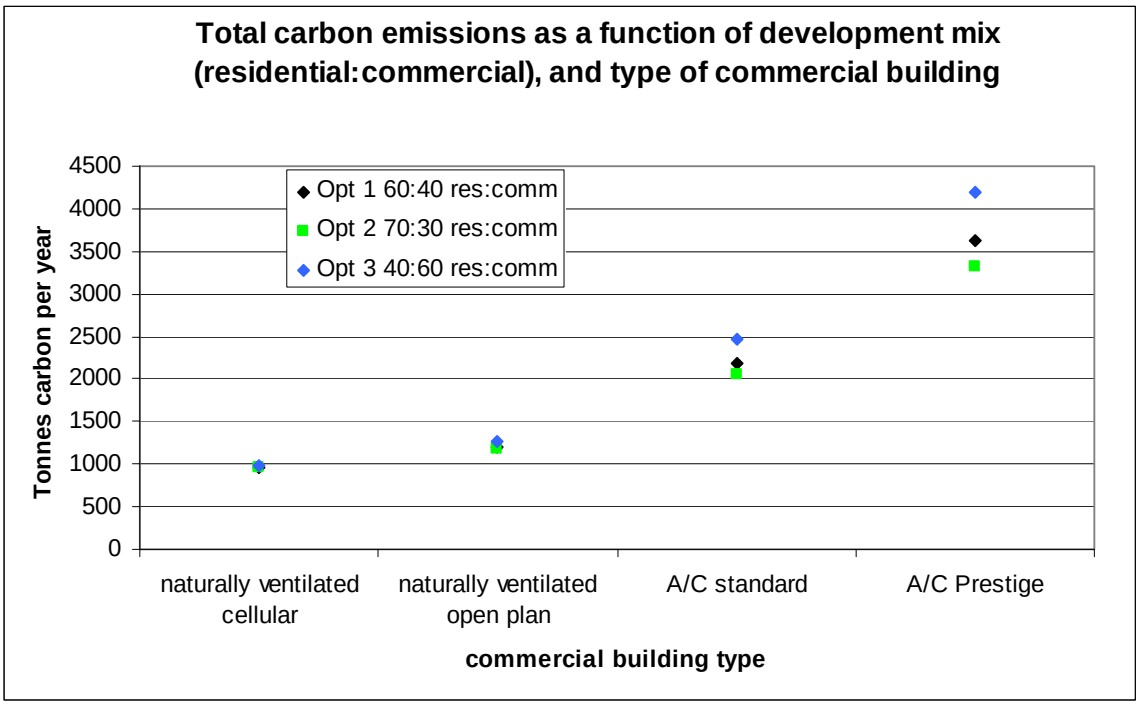

Figure 10.2. Analysis of carbon dioxide emissions (expressed as carbon). The main factor determining emissions is the type of commercial building, with the lowest emissions from naturally ventilated buildings, and the highest emissions from prestige A/C commercial buildings. The calculated emissions are not sensitive to the development mix options for naturally ventilated buildings. For A/C buildings, options 1 and 3 have a marginally higher impact. Based on published good practice energy consumption and carbon emission data (Scrase 2004).

Transboundary Pollutants

10.4.13 Ireland has international obligations to limit the emissions of transboundary atmospheric pollutants, under the Gothenburg Protocol and the EU Directive on National Emissions ceilings. The draft national strategy is outlined in a discussion paper published by the Department of Environment in 2003.

10.4.14 The discussion paper mentions the possibility of tighter emission limits for domestic and commercial heating systems, and energy efficiency. Effective reductions in emissions of nitrogen dioxide can be achieved through energy efficiency measures, as less fuel consumption and lower emissions would be required to service a given development. Meeting the requirements of national policy for reducing carbon dioxide emissions, through energy efficiency measures, would therefore also meet the requirements for reduction of the generation of transboundary pollutants.

10.4.15 For the proposed development, the only transboundary pollutants of interest are nitrogen oxides (NO_x). The calculated total emissions of nitrogen oxides from the proposed development are presented in Figure 10.3. These include locally generated emissions from heating boilers and emissions from power plants supplying electricity to the development.

10.4.16 The lowest emissions are obtained for naturally ventilated buildings. For naturally ventilated and standard A/C buildings, there is little difference in calculated total emissions for the three development mix scenarios considered. The highest emissions are associated with prestige type A/C commercial buildings, which are more than three times those associated with naturally ventilated options.

10.4.17 The requirements of the draft national objectives can be achieved by designing the buildings in accordance with energy efficient principles, utilising natural ventilation as far as feasible.

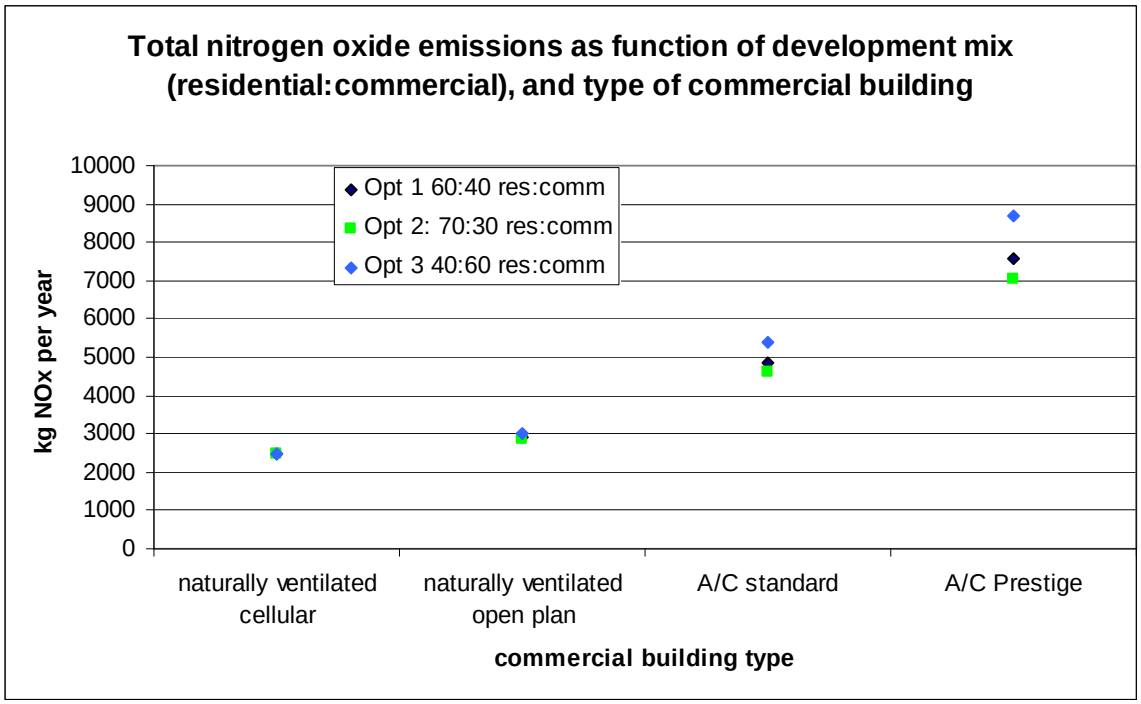

Figure 10.3: Analysis of nitrogen oxide emissions. The main factor determining emissions is the type of commercial building, with the lowest emissions from naturally ventilated buildings, and the highest emissions from prestige A/C commercial buildings. The development mix options have an effect only for A/C building types. Based on published good practice energy consumption data (Scrase 2004), and emission factor of 0.05kgNOx/GJ for natural gas/oil.

10.5 MITIGATION MEASURES

Construction Phase

10.5.1 Prior to any demolition or construction activity, surveys should be carried out for any hazardous materials such as asbestos, hazardous fibres and residual chemicals stored on site. An investigation of the ground should also be carried out to determine if there are any hazardous materials which could become suspended as airborne dust. Any such materials should be removed and disposed of in accordance with legal requirements prior to development.

10.5.2 During the construction phase, soiling of roads can be minimised by use of truck wheel washes, covering of trucks carrying fine materials and surfacing of the site exit roads. A road cleaning service at critical times is also beneficial.

10.5.3 Active management is required throughout the construction phase to minimise the generation of dust. During dry periods, water sprays may be required. Any temporary stockpiling of soil should be designed to minimise exposure to wind.

Operational Phase

10.5.4 The buildings should be constructed and operated according to energy efficient principles, in compliance with the requirements of the National Climate Change Strategy, and any specific requirements to meet the DDDA energy policy for the overall docklands development. In accordance with the DDDA EIS of June 2000 *"Developers will also be encouraged to maximise usage of natural ventilation and passive solar principles."*

10.5.5 For residential buildings, the national building regulations apply with regard to thermal insulation. In the absence of specific national guidelines for commercial buildings, the developer should take account of the general principles of the EU Directive on the Energy Performance of Buildings 2002/91/EC, and should liase with Sustainable Energy Ireland, the national energy authority, to keep abreast of evolving energy efficiency guidelines.

10.6 REFERENCES

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11.0 NOISE AND VIBRATION

11.0 NOISE

11.1 INTRODUCTION

11.1.1 The impact of the proposed development at the Grand Canal Dock is considered in terms of the environmental noise aspects.

11.1.2 The development consists of mixed residential and commercial units. The potential noise impacts considered are as follows:

- Demolition and construction phase noise and vibration.
- Additional traffic noise and car parking noise associated with the completed development.
- Services noise impacts at nighttime.

11.1.3 The proposed development is part of an integrated development plan for the area by the Dublin Docklands Development Authority (DDDA).

11.1.4 Environmental aspects in terms of noise were considered in general terms in an overall Environmental Impact Statement (EIS) for the Planning Scheme in 2000. This present report analyses the specific noise impact of the zone 4 development area. An EIS was previously carried out for an earlier proposed development at the study site (Burwood House Ireland Ltd. – Mc Hugh Consultants 2001).

11.1.5 Two new bridges are proposed for the area. One is a bridge linking Britain Quay to York Road, which will carry public transport, pedestrians and cyclists. An EIS for the proposed bridge was carried out in 2003 (Reid Associates). A bridge is also proposed to cross the Liffey at Macken St. The impact of these bridges on traffic flows in the vicinity was included in the report.

11.2 PROPOSED DEVELOPMENT

11.2.1 The proposed development lands form part of the Grand Canal Dock Planning Scheme Area. The site is located in the north eastern corner of the development area, bounded by Sir John Rogerson's Quay, Britain Quay, Benson Street to the west, and Green Street to the south. It is identified as Zone 4 in the DDDA Grand Canal Dock Planning Scheme 2000.

11.2.2 This is a mixed industrial/commercial and residential area. The nearest residential locations are apartments to the east, across the River Dodder, at a distance of 130m, and apartments at Charlotte Quay to the southwest at a distance of 250m.

11.2.3 Three options for the development are under consideration namely:

Option 1: 60:40 residential: commercial, with 370 residential units and 51,700 m^2 of commercial development

Option 2: 70:30 residential: commercial, with 432 residential units and 46100 m^2 of commercial development

Option 3: 40:60 residential: commercial, with 247 residential units and 62770 sq. metres of commercial development.

11.2.4 The urban design options proposed for the site have no significant impact on noise emissions and will not be considered further.

Methodology

11.2.5 A daytime and nighttime baseline noise survey was undertaken at the site to establish the existing noise environment. It was undertaken in accordance with ISO 1996 *"Description and Measurement of Environmental Noise".*

11.2.6 Construction noise impact was assessed using noise levels measured at similar sites, and with reference to BS5228 *"Noise Control on Construction and Open Sites".*

11.2.7 The traffic noise generated by the proposed development was calculated using the U.K. Dept. of Transport "*Calculation of Road Traffic Noise"* (CRTN) methodology from the Design Manual for Roads and Bridges (DMRB).

11.2.8 Regarding services noise, the approach taken was to set an environmental nighttime design target at the nearest noise sensitive location, with reference to the Environmental Protection Agency guideline nighttime noise limits, and the assessment procedures of BS 4142, *"Rating Industrial Noise Affecting Mixed Residential and Industrial Areas".*

11.2.9 The suitability of the proposed development site for residential use was assessed in accordance with Planning Guideline PPG24.

11.2.10 All noise levels in the text of this report are in terms of average noise levels (L_{Aeq}), unless otherwise indicated.

11.3 DESCRIPTION OF EXISTING ENVIRONMENT

11.3.1 A baseline noise survey was carried out on three occasions in November 2004 and April 2005 to determine the existing daytime and nighttime noise environment.

Measurement Details

Assessment and Measurement Locations

11.3.2 The nearest noise sensitive locations are apartments/offices at the South Bank Quay, to the east of the proposed development and Waterside apartments on Charlotte Quay, to the south. Noise levels were measured at these locations and at a further three locations. The measurement locations are indicated in Figure 11.1 and are as follows:

N1: Apartments/offices, South Bank Quay. Measurements were made adjacent to a jetty on the River Dodder. This is a noise sensitive location.

N2: In front of Waterside Apartments, Charlotte Quay. This is a noise sensitive location.

N3: Hanover Quay, at junction with Benson Street. Measurements were made near the water, at 5m from the roadside.

N4: Sir John Rogerson's Quay, between Benson St. and Britain Quay.

N5: North Wall Quay, 5 m from roadside, near water.

Survey Details

Survey Date	26/11/04
Survey period	12:00 hours to 15:30 hours
Weather	Dry, cold, light breeze
Instrumentation	Brüel & Kjær 2260 Sound Level meter (Type 1)
Calibration	Brüel & Kjær Type 4231 Calibrator
Personnel	Kieran Corcoran M.Sc. ANV Technology

Survey Date	30/11/04 & 31/11/04
Survey period	15:00 hours to 01:00 hours
Weather	Dry, light breeze with moderate gusts
Instrumentation	Brüel & Kjær 2260 Sound Level meter (Type 1)
Calibration	Brüel & Kjær Type 4231 Calibrator
Personnel	Kieran Corcoran M.Sc. ANV Technology

Survey Date	26/04/05
Survey period	Nighttime 02:00 to 05:00 hours Daytime 10:45 to 16:00 hours
Weather	Nighttime: Calm, wet surfaces Daytime: Dry, light SE breeze
Instrumentation	Svan 947 Sound Level meter (Type 1)
Calibration	Brüel & Kjær Type 4231 Calibrator
Personnel	Ross Whyatt B.Sc. ANV Technology

Measurement Parameters.

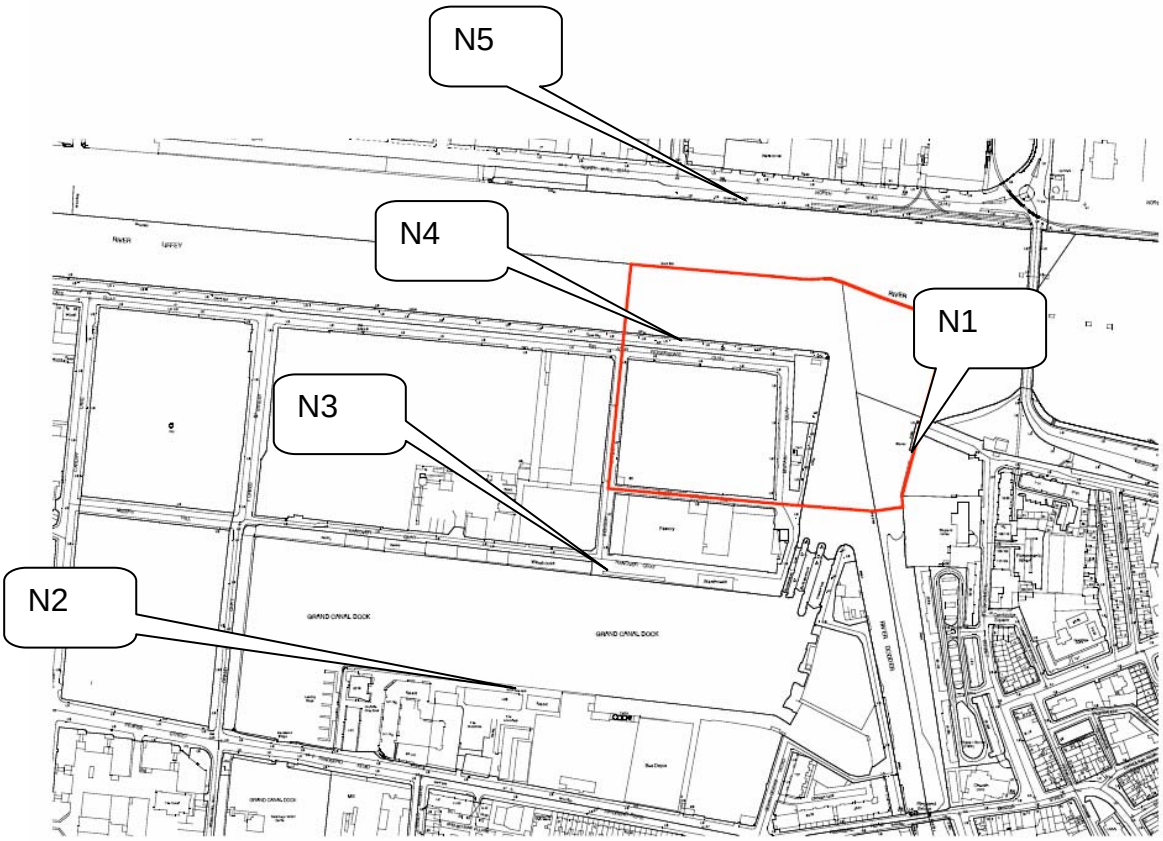
11.3.3 Noise levels are measured using a logarithmic noise scale (decibel) and are denoted dB(A). The "A" indicates that a frequency weighting has been applied to allow for the variation in the sensitivity of the human ear as a function of frequency. The duration of the measurement was a minimum of 15 minutes and the measurement parameters are as follows:

L_{Aeq} the average noise level during the measurement period, which includes all noise events. The L_{Aeq} value has been found to correlate well with human tolerance of noise.

L_{A90} the noise level exceeded for 90% of the time. It is generally taken as being representative of the steady background noise at a location. It tends to exclude short events such as cars passing, dogs barking, aircraft flyovers etc.

L_{A10} the noise level exceeded for 10% of the time. It is a measure of the higher noise levels present in the ambient noise. The L_{A10} parameter is commonly used to describe traffic noise.

Figure 11.1 Noise Measurement and Assessment Locations



Description of Existing Noise Environment

11.3.4 The measured and calculated traffic noise levels are given in Table 11.1 for daytime and Table 11.2 for nighttime.

Daytime

11.3.5 The dominant noise source in the locality is distant traffic noise. There was extensive construction noise during each survey, and a relatively high proportion of heavy commercial vehicles, associated with both construction and with local commercial activity. There was minimal local traffic along the site boundaries. Although there are a number of commercial units in the area, there was no significant industrial noise audible in the immediate vicinity.

11.3.6 The ambient daytime noise level at South Bank Quay was 60 dB(A). It was influenced primarily by traffic on the toll bridge and along North Wall Quay.

11.3.7 The ambient noise level at the Charlotte Quay apartments was 57 dB(A), again influenced primarily by distant traffic and construction noise.

11.3.8 At N3, on Hanover Quay, the ambient noise level was 64 dB(A). This was influenced considerably by truck movements associated with the nearby Kilsaran concrete works. Neither the concrete works nor any local industry was directly audible at this measurement position.

11.3.9 There was negligible local traffic along Sir John Rogerson's Quay at N4. The noise levels were similar to Hanover Quay. The main noise sources were traffic on the North Wall Quay and the Toll Bridge, along with some construction noise.

11.3.10 Ambient noise levels were relatively high on the North Wall Quay, at 72 dB(A). This was due to high volumes of traffic and a high percentage of heavy commercial vehicles (HCV's).

Nighttime

11.3.11 At nighttime the ambient noise level decreased by approximately 10 dB, with mean noise levels of 50 dB(A) and 47 dB(A) at South Bank Quay and Charlotte Quay respectively.

11.3.12 At nighttime, in the lulls in traffic, the underlying steady component of the noise (background noise) varied from 37 to 49 dB(A), with a mean value of 44 (L_{A90}) at South Bank Quay and 41 dB(A) at Charlotte Quay. The higher noise levels were experienced earlier in the night, due to traffic on the toll bridge and shipping activity.

11.3.13 Distant traffic noise was the dominant component of the steady background noise. These levels are relatively low for urban areas. Table 11.1 below indicates measured noise levels, Grand Canal Dock, Daytime.

Proposed Changes to Existing Environment

11.3.14 A number of developments are planned in the area which will influence the noise environment.

11.3.15 A bridge is proposed linking Britain Quay to York Road. The bridge will serve public transport, pedestrians and cyclists. This will result in increased traffic along Sir John Rogerson's Quay and South Bank Quay.

11.3.16 The impact of the noise was evaluated by Reid Associates in December 2003. It was estimated that the noise level would increase by 2-4dB during peak hours.

11.3.17 Extensive building development is in progress or planned within the Grand Canal Dock Planning Scheme Area. As the proposed site is at the most eastern corner, it will not be greatly affected by traffic noise associated with these developments. At nighttime, a given noise sensitive location may be exposed to services noise from a number of different developments.

11.3.18 A bridge is proposed which will cross the Liffey at Macken Street. This will result in a slight increase in traffic along Sir John Rogerson's Quay, but the overall traffic volumes will remain very low.

11.4. PREDICTED IMPACTS OF THE DEVELOPMENT

Assessment Criteria

Construction Noise Criteria

11.4.1 There are no mandatory noise limits for construction noise in Ireland or in the UK. Criteria for daytime construction noise are often set at a level higher than for other permanent intrusive noise sources because it is recognised that it is a short-term activity. In setting criteria for construction noise, account has to be taken of the technical feasibility of the proposed criterion, and also the trade-off between the noise level, and the duration of the noise exposure.

11.4.2 For prolonged exposures above 70dB(A), the level of noise intrusion into houses may however prove unacceptable. A level of 70 dB(A) is the construction noise limit proposed in the recent National Roads Authority guidelines for road construction projects ("Guidelines for the Treatment of Noise and Vibration in National Roads Schemes").

11.4.3 These construction noise limits, which are presented in Table 11.3, represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable ambient noise level for the residents.

Days & Times	$L_{Aeq\ (1hr)}$ dB	L_{Amax} dB
Monday to Friday 07.00 to 19.00	70	80
Monday to Friday 19.00 to 22.00	60	65
Saturday 08.00 to 16.30	65	75
Sundays and Bank Holidays 08.00 to 16.30	60	65

Table 11.3: Maximum permissible noise levels at the façade of dwellings during construction (NRA published guidelines 2004)

Traffic Noise Criteria

11.4.4 The impact of the additional traffic noise associated with the proposed development was assessed by considering the change in noise level brought about by the development.

11.4.5 An overview of the significance of traffic noise levels, and the subjective perception of changes in traffic noise levels is provided in Table 11.4.

Change in Noise Level	**Subjective Perceived Change**	**%Change in Loudness**
0 dB	No change	0%
1 to 2 dB	Negligible change	10%
3 to 5 dB	Noticeable change	30%
6 to 9 dB	Clearly noticeable	70%
>10 dB	Substantial change	>100% (more than twice as loud)
Level L_{den}	**Description of Traffic Noise**	
<45 dB(A):	low traffic noise	
45-50 dB(A)	reasonably low level, quiet residential area	
50 - 55 dB(A):	low to moderate – audible but not intrusive	
55-60 dB(A):	moderate level, clearly audible, slightly intrusive	
60-65 dB(A):	loud traffic noise – typical busy town centre	
>65 dB(A):	very loud – close to roadside with fast traffic	

Table 11.4: Subjective response to changes in noise level, and description of typical noise levels

Services Noise Criteria

11.4.6 For nighttime services noise, it is relevant to consider the EPA (Environmental Protection Agency) guidelines. These suggest levels of 55dB(A) or less during daytime and 45dB(A) or less at night, at noise sensitive locations. In the absence of other national standards, these levels are often used as guideline limits in assessing services noise impacts.

11.4.7 Use of the 45 dB(A) guideline limit can result in a significant increase in the nighttime noise level. Consequently, it is generally more appropriate to set a services noise emission target relative to the existing background noise. BS 4142, *"Rating Industrial Noise Affecting Mixed Residential and Industrial Areas",* sets out a methodology which can be used to establish acceptable levels of services noise.

11.4.8 According to BS 4142 there is a likelihood of noise complaints when additional noise from a development significantly exceeds the existing background noise level. When the additional noise is equal to or lower than the background noise, complaints are considered unlikely.

11.4.9 The lowest measured existing nighttime background noise level in the area was approximately 37dB(A) L_{A90}. It would therefore be a reasonable design criterion to require that services noise emissions from the development at nighttime do not exceed 37 dB(A) at the nearest noise sensitive locations. This would result in a slight increase in the minimum background noise level to about 40dB(A), which would not be noticeable, and which is not likely to be audible indoors.

Construction Phase

Construction Activities

11.4.10 The highest noise levels are likely to be generated during the demolition of the existing buildings, and during site clearance and preparation phase.

11.4.11 One hour average construction noise levels at busy construction sites have been measured by ANV Technology to be typically less than 65 dB(A) at a reference distance of 50m. This includes noise from excavations, construction plant, and vehicles on site. During the actual construction phase of the buildings, noise levels are likely to be lower.

11.4.12 Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the distance from the main construction activities to the receiving houses.

11.4.13 The average construction noise level at the nearest residences at N1 and N2 is expected to be about 55 dB(A) or lower. The existing ambient noise level at these locations is 60 dB(A) and 57 dB(A) respectively. While construction noise would be audible, it is unlikely that it will be intrusive at these properties, and there is no adverse impact.

11.4.14 When higher noise activities such as piling are undertaken, the noise level is expected to be about 5-10dB higher during this phase. While this will be noticeable at both N1 and N2, the noise level is likely to be below 70 dB(A) and is considered acceptable for construction works during daytime hours.

Vibration

11.4.15 It is not expected that there will be significant generation of ground-borne vibration beyond the site boundaries due to construction activities.

11.4.16 Guideline ground vibration limits given in BS 7385 range from 15mm/s at low frequencies to 50mm/s at high frequencies. It is expected that ground vibration levels at nearby properties will be significantly below these values.

11.4.17 Excavation does not generally create significant vibration. Rock-breaking or blasting is not expected on this site. There may occasionally be perceptible vibration at the site boundaries associated with piling, excavators or movement of heavy tracked excavators. The resulting ground vibration levels at the nearest properties would however be imperceptible.

Construction Traffic

11.4.18 At this planning stage details are not available on likely construction traffic. Additional traffic noise can however be expected on haul routes to the site. Based on a nominal assumption of 20 vehicle movements per hour travelling to and from the site, the additional traffic noise generated at properties fronting the haul route is expected to be about 60 dB(A).

11.4.19 This is similar to existing noise levels in the immediate vicinity and is not likely to be intrusive. It would not be noticeable along the more heavily trafficked streets.

Operational Phase

Traffic Noise Impact

Car Traffic

11.4.20 The traffic noise impact is based on the projected additional traffic associated with the development, as presented in the traffic section of the EIS and summarised in Table 11.5. The annual average daily traffic is essentially the same with all options.

Table 11.5: Predicted traffic flows along Sir John Rogerson's Quay in 2006 (with Macken St. Bridge)

Scenario	Predicted Traffic Flow		
	AM peak	PM peak	AADT[1]
Do Minimum	69	65	670
Option 1	53	89	710
Option 2	58	85	715
Option 3	44	98	710
Do minimum + option 1	122	154	1380
Do Minimum + option 2	127	150	1385
Do Minimum + option 3	113	163	1380

[1] 10 times average peak flow
Source: Faber Maunsell

11.4.21 A new bridge is proposed to cross the River Liffey at Macken St. This does not have a significant impact on the traffic flow along Sir John Rogerson's Quay. However, the assessment is undertaken on the assumption that Macken Street Bridge is operational.

11.4.22 The traffic is likely to emerge from the development along Sir John Rogerson's Quay. There is no significant vehicular access facing South Bank Quay. Given the distance and the screening to the noise sensitive locations, there is no impact from traffic associated with the development.

11.4.23 The noise level at properties fronting Sir John Rogerson's Quay due to the traffic associated with the development is determined to be 52 dB(A), in accordance with the methodology of the UK Design Manual for Roads and Bridges (DMRB).

11.4.24 This is less than the existing ambient noise level and will not contribute significantly to overall noise levels. Hence there is no impact due to traffic noise on Sir John Rogerson's Quay as a consequence of the development.

Car Parking

11.4.25 Depending on the option developed, there will be approximately 600 car parking spaces provided. As these will be underground, there will be no significant noise emissions due to car parking noise.

Building Services Noise Impact

11.4.26 The main potential impact would be any external noise sources operating at nighttime such as ventilation equipment.

11.4.27 At this planning stage, details are not yet available on the noise emission specifications for any external noise sources associated with the development.

11.4.28 The existing underlying background noise level in the locality is relatively low. The lowest level measured was 37 dB(A) L_{A90}.

11.4.29 A typical design criterion for the nearest noise sensitive locations is a services noise level of say, 37 dB(A) at the nearest residence. This would result in an increase to 40 dB(A), which is considered acceptable. However, in an extensive area development such as this, a noise sensitive location will be exposed to the cumulative noise impact from a number of individual developments, which may combine to result in elevated nighttime exposure.

11.4.30 Consequently the proposed design criterion is to specify items of external noise generating equipment such that the resulting services noise level does not exceed 37 dB(A) at residences within the development itself. This will ensure a good nighttime noise environment for future residences and result in negligible impact at existing noise sensitive locations beyond the site boundaries.

11.4.31 This proposed criterion can readily be achieved for the development by ensuring that any significant wall mounted noise sources are located such that there is no line of sight to the nearest residences, and by applying noise emission limits for any equipment to be installed at roof-top level.

Assessment of Suitability for Housing

11.4.32 There are no Irish national planning guidelines in terms of noise exposure of proposed residential developments. The UK, Planning Policy Guideline PPG 24 on “Planning and Noise” defines noise exposure categories, to assist planning authorities evaluate residential developments with respect to noise. Residential developments should normally fall within noise exposure categories A or B, which are defined as follows:

Noise Exposure Category A: daytime <55 dB(A); nighttime < 45 dB(A) no planning restrictions.

Noise Exposure Category B: daytime 55-63 dB(A); nighttime 45 – 49 dB(A) noise should be considered.

11.4.33 The existing daytime ambient noise environment within the proposed development site is estimated to be below 60dB(A). This is based on measurements at the boundary positions and an allowance for the contribution due to construction noise. The noise environment is likely to vary within the completed development due to screening provided by buildings.

11.4.34 This is within the U.K. noise exposure category B (NEC B). In accordance with PPG24 for residential developments within NEC B *"Noise should be taken in to account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise".*

11.4.35 For well screened areas within the site, the noise level may be below 55 dB(A), which is within NEC A. Also the noise level at nighttime is below 45 dB(A), and consequently is within NEC A. For residential developments within NEC A

"Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable level."

11.4.36 This analysis indicates that the proposed development site is suitable for residential accommodation. However, due regard should be paid to noise aspects such as façade insulation and minimising building services noise within the development.

11.5 MITIGATION MEASURES

Construction Noise

11.5.1 This proposed development forms part of an extensive scheme for the rejuvenation of the Grand Canal Docks. The Dublin Docklands Development Authority published an Environmental Impact Statement (EIS) "Development Proposals contained in the Draft Planning Scheme for the Grand Canal Dock" in June 2000. This document states that *"noise generation during the construction phase will be governed by all relevant legislation in respect of permissible limits".* An appropriate limit for a typical construction project is 70 dB(A) during daytime hours.

11.5.2 Where construction works occur over a long period of time, the EIS states that

"The following guidance will be applied in order to minimise noise generation to neighbouring communities and enterprises:

- *Working house will be 07:00-17:00hours, except where emergency works need to be carried out.*
- *Work will not normally be permitted on Sundays or Bank Holidays; and*
- *Where, and if, sheet piling will occur for a period exceeding one month then consideration will be given wherever possible to the use of "hush" piling rig or contiguous board piles if applicable."*

11.5.3 The construction plant would be required to comply with SI320 of 1998 EC (permissible Noise Levels) Regulations. Account shall also be taken of BS 5228:1994 *"Noise control in construction and open areas".*

11.5.4 These measures are considered sufficient to adequately mitigate the impact due to construction noise at the proposed site.

Operational Phase

Traffic

11.5.5 The impact of projected increased traffic to and from the development is negligible.

11.5.6 The DDDA EIS of June 2000 stated that measures to ameliorate and minimise the impact of traffic generated by the new development will be implemented, including the introduction of traffic calming measures.

11.5.7 The exclusion of general transport from the Britain Quay-York St Link Bridge will be an effective measure in minimising traffic noise.

Nighttime Services Noise Mitigation

11.5.8 A nighttime services noise design target of 37 dB(A) within the development is proposed to ensure that any building services noise emissions have minimal impact. This should be incorporated into the project contracts.

11.5.9 The proposed target can be achieved by ensuring external noise emitting equipment is screened from the nearest residences, and that emission limits are placed on roof-top items of equipment.

11.6 REFERENCES

Dublin Docklands Development Authority, “Grand Canal Dock, Planning Scheme”, 2000.

Dublin Docklands Development Authority, “Environmental Impact Statement of Development Proposals contained in the Draft Planning Scheme for the Grand Canal Dock”, June 2000.

Reid Associates, Environmental Impact Statement for Bridge Linking Britain Quay to York Road”, December 2003.

McHugh Associates “Environmental Impact Statement Burwood House (Ireland) Ltd.”, February 2001.

ISO 1996 “Description and Measurement of Environmental Noise”
BS5228 “Noise Control on Construction and Open Sites”.
BS 4142, “Rating Industrial Noise Affecting Mixed Residential and Industrial Areas”.

U.K. Design Manual for Roads and Bridges/Calculation of Road Traffic Noise.

UK Department of the Environment “Planning and Noise” PPG24.

12.0 SOIL AND WATER

12.0 SOIL AND WATER

12.1 INTRODUCTION

12.1.1 This section of the EIS assesses the impact of the proposed mixed-use residential and commercial development at Grand Canal Dock on the soils and geology, on local water supply and foul and surface water drainage systems, and also on groundwater during the construction and operational phases of the proposed development. It also addresses and mitigates impacts associated with each phase.

12.1.2 The assessment of the potential impact of the proposed development on the soils, geology and water environment was carried out according to the methodology specified by the Environmental Protection Agency (EPA)[1,2]

12.1.3 The Geological Survey of Ireland (GSI) geological maps and records for the area were inspected, with reference to geology and hydrogeology [3].

12.2 PROPOSED DEVELOPMENT

12.2.1 The proposed development site is bounded by Benson St. to the west and Green St. East to the south. The site boundary extends to the Slipway at the Dodder/Liffey confluence to the east and to the centre of the River Liffey to the north. The proposed development will consist of a mixed-use development, with residential and commercial units. A public transport bridge will span the confluence of the Dodder and the Grand Canal Dock, springing from Britain Quay and landing at York Street in Ringsend. There are a number of land use options for development, which are as follows:

<u>Option 1</u>

60:40 of residential:commercial
a. 370 residential units
b. 51,700 m^2 of commercial

<u>Option 2</u>

70:30 of residential:commercial
a. 432 residential units
b. 46,100 m^2 of commercial

Option 3

40:60 of residential:commercial
a. 247 residential units
b. 62,770 m^2 of commercial

12.2.2 There are two urban design approaches to the future development of the lands and also two alternative variation urban design options. The urban design options have no significant impact on the soil and water issues and will not be considered further. The characteristics of the proposed development with specific regard to the soil and water environments are outlined in this section.

Construction Phase

12.2.3 The proposed development will involve excavation of material from the site to accommodate foundations and basement construction.

12.2.4 It is not expected that construction will involve excavation of bedrock, due to the depth of overlying quaternary deposits. However, piling will be necessary to form foundations for some of the more significant buildings, and this piling will extend to bed rock. Groundwater may also be encountered during the excavations and dewatering may be required during the construction phase.

Operational Phase

12.2.5 The operation of the development will include residential and commercial use. Surface water and foul water drainage will be discharged from the site to local watercourses and Local Authority maintained sewers respectively.

12.3 DESCRIPTION OF EXISTING ENVIRONMENT

Geology

Bedrock Geology

12.3.1 Much of the bedrock underlying Dublin is dominated by rocks of Carboniferous age. During the early Carboniferous period, the eastern part of Ireland underwent uplift and erosion. Following this, there was a period of general subsidence in the area.

12.3.2 This subsidence permitted the sea to invade the lower ground from the south during the Carboniferous age[3]. Continued subsidence resulted in shallow and then deeper marine sediments accumulating across most of Dublin City and County.

12.3.3 The depth of the sea and type of seabed varied from place to place, as did the rate of sedimentation and so a variety of carbonate sediments were produced in the area.

12.3.4 The Calp limestone, which covers most of Dublin was deposited in the basins that formed over 300 million years ago [3]. Thick sequences of muds and muddy limestones accumulated in the basins, sometimes showing graded bedding. The Calp Limestone itself is comprised of dark grey, fine-grained, graded limestone with interbedded black, poorly fossilised shales.

12.3.5 At this time erosion was also occurring in the Leinster Massif, which is the underlying geology of south Co. Dublin and the Wicklow Mountains. Some clasts and boulders from there were deposited in the Calp Limestone.

12.3.6 There are a number of faults in the Calp limestone, however none are within the site area.

12.3.7 There are no bedrock outcrops on the site, or in the immediate surrounding area. An EIS prepared in 2001 for a proposed development of the former Hammond Land Metal Works on Sir John Rogerson's Quay, Grand Canal Dock, found depths to bedrock of 15.5m to 18.5m below existing ground level [4].

Quaternary Geology (Subsoils)

12.3.8 The Quaternary Period is the final stage of the geological time scale. This period includes the start of the Ice Age (approximately 1.6 million years ago), known as the Pleistocene Epoch right through to the postglacial period, known as the Holocene Epoch, which began 10,000 years ago.

12.3.9 The Pleistocene Epoch in Ireland began when there was a significant cooling of the Earth's climate, and was characterised by alternating extended periods of very cold conditions, during which time much of the country was covered by an ice sheet [3].

12.3.10 These colder periods were interspaced with warmer periods, known as interglacials, which lasted for approximately 10,000 years at a time.

12.3.11 Ice sheets that influenced the Dublin Region were from the Midlands and the Irish Sea Basin. These ice sheets vied with each other for the occupation of the coastal area north of Kilcoole, including much of the area Dublin City covers today.

12.3.12 As the ice travelled over the ground, it eroded underlying bedrock and formed, within and beneath the ice sheet, a sediment, which

consisted of particles with a massive size distribution, from clay particles to boulders. This material has been labelled glacial till or boulder clay and is the most widespread sediment type in Ireland. Glacial till can range in thickness from less than 1m thick to tens of metres thick.

12.3.13 The Quaternary deposits in the South Dublin area are quite uniform in composition. They consist of tills derived and gravels, deposited by the ice sheet from the Irish Sea Basin. The till may contain shells dredged from the floor of the Irish Sea.

12.3.14 The deposits along the northern section of Dublin Bay are predominantly sand overlying gravels and clay.

12.3.15 GSI records indicate that the depth of the deposits increases towards the City Centre and the mouth of the Liffey, as one moves south or north along the coastline, from the extremes of the City. Depths of 10m or greater, of sands, gravels and estuarine muds have been recorded in Ringsend and East Wall and along the south and north quays.

12.3.16 The EIS prepared for the former Hammond Lane Metal Works site found that the quaternary geology of the area was typically formed of made ground, exhibiting depths of between 0.35 – 4.5m, overlying a sand and gravel horizon of 0.9m – 4.8m deep, overlying a silt layer of 0 – 5m thickness.

Soils

12.3.17 The soil of Dublin is derived from glacial till of Irish Sea origin, with limestone and shale and is largely Grey Brown Podzolic. Grey Brown Podzolic soils, as shown on the Soil Map of Ireland [5], are usually formed from a calcareous parent material (limestone). The lighter-textured Grey Brown Podzolics are good all-purpose soils, while the heavier-textured members are highly suited to pasture production, responding well to manurial and management practices.

12.3.18 However, the estuary and coast of Dublin has a layer of alluvium overlying the topsoil, which is a result of the low-lying status of the city and the proximity of a major river. The above sequence of soils only remains in undisturbed areas of the coast. As Dublin is a very built-up city, much of the topsoil and alluvium have long since been removed. As the above referenced site investigation notes, the soil layer on the proposed site has long since been removed and replaced by made ground.

Made Ground

12.3.19 A significant portion of Dublin City is built on reclaimed or infilled land. This reclamation began back in the 18th Century. The North Docklands, was reclaimed between 1717 and 1729. A 1 km stretch of land between the city centre and the River Dodder, on which the current site is located, was reclaimed by Sir John Rogerson between 1917 and 1927 [3].

12.3.20 North Lotts, and East Wall were reclaimed by the end of the 1750s. A bank was constructed along the present South Lotts Road by 1760. The area between these banks was gradually reclaimed together with adjoining areas of the Dodder Estuary. The dry dock between the Grand Canal Dock and the Dodder was filled in 1918.

12.3.21 Reclamation continued progressively in an easterly direction from the beginning of the 19th Century.

12.3.22 Traditionally the material used for reclamation in Dublin included construction and demolition waste, waste topsoil and municipal and industrial wastes. The 2001 EIS referred to above noted that the made ground in this area comprised brick, glass, concrete, timber, ash, clinker and builders rubble, in a light brown/dark brown clay matrix.

12.3.23 The EIS also noted that elevated concentrations of arsenic, copper, lead and zinc, PAH (Polycyclic Aromatic Hydrocarbons) and mineral oils were noted in the made ground.

Hydrology and Hydrogeology

Surface Water

12.3.24 The hydrological environment is defined by 3 significant water bodies, namely the Liffey which flows east along the northern boundary of the site, the Dodder which flows north along the eastern boundary of the site and the Grand Canal Basin, which is located some 40m to the south of the site. The confluence of the Liffey and the Dodder is at the eastern boundary of the site.

12.3.25 The water quality and flow of the River Liffey and River Dodder is monitored on an ongoing basis, by the EPA [5]. The EPA Data for the River Liffey is taken from the Islandbridge Weir monitoring site, which is some 5.5 km upstream of the proposed development site.

Parameters	Units	1999	2000	2001	2002	2003	2004
Temp	^{o}C	10.28	13.15	12.14	13.36	10.11	5.80
pH	pH units	8.17	8.16	8.32	8.28	8.19	8.10
Conductivity	µS/cm	550.78	548.36	514.55	517.12	494.24	482.00
BOD	mgO_2/l	2.50	-	-	-	-	-
Ammonia as N	mg N/l	0.10	0.05	0.06	0.06	0.11	0.09
Rct_PhosP	mg P/l	0.16	0.15	0.08	0.05	0.04	0.05
Total Oxidised Nitrogen	mg N/l	2.32	1.94	2.00	1.89	2.24	2.04

Table 12.1: Water quality monitoring data for the River Liffey (1999 – 2004)

Parameter	Range
pH	7.7 – 8.8
Conductivity (uS/cm)	323 – 10730
BOD (mg/l)	2 – 3
Total Ammonia (mg/l)	0.03 – 0.33
Oxidised Nitrogen	0.7 – 2.3
Orthophosphate	0.03 – 0.13

Table 12.2: Water quality data for River Dodder at Londonbridge Road

- Bridge, some 1km to the south of the proposed development site.
- (for the period 1998 – 2000).

Test Parameter	Limits from S.I. 294 of 1989 [1]	Limits from S.I. 294 of 1989 [1]	Limits from S.I. 294 of 1989 [1]	Limits from S.I 293 of 1988 [2]
	A1 Waters	A2 Waters	A3 Waters	
pH	5.5 – 8.5	5.5 – 9.0	5.5 – 9.0	6 – 9
Conductivity (μS/cm)	1000	1000	1000	N/A
Ammonium (mg NH_4-N/l)	0.2	1.5	4.0	<1
Oxidised Nitrogen as Nitrate (mg/l)	50	50	50	50
B.O.D. (mg O_2/l)	5	5	7	<5
Total Phosphorous (mg P/l)	N/A	N/A	N/A	0.062/0.124 [5]
Orthophosphate (mg P/l) [4]	0.03	0.03	0.03	N/A

Table 12.3: Limit values for surface water

1 Limits from The European Communities Quality of Surface Water Intended for the Abstraction of Drinking Water Regulations (S.I 293 of 1989).

2 Limits from the European Communities (Quality of Salmonid Waters Regulations) (S.I. 293 of 1988).

3 Limits from the Drinking Water Directive 1998.

4 Limits from The Phosphorous Regulations 1998 (for waters classed as Q 3-4 the target value for orthophosphate (expressed as mg P/l) is 0.03.

5 Parameters of Water Quality, pp 88-89, EPA, 2001.

12.3.26 It can be seen from the above Tables that the Liffey is of reasonable quality at the Island Bridge Weir, and in particular the installation of phosphate removal technology on sewage works discharging to the Liffey has had a considerable positive impact on background phosphate concentrations in the water. The Liffey in the vicinity of the site is influenced by the sea and conductivity levels similar to those measured in the Dodder would be expected for the Liffey in the vicinity of the site.

12.3.27 The water quality results for the Dodder show that phosphate concentrations exceeded the relevant limit values, as did ammonia. The conductivity of the Dodder is also quite high at the monitoring point, due to the influence of the sea.

12.3.28 The Grand Canal Basin is potentially the most vulnerable of the water bodies in the vicinity of the site, due to the very slow flow of water through the basin and hence it has many of the characteristics of a lake, such as long BOD and solids retention time, low dissolved oxygen concentrations and it is further compromised by surface water discharges to the Basin. However, Dublin City Council are actively working to improve water quality within the Basin and the surrounding watercourses, as part of the Dublin Drainage Strategy (2004).

12.3.29 In summary, it can be concluded that the water bodies in the vicinity of the site are of reasonable to good quality, but are vulnerable to any emissions from the activities which take place in their vicinity.

Tide Levels and Sea Level Rise

Sea Level Rise

12.3.30 According to an EPA report 'Climate Change – Scenarios and Impacts for Ireland' Environmental RTDI Programme 2000 – 2006, a sea level rise of 0.5 metres is expected during the period 1990 – 2100, i.e. an average rise of 0.45 cm per year [7].

12.3.31 A UK DEFRA report 'Climate Change' from November 2000 predicts an increase in sea level of between 21 cm (Western Scotland) and 41 cm (East Anglia) by 2050, i.e. an average rise of 0.62 cm per year [8].

High Tide

12.3.32 The Highest Astronomical Tide recorded since 1923 (the year records started), is 5.46 m O.D. at Poolbeg, Ringsend. This occurred in February 2002, and the next highest was 5.1 m in 1924[9].

12.3.33 An EIS published by the DDDA in June 2000, noted that the December 1924 tidal event is equivalent to a Malin Datum level of 2.6m OD and the pavement at Sir John Rogerson's Quay is at 3m OD and the Grand Canal Dock ground level is at 4.5m OD, hence compared with the 2002 level of 2.96m, the Dock ground level is still above the 2002 level.

12.3.34 However, it is important to note the above comments with respect to sea level rise and for the detailed design phase of the development and selection of final finished floor levels, reference should be made to the recently produced Dublin Bay Hydrological Model, produced by Posford Haskonning Consultants to Dublin City Council, in late 2004. This model allows prediction of probable high tide events to the year 2025 for the Dublin Bay area.

Groundwater

12.3.35 Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub-soils. Aquifers are rocks or deposits that contain sufficient void spaces and which are permeable enough, to allow water to flow through them in significant quantities. The potential of rock to store and transport water is governed by permeability of which there are two types, intergranular and fissure permeability [3].

12.3.36 Intergranular permeability is found in sediments, sands, gravels and clays and fissure permeability is found in bedrock, where water moves through (and is stored in) cracks, fissures, planes and solution openings. The major aquifer underlying the site is a quaternary (gravel) aquifer and therefore the primary characteristic of this aquifer is defined by intergranular permeability as opposed to fissure permeability, which would apply in the case of a bedrock aquifer.

12.3.37 A report carried out on the hydrogeology and geology of Dublin shows the Calp limestone in the Dublin Basin has good permeability, and is suitable for domestic supplies, as permeability is higher near the surface[10]. Therefore the limestone bedrock beneath the site is regarded as a minor aquifer, being moderately productive in local zones. However, due to the proximity to the coast, drinking water supplies would not be abstracted from this area, due to high saline content. Industrial and commercial activities over the centuries in Dublin City Centre have also led to contamination of the aquifer.

12.3.38 The 2001 EIS referenced above noted two gravel aquifers underlying the area, an aquifer between 0.9m and 4.8m thick, at depths of up to -3m AOD Malin and the second aquifer some 0.2 – 5.5m thick, at depths of – 5.5 to -9.9m AOD Malin. Groundwater in

the gravel aquifers was contaminated with similar contaminants to those present in the soil environment. The aquifers are hydrologically linked to the River Liffey and are influenced by the tidal cycle.

12.3.39 The GSI, EPA and the Department of Environment and Local Government (DoELG) have developed a programme of Groundwater Protection Schemes, with the aim of maintaining the quantity and quality of groundwater in Ireland, and in some cases improving groundwater quality, by applying a risk assessment approach to groundwater protection and sustainable development.

12.3.40 The Groundwater Protection Scheme divides a chosen area into a number of Groundwater Protection Zones, according to the degree of protection required for the aquifer. These zones are based on both aquifer vulnerability and the degree of importance the aquifer holds; regional, local or not important.

12.3.41 The Groundwater Protection Scheme for Dublin is currently being completed. This protection scheme will outline the degree of vulnerability of the aquifers in the county, and outline guidelines as to how to protect these aquifers.

Surface Water Drainage

12.3.42 The surface water drainage environment is characterised by natural drainage by overland and sub-surface flow to the water bodies bordering the site and by discharge to the combined sewer system in the area.

Foul Water Drainage

12.3.43 An existing Dublin City Council 300mm diameter combined sewer is located on Sir John Rogerson's Quay, and it connects to a trunk sewer at the junction of Macken St. and Sir John Rogerson's Quay.

Potable Water

12.3.44 An existing 150mm diameter water main runs along Sir John Rogerson's Quay, Britain Quay, Green Street East and Benson St.

12.4 PREDICTED IMPACTS OF THE DEVELOPMENT

12.4.1 The predicted impacts of the proposal for the construction and operation phases of the development on the soil and geology, and the water and hydrogeology environments are outlined in the following paragraphs.

Construction Phase

Soils and Geology

12.4.2 It is not expected that bedrock will be encountered during construction of the proposed development, however piling will extend to bedrock.

12.4.3 The construction works will involve disturbance and removal of natural and made ground. It has been noted that ground contamination is present in some areas of the site and it will therefore be necessary to prepare a detailed Site Remediation Strategy and set appropriate target values for contaminants in soil, given proposed site use, using a site specific risk assessment, which can be conducted using the RISC Human Model 3.0 or the UK CLEA Model.

12.4.4 Further site investigation works will also be required on site to define in detail potentially contaminated areas and leachate testing will be required on soils to be removed from the site, to determine the most appropriate disposal route. Some of the excavated soils will be classed as contaminated and possibly hazardous. All excavated materials will require disposal at appropriately licensed disposal facilities, in compliance with the Waste Management Acts of 1996 (as amended in 2001) and 2003 and associated regulations. The classification of the excavated materials at the site will be as per the EC Landfill Directive of 2002, which provides for classification of materials as inert, non hazardous and hazardous, and the EPA Hazardous Waste Classification Tool.

12.4.5 During the initial site preparation stage and the construction of the buildings and roads, there will be a large volume of machinery on site. The potential impacts to the underlying soil from the construction of the proposed development could derive from accidental spillage of fuels, oils, paints and solvents, which could impact soil and bedrock quality, if allowed to infiltrate to ground during storage and dispensing operations. Mitigation measures outlined in this Chapter of the EIS will ensure that this potential impact is addressed.

12.4.6 If topsoil or fill material is required as part of the proposed development works, details for the correct importation and handling of imported fill materials are presented in this Chapter.

12.4.7 The overall impact on the soil is classed as positive, due to the remediation of soil at the site and the removal of contaminated soil.

Surface Water

12.4.8 The Liffey and the Dodder and in particular the Grand Canal Basin are sensitive water bodies. The remediation of the site will entail excavation of contaminated materials and handling and movement of these materials on site. Mitigation measures put in place will ensure that the risk of contamination of the surface waters is kept to a minimum and that the impact of the construction phase on surface waters is short term and neutral.

Surface Water Drainage

12.4.9 Surface water generated during the construction phase, from excavations and from run off at the site, could potentially be contaminated and could impact on the receiving water environment. Surface water generated on the site will be collected on site and tested prior to discharge to the foul sewer, to ensure any related impacts are short term and neutral during the construction phase.

Groundwater

12.4.10 Some dewatering of excavations may be required, which may involve pumping groundwater from the site. This water is potentially contaminated and will be tested prior to discharge. The impact of the construction phase on groundwater is classed as positive as contaminated water will be removed from the site and the removal of contaminated soil will have the effect of reducing the contaminant flux to the groundwater.

Foul Drainage

12.4.11 Contaminated ground and surface water may require discharge to the foul sewer system. This would be subject to a licence for discharge of Trade Effluent from Dublin City Council. The discharge may require treatment and as a precaution a grit chamber and 3 chamber hydrocarbon interceptor will be used to treat any ground or surface water prior to discharge.

12.4.12 Welfare facilities will be provided for construction operatives. These facilities will be connected to the foul sewer. The overall predicted impact during the construction phase is short term and neutral.

Potable Water

12.4.13 Water will be required during the construction phase but demand will be relatively insignificant and any impacts will be short term and neutral.

Operation Phase

Soils and Geology

12.4.14 The operation of the development will have no direct impact on the soil environment. The area will be permanently covered with an impermeable surface. The effect of soil remediation conducted as part of the development will be a long term and positive impact on the soil environment.

Surface Water

12.4.15 It is possible that drainage water leaving the site at the moment and entering the surrounding water bodies through overland or subsurface flow or the existing drainage system, is contaminated due to the contaminants in the soil. The remediation of the site will therefore lead to a long term positive impact on the surface water bodies bordering the site.

Surface Water Drainage

12.4.16 Surface water drainage from the site will be diverted from the existing combined sewer system to a separate surface water discharge outfall to the River Liffey, via a non return valve to prevent tidal ingress. The pipes will be sized such that additional capacity is provided during a high tide and storm event, when the valve may be closed by a high tide and heavy rain falling on the site may require storage until the tide has dropped. Drainage from the basement and any roads or other spaces where traffic may be present will be treated through a Class 1 - 3 chamber coalescing hydrocarbon interceptor, designed to EN 858. The overall predicted impact on surface water drainage is long term and positive.

Groundwater

12.4.17 The removal of contaminated soil from the site will lead to a long term positive impact on the groundwater environment.

Foul Drainage

12.4.18 Estimated foul drainage discharge rates are provided in the following table.

	Residential	WasteWater Flow	Commercial	WasteWater Flow	Total Flow
	Units	(m^3/day) *	m^2	(m^3/day)**	m^3/day
Option 1	370	225	51,700	138	363
Option 2	432	262	46,100	123	385
Option 3	247	150	62,770	167	317
Table 12.4	Wastewater	Flow rates			
*Based on average occupancy of 2.7 persons/unit					
** Based on 15 m^2 per person for commercial units and 40 l/person/day					

12.4.19 As surface water drainage will be diverted from the foul sewer, sufficient capacity will be available subject to verification by Dublin City Council.

12.4.20 Overall the predicted impact on the foul drainage system is long term and positive due to the removal of surface water discharge from the foul sewer system.

Potable Water

12.4.21 Predicted potable water demand is as follows:

	Residential	WasteWater Flow	Commercial	WasteWater Flow	Total Flow
	Units	(m^3/day) *	m^2	(m^3/day)**	m^3/day
Option 1	370	225	51,700	138	363
Option 2	432	262	46,100	123	385
Option 3	247	150	62,770	167	317
Table 12.5	Pot.Water	Flow rates			
*Based on average occupancy of 2.7 persons/unit					
**Based on 15 m^2 per person and 40 l/person/day					

12.4.22 The supply will be met by the existing Dublin City Council 150mm diameter main from the Dublin City water supply system. The water supply system in the development will be designed in compliance with current Dublin City Council guidance and Bye Laws. The overall predicted impact on the potable water supply system is neutral and long term.

12.5 MITIGATION MEASURES

Construction Phase

12.5.1 These mitigation measures are designed to address the impacts associated with the construction phase of the development.

12.5.2 Any fill material excavated at the site, which is deemed to be contaminated, will be dealt with as per the Waste Management Acts of 1996 (amended 2001) and 2003 and associated regulations. The classification of the excavated materials at the site will be as per the EC Landfill Directive of 2002, which provides for classification of materials as inert, non hazardous and hazardous, and the EPA Hazardous Waste Classification Tool.

12.5.3 Classification will take place where possible prior to excavation, to minimise the amount of material stockpiling at the site, through the use of soil sampling, contaminant testing and leaching tests. Material will be transported from the site using appropriately permitted waste contractors, holding permits from Dublin City Council or other authorities permitted to issue permits for waste collection in Dublin City. Material will be transported to an appropriately licensed facility for further treatment or disposal.

12.5.4 Excavated materials will be handled appropriately to minimise the risk of run off from wet excavated materials or from rainwater falling on the material and entering the surrounding water bodies. This requirement will be need careful attention during the formulation of the Site Remediation Plan.

12.5.5 Surface water and groundwater generated on the site will be collected on site and tested prior to discharge to the foul sewer, to ensure any related impacts are short term and neutral during the construction phase. Any discharge will be within limits set by Dublin City Council, as part of a trade effluent discharge ,licence. As an additional mitigation measure, the discharge will be treated through a 3 chamber hydrocarbon interceptor and grit trap prior to disposal.

12.5.6 To minimise any impact on the underlying subsurface strata, and the surface water and groundwater environment from material spillages, all oils, solvents and paints used during construction will be stored within specially constructed dedicated temporary bunded areas or suitable bunded lockable storage containers. Oil and fuel storage tanks shall be stored in designated areas, when not in use and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s).

Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

12.5.7 Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area of the site. Spill kits and hydrocarbon adsorbent packs will be stored in this area and operators will be fully trained in the use of this equipment.

12.5.8 If vehicles cannot be moved to the dedicated refuelling area, a mobile double skinned tank accompanied by trained personnel and a spill kit will be used to deliver fuel to the vehicle.

12.5.9 All associated hazardous waste residuals, such as oil, solvent, glue and solvent based paint containers will also be stored within appropriate covered skip containers prior to removal by an appropriate Local Authority or EPA approved waste management contractor for off-site treatment/recycling/disposal.

12.5.10 The combined application of these measures will ensure that inputs to, and subsequent contamination of, the soil and groundwater environment do not occur at the site during the construction phase.

12.5.11 At the detailed design phase of the development and selection of final finished floor levels, reference should be made to the recently produced Dublin Bay Hydrological Model, produced by Posford Haskonning Consultants to Dublin City Council, in late 2004. This model allows prediction of probable high tide events to the year 2025 for the Dublin Bay area. In particular finished ground floor levels should have regard to potential high water levels to minimise risk of flooding.

Operational Phase

12.5.12 Surface water drainage from the site will be diverted from the existing combined sewer system to a separate surface water discharge outfall to the River Liffey, via a non return valve to prevent tidal ingress. The pipes will be sized such that additional capacity is provided during a high tide and storm event, when the valve may be closed by a high tide and heavy rain falling on the site may require storage until the tide has dropped. Drainage from the basement and any roads or other spaces where traffic may be present will be treated through a Class 1 - 3 chamber coalescing hydrocarbon interceptor, designed to EN 858.

12.5.13 A regular inspection and maintenance/desludging programme will be implemented whereby any oil/solids/debris trapped within the interceptors will be removed and disposed of off-site by an

appropriately licensed Local Authority or EPA approved waste disposal contractors.

12.5.14 All waste materials generated on site during the operational phase, including cooking oils which have the potential to contaminate ground and surface waters will be stored in an appropriately designed area, with a bunded container for cooking oil storage and a connection to the foul drain, to ensure any leakages from waste containers and wash down water from waste washdown is controlled and diverted to foul sewer.

12.6 MONITORING

12.6.1 Regular monitoring of surface and ground water to be discharged from the site will be conducted in compliance with the requirements of Dublin City Council, during the construction phase. Monitoring of excavated fill material generated at the site will be required as part of the Site Remediation Plan, which shall be agreed with Dublin City Council prior to commencement of work on site.

12.6.2 Monitoring of surface water discharges will be carried out periodically as required during the operational phase of the development.

12.7 REINSTATEMENT

12.7.1 No reinstatement measures are proposed.

12.8 REFERENCES

1. EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), Environmental Publications, 17 Duke Street, Dublin 2, 2003.

2. EPA Guidelines on the Information to be Contained in Environmental Impact Statements, Environmental Publications, 17 Duke Street, Dublin 2, 2002.

3. Geology of Kildare – Wicklow, Sheet 16. McConnell, B. and Philcox, P., Geological, Survey of Ireland, 1994.

4. EIS for Burwood House (Ireland) Ltd, by McHugh Consultants, February 2001.

5. Soil Map of Ireland, 1980, An Foras Taluntais.

6. EPA 2002 Water Quality database, 2002. EPA, Johnstown Castle Estate, Wexford.

7. ‘Climate Change – Scenarios and Impacts for Ireland’ Environmental RTDI Programme, EPA, 2000 – 2006.

8. UK DEFRA ‘Climate Change’, November 2000.

9. Dublin City Drainage Dept, 2003.

10. The Geology and Hydrology of County Dublin with Particular Reference to the, Location of Waste Disposal Sites, Creighton J.R., Daly D. and Reilly, T. A., Geological Survey of Ireland, 1979.

13.0 DAYLIGHT AND SUNLIGHT

13.0 DAYLIGHT AND SUNLIGHT

13.1 INTRODUCTION

13.1.1 This section of the EIS assesses the issues of overshadowing, and access to sunlight and daylight that would arise from carrying out the various development options for the subject lands. As the proposals are schematic, and detailed architectural schemes have not yet been designed, this report is carried as only far as it is considered justified by the form of the proposals. A general assessment of the potential impacts of development is therefore provided. This report in particular concentrates on the potential daylight and sunlight impacts of Option 1 and Option 2 described in the proposals issued by Loci Consultants and in particular *Diagram 4-Block Heights* summarised in this Report as Fig. 13.4 Key Plan Option 1, and Fig. 13.5 Key Plan Option 2. Appendix 13.1 contains a detailed shadow analysis of the proposed landmark tower.

13.2 DESCRIPTION OF EXISTING ENVIRONMENT

13.2.1 The subject-site is a city quayside site of 2.6 hectares, of approximately rectangular shape, 187m wide by 144m with its long axis running E to W and its short axis N to S.

13.2.2 It is surrounded by water on two sides: on the north by (Sir John Rogerson's Quay) and the River Liffey; and on the east (Britain Quay) by the confluence of the Grand Canal with the outfall of the River Dodder. It is bounded to the west by Benson St. and to the south by Green St. East which, at a distance of some 70m, runs parallel to Hanover Quay on the Grand Canal Dock.

13.3 PROPOSED DEVELOPMENT

13.3.1 Four proposals have been put forward for assessment. Options 1 and 2 are included in the Amended Planning Scheme. In addition to the two principle design options, two alternative variation options are also considered in this section – Option 1 (a) and 2 (a). In every case a wide promenade is envisaged running the length of the north edge (Sir John Rogerson's Quay). In every case a tall landmark building is proposed at, or near the north east corner of the site.

Option 1

13.3.2 Apart from Building E, which is constant in all versions, Option 1 can be characterised as five roughly parallel finger blocks extending south to north. Blocks A and C are separated by a wedge-shaped element of 5 or 6 storeys. Block (N+O) and Block (L+M) are separated by a single-storey wedge-shaped block for commercial use. The blocks are generally stepped up in height as one proceeds from south to north.

13.3.3 It is generally taken that the average storey height envisaged here is 3.6m for commercial buildings and 3.0m for residential buildings.

13.3.4 The blocks are separated from one another laterally, by the following approximate distances:

Block A from Block C by 8m at narrow to 20m at wide end

Block C from Block D by 31m at wide end to 22m at narrow end

Block D is relatively unobstructed

Block I from Block F by about 12m

Block J from Block G by about 12m

Block K from Block H by about 12m

Block P from Block (N+O) by about 22m at narrow, 30m at wide end

Block N from Block L by about 18m at wide, 13m at narrow end

Block O from Block M by about 13m at wide, 7m at narrow end

Block M from Block (J+K) by about30m at narrow, 40m at wide end

Block (I+J+K) separated from Block (F+G+H) by about 10m

13.3.5 Generally, the blocks can be described as finger blocks (but not the wedge-shaped blocks) are not too deep front-to-back to be able to be used as either dual-aspect or single-aspect residential blocks if desired. Furthermore, their aspect to the east on one side, and to the west on the other will be favourable for exposure to sun provided there is no close obstruction.

13.3.6 The following facades will have fairly good exposure to sunlight (and to

daylight) for residential use:

Block P
Block N+O west face
Block L+M east face
Block I+J+K west face
Block F+G+K east face
Block D west face

13.3.7 The following facades will have moderately good exposure to sunlight (and to daylight) for residential use:

Block C west face
Block D east face

13.3.8 The following facades will have relatively poor exposure to sunlight (and to daylight) for residential use:

Block A, west face
Block A, east face
Block (F+G+H) on New Street facing west.
Block (I+J+K) on New Street facing east

13.3.9 Buildings that have 'gable ends' —which are south facing—where the blocks are stepped up towards the north can have excellent conditions, if as residential blocks they are planned with windows taking advantage of their exposure to the south. This is to say, the top floor of Block A, the top two floors of C, D, J and G, top floor of L, N, I and F, all face almost due south. We are not sure how many apartments it would be possible to orientate in this way.

13.3.10 The proposed layout appears to us to produce a relatively favourable outcome in terms of access to daylight and sunlight for a scheme of this size and density. In practice it requires, however, (i), careful planning of apartments on the gable faces, (ii), judicious planning of dual-aspect configurations for residential use where one face is poorly orientated by reason of nearby obstructions, and the limitation to commercial purposes of buildings, at the lower levels, especially, where the outlook is restricted.

Option 2

13.3.11 Option 2 is like Option 1 and characterised by five roughly parallel finger blocks extending south to north. Blocks (A+N), (C+M) and (D+L) in Option 2 are very much as the corresponding footprints, (A+P),

(C+N+O) and (D+L+M) in Option 1. The principal difference is that in Option 2 the maximum heights of these blocks (at the north) are 7 storeys, 7 storeys, and 7 storeys in order, (that is, 7 storeys residential or 6 storeys commercial), rather than 7 storeys, 9 storeys and 9 storeys. This is to say, C and D are two storeys less in Otion 2. Block F is the same in both versions.

13.3.12 The main difference is in relation to Block (I+ J+ K), is

(i) one storey less in Option 2 (in respect of I and J), and

(ii) whose footprint instead of being parallel with Block (F+G+H) across a narrow distance (as in Option 1) is turned about 30 degrees from the N—S line to open up the intervening space and is about 38m wide at its widest (at the south end).

13.3.13 The following facades will have fairly good exposure to sunlight (and to daylight) for residential use:

Block (I+J+K) east face
Block (F+G+H) west face
Block (F+G+H) east face
Block N east face
Block M west face

13.3.14 The following facades will have moderately good exposure to sunlight (and to daylight) for residential use:

Block A east face
Block A, west face
Block C west face
Block D west face
Block D east face

13.3.15 The following facades will have relatively poor exposure to sunlight (and to daylight) for residential use:

Block (I+J+K) facing west
Block M east face
Block L east face
Block L west face

13.3.16 The proposed layout appears to produce a relatively favourable outcome in terms of access to daylight and sunlight for a scheme of this size and density. In practice it still requires, however, (i), careful

planning of apartments on the 'gable' faces, (ii), judicious planning of dual-aspect configurations for residential use where one face is poorly orientated by reason of nearby obstructions, and the limitation to commercial purposes of buildings, at the lower levels, especially, where the outlook is restricted. The north-to-south 'finger' layout has the advantage that virtually no apartment face and no open space will be completely devoid of sunlight, as would be the case with certain types of configuration running east to west.

13.3.17 Option 2 will produce somewhat better environmental conditions for residential users than Option 1, essentially because the intermediate buildings (that is midway between the south edge and the north edge of the site) are about one storey lower (in Option 2) and have less obstructive effect on the buildings on the Sir John Rogerson's Quay end. This improvement is apparently at the cost of a lower overall density.

Option 1(a)

13.3.18 This is essentially a courtyard scheme. The courtyard plan has the disadvantage that obstruction is hard to avoid where the corners intersect or butt together. Where a courtyard is triangular in plan (rather than rectangular) conditions may be unsatisfactory at the acute angle especially.

13.3.19 Block AA is workable as single - aspect apartments. On the N face, sunlight is not required by the recommendations and very little will actually be available. On the S face sun will be available except where the block butts into BB and DD on lower floors.

Block FF: satisfactory to S and SE
Block GG: satisfactory to S; for W aspect, other building too close
Block EE: for E aspect, other building too close
Block HH: satisfactory at upper levels
Block BB: satisfactory where there is no junction
Block DD: satisfactory for E aspect
Block II: satisfactory for E aspect
Block CC: although SE-facing will not receive much sunshine because of the narrowness of the diagonal street.

Option 2(a)

13.3.20 This is similar to Block 1(a). The main difference is that Block AA is lower by 3 storeys and Block FFGG has more ample courtyard by the omission of Block II in Option 1(a)

Possible Effects of Proposals of this Kind

13.3.21 A badly-designed scheme can lead to overshadowing and overlooking at the expense of existing users in the immediate surroundings, and might not provide sufficient daylight and sunlight in living spaces for prospective tenants within the scheme itself. Unsatisfactory conditions generally arise from placing buildings too close together and from failure to take orientation and site conditions into account.

13.3.22 A well-designed scheme will fit agreeably into its setting, provide abundant sunlight and daylight for those living in a scheme, and sunlit open amenity spaces. This report follows as far as appropriate the general recommendations of *Site Layout planning for daylight and sunlight: a guide to good practice* (by PJ Littlefair, BRE, 1991).

Effect on Surrounding Sites (Sunlight Access)

13.3.23 In the general sense almost all development diminishes daylight and sunshine access for neighbouring sites. In the absence of sufficient detail, we have not here given explicit attention to the overshadowing effect (of proposals on the subject-site) on the surrounding areas, nor of developments in the surrounding areas on the proposals in question.

Effect on Surrounding Sites (Daylight Access)

13.3.24 Our comment would be as in the previous paragraph. We can form a general view only, in the context of a planning scheme. Rights to light associated with individual properties would be properly considered only after a detailed survey of every existing window and room whose light might conceivably be affected.

13.3.25 Availability of Sunshine in Open Spaces (i.e., amenity areas at ground level) in scheme (sun-on-ground availability) has not been considered in detail, but there is clearly scope for the development of interesting civic spaces in the proposals.

13.4 MITIGATION MEASURES

13.4.1 The detailed design of each building needs to be considered to ensure that adequate standards of daylight and sunlight will be met.

Scale 1 to 1000

FIG 13.1 KEY PLAN Option 1

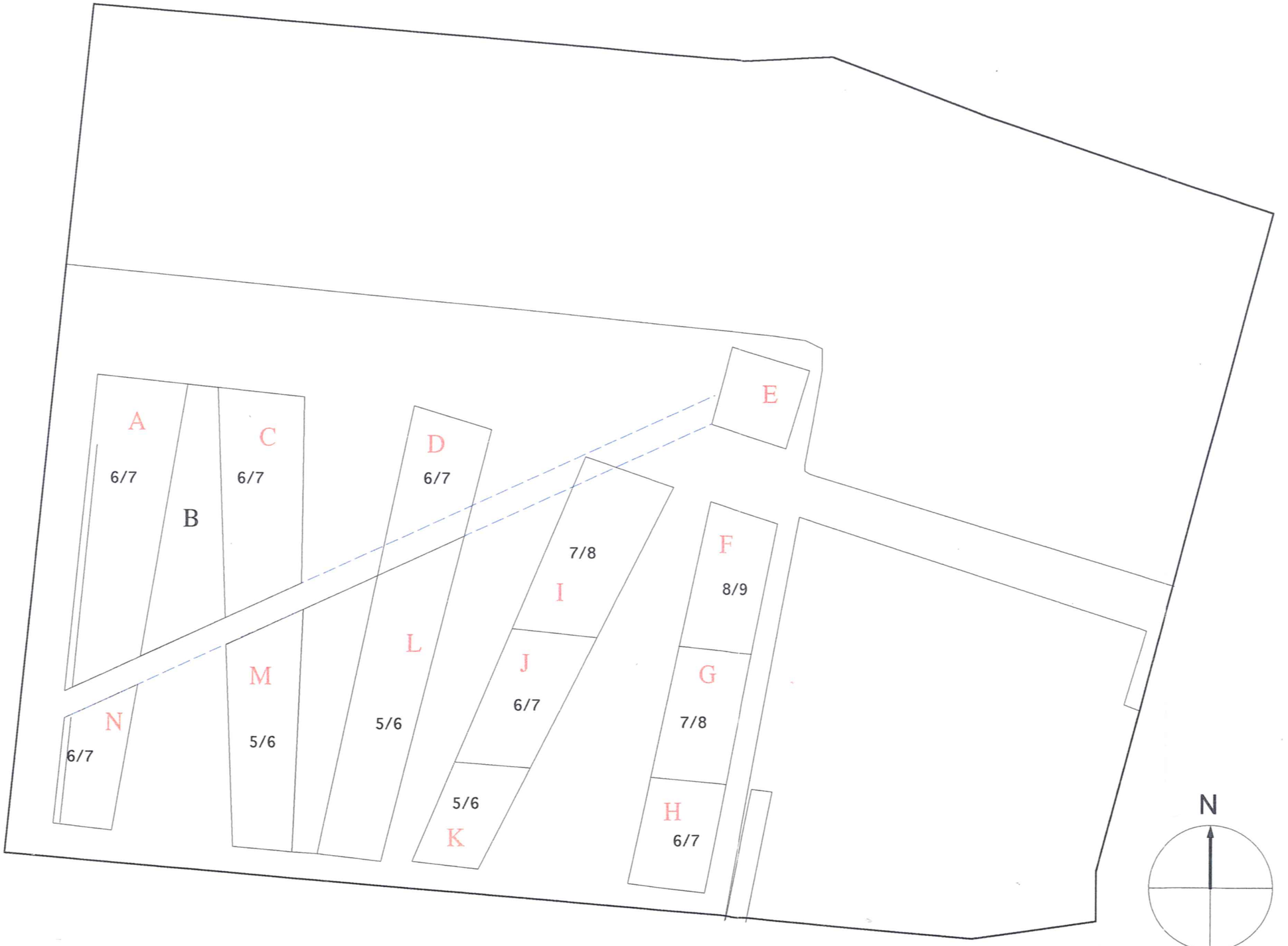


FIG 13.2 **KEY PLAN Option 2**

Scale 1 to 1000

FIG 13.3 **KEY PLAN Option 1a**

1 to 1000

FIG 13.4 **KEY PLAN Option 2a**

14.0 WIND

14.0 WIND

14.1 INTRODUCTION

14.1.1 This report is an analysis of the wind conditions expected around the proposed development of a site at the Grand Canal Dock in Dublin. A quantitative assessment using the method of Maruta is presented and tempered by our experience with other similar schemes and expert knowledge of the interaction of wind with the built environment.

14.1.2 The site description is used mainly to identify building massing and features that are pertinent to the wind microclimate on site. The discussion describes meteorological conditions and the expected main flow interactions around the site.

14.1.3 The term tolerable to describe the likely wind conditions is used in a specific technical sense and is defined in Table 14.1 and Table 14.2 for different pedestrian activities. These tables summarise the Lawson comfort criteria which RWDI Anemos routinely uses in assessments of this kind. Within the report conditions are sometimes described as being tolerable for (say) *standing or better*. The *or better* qualifier reflects the general guideline that during the summer months wind conditions are typically one criterion lower than the windiest winter time results.

14.2 SITE DESCRIPTION

14.2.1 The project concerns the construction of a new development in the Grand Canal Docks area of Dublin. The co-ordinates of the site are latitude 53:20:44N and longitude 6:13:50W. An architectural impression of the development is shown in Figure 14.1.

14.2.2 The site is bounded by the Grand Canal Dock to the south, River Liffey to the north, River Dodder to the east, and Benson Street to the west. At present, the site has been cleared. However, it is proposed to develop the site with tall commercial and residential blocks and a landmark tower near the river bank.

14.2.3 The plan of the proposed landmark building is square in shape and is situated on the riverbank at the north east corner. The orientation of the tower is rotated approximately 5° east of north. The indicative plan

dimensions are 25m × 25m, with an approximate height of 120m. The building is a twisted prism with tapered top levels. With increasing height, the building is twisted in a counter clockwise direction.

14.2.4 The neighbouring buildings in the vicinity of the site range in height from one storey to nine storeys. The surrounding buildings are mixed-use, comprising commercial, cultural, and residential use. The proposed site layouts with the consideration of these taller obstructions are shown in Figure 14.2 for two options:

Option 1

14.2.5 An open public space is shown west of the tower and adjacent to the bank of the River Liffey.

14.2.6 South of the riverbank are a series of building units generally aligned in the north and south directions. The heights of these buildings decrease in a stepwise fashion moving southward along the buildings, away from the River Liffey. Public plazas and squares are shown between these buildings with retail units at ground around most buildings.

14.2.7 Directly south of the tower there is nine-storey mixed, commercial and residential and cultural usage building. The building is slender and trapezoidal in shape, in plan it tapers towards the south. The street widths for Option 1 taper together for four of the blocks whereas the two most easterly buildings are separated by a narrow, parallel street.

Option 2

14.2.8 The option 2 layout is similar to that of option 1. The location and orientation of the landmark tower and the general allocation of open spaces are the same.

14.2.9 The low-rise commercial and residential blocks have the same number of building units but the buildings are lower than those of option 1.

14.2.10 The parallel street between the two most easterly blocks for option 1 is replaced by a tapered street that narrows from south to north and the street west of this then tapers from north to south.

Option 1a

14.2.11 The option 1a layout includes a wider diagonal street across the site than option 1 and the buildings are arranged in four blocks each around a central courtyard. There is also a much wider public square to

the left of the landmark tower than on the option 1 scheme.

Option 2a

14.2.12 The option 2a layout includes a wider diagonal street across the site than option 2 and the buildings are arranged in four blocks each around a central courtyard. The wide public square to the west of the landmark tower is similar to that shown in option 1a, but there is a separate rectangular plan building to the south of the tower which is replaced by the east perimeter of a courtyard block in option 1a.

14.3 METEOROLOGICAL DATA

14.3.1 Knowledge of the prevailing wind direction allows us to focus attention on the likely impact of these winds on the site except where the building massing/layout indicates that winds from other directions are likely to be important. This means that, taking account of other design constraints, it is desirable that the site is arranged so that the maximum acceleration of the wind due to the building massing occurs for the lightest and most infrequent wind speeds and directions. In this way pedestrian comfort is optimised.

General Meteorological Conditions

14.3.2 The wind climate in Dublin has prevailing winds from the south west quadrant which account for around 48% of all wind. The polar plot of Figure 14.3 shows annual data from the Dublin Airport site.

14.3.3 There is a noticeable dip in the wind rose for southerly wind directions, which is presumed to be due to the hills south of Dublin providing a degree of shelter to the city.

Surface Roughness

14.3.4 The ground roughness in each wind direction, or fetch, greatly affects the wind flow characteristics. For example, a wide-open space permits the wind to blow down to ground level generating conditions similar to that of open countryside, i.e. lower turbulence and higher mean wind speeds, even within a built-up area. An assessment of the ground roughness for the proposed site was conducted using the BREVe2[1]

[1] *BREVe2 – A publicly available software implementation of the design wind speed rules of BS6399-2 sold by BSI, BRE and RWDI Anemos. The program includes terrain and topography information from BRE and Ordnance Survey.*

software. Table 14.3 presents the 'mean factors' for the proposed sites where the mean factor represents the ratio of wind speed on site, at the stated reference height, as a fraction of the wind speed in open, flat countryside at a height of 10m. The factors for 10m height vary from 0.57 to 1.22, a wide range, which reflects the urban fetch to the west and the open sea to the east.

14.4 LAWSON COMFORT CRITERIA

Pedestrian Comfort

14.4.1 The assessment of the wind conditions requires a standard against which the measurements can be compared. RWDI Anemos use the Lawson criteria[2] which have been established for some thirty years and have been widely used on building developments across the U.K. and Ireland. Lawson defined a twelve-point scale to represent equal increments of pedestrian annoyance to the wind (not shown here). This scale forms the basis of the comfort criteria which seek to define the reaction of an average pedestrian to the wind.

14.4.2 The criteria set-out six pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions (Table 14.1). The six categories are sitting, standing, entering/leaving a building, leisure walking, business walking and roadway/car-park, in ascending order of activity level.

14.4.3 For each of these categories an upper threshold is defined, beyond which conditions are unacceptable for the stated activity. If the wind conditions are below the threshold then conditions are described as tolerable for the stated activity. An unacceptable result implies that remedial action should be taken to mitigate wind conditions or that the proposed pedestrian activity at that location should be redefined.

14.4.4 The criteria are derived for open air conditions where it is expected that pedestrians will be suitably dressed for the season. If the measurement location is beneath an open canopy then we advise caution in the interpretation of the Lawson criteria as the canopy may change users' expectations of shelter.

Pedestrian Safety

14.4.5 The Lawson Criteria also specify a lower limit safety criterion when winds exceed Beaufort Force 6. If this safety criterion is exceeded then

[2] Lawson T.V., "Building Aerodynamics", Imperial College Press, April 2001. [ISBN 1-86094-187-7]

there may be a need for mitigation measures or a careful assessment of the expected use of that location, e.g. is it reasonable to expect vulnerable pedestrians to be present at the location on the windiest day of the year?

14.4.6 In order to ascribe a measure of significance to wind speeds greater than Beaufort 6, RWDI Anemos defines three threshold levels above Beaufort 6 but these cannot be resolved in a study of this kind. As a general rule-of-thumb business walking and roadway conditions are associated with wind speeds in excess of the B6 safety criterion.

14.5 WIND IN THE BUILT ENVIRONMENT - OVERVIEW

Urban Airflow

14.5.1 As the wind approaches a built-up area it is displaced upwards to roof level and tends to blow across the roof tops with gusts down to street level that are a function of the relative heights-to-width of the street canyon. When the height-to width ratio of the street canyon is greater than 0.7 the skimming flow regime dominates and the wind blows across the top of the street with little penetration down to ground level, whereas a height-to-width ratio less than 0.4 produces conditions similar to the isolated building scenario[3]. However, when there is an increase in building height across the street this can reinforce the rotating, or vortex, air movements within the street. Relatively open spaces, even inside a city, can be windy as the wind blows down from roof level into the open space.

14.5.2 Calm areas are generally desirable for pedestrian comfort. However, very slow air movement can result in poor ventilation of pollutants and in these areas it is desirable that pollutant sources are limited.

Seasonal Variability

14.5.3 Pedestrian activity differs during the summer and winter months when other climatic conditions, for example air temperature, have a marked impact. Comfort criteria generally assume that pedestrians will be suitably dressed for the season and when making a worst-case assessment it is reasonable to assume that pedestrians will not be sitting at a street-side café on the windiest days of the year.

14.5.4 Typically there is a one category difference between the worst-case wind conditions and those experienced during the summer, e.g.

[3] T. R. Oke, 'Boundary Layer Climates', Routledge, © 1987

business walking conditions become leisure walking during the summer and leisure walking conditions become standing/entrance conditions.

Entrances

14.5.5 Pedestrians are particularly sensitive to wind conditions at entrances because of the potentially marked change between the controlled environment inside the building and external conditions. For this reason it is important that conditions immediately adjacent to an entrance are relatively benign or that there is a sheltered 'buffer' zone, which allows pedestrians time to acclimatise. For recessed entrances the recess creates a buffer zone but is also prone to accumulating wind-blown debris because of the trapped vortex, or rotational, flows that can occur in the recess. Entrances are also used throughout the year so that even during the windiest days of the year the entrance should be relatively sheltered.

14.5.6 Entrances on different building elevations are also susceptible to pressure-driven through flows when opened simultaneously. The windward façade is generally positively pressurised whereas the side and/or downwind façades are at a lower pressure. If the entrances are into a central atrium then the different external surface pressures can be directly connected when doors are opened simultaneously. This can lead to nuisance draughts and in extreme cases difficulty in opening doors or whistling as the pressure difference forces the doors slightly ajar. Revolving doors eliminate the problem because the pressure seal across the building envelope is maintained. The extent of any potential nuisance is in part related to the footfall through the entrances because this will affect the probability of doors being opened simultaneously. Lobby doors are another means of limiting the impact of nuisance draughts, although the likelihood of both sets of lobby doors being opened simultaneously should be considered when specifying this option.

Landscaping

14.5.7 Planting is a very useful means of softening the streetscape and creating naturalised shelter within and around the site. There are generally two ways in which planting works; relatively dense lines of planting act like a solid screen deflecting the wind, whereas more open planting removes energy from the wind as it flows through the screen. In both cases shelter is created but for the case of the more solid screen winds can remain relatively strong at the extreme ends of the screen. If we consider the case of street canyons in Irish towns and

cities, the tree canopy minimises the penetration of vertical gusts down to pedestrian level and horizontal winds are displaced upwards by the canopy.

14.5.8 Another consideration is the seasonal variation of the species. Deciduous varieties create a denser screen during the summer months but during the winter months offer limited protection due to the bare branches. Evergreen varieties offer more consistent shelter throughout the year. When considering seasonal variability, account should be taken of the more transient pedestrian activity during the winter months where other climatic factors, e.g. air temperature, impact upon the way in which pedestrians will use a site. Finally, the maturity of the planting is significant; semi-mature species offer reasonable protection from an early stage in the life of the development, whereas immature planting will take time to establish.

14.5.9 More structural landscaping in the form of earth mounds or screens have the advantage of offering year-round shelter.

Balconies

14.5.10 If there are buildings with recessed balconies then in general these will be sheltered unless they are particularly long balconies when the wind can blow along and into the balcony. Partition walls/screens between the balconies of adjoining properties are usually sufficient to eliminate this potential wind nuisance.

14.5.11 Protruding balconies are potentially more susceptible to wind nuisance because the main flow along the surface of the building can blow directly across the balcony. This condition is exacerbated if the protruding balcony skirts around a corner of the building where the strong corner winds will blow across the balcony. There is usually a requirement to screen the ends of the protruding balconies in order to displace the wind away from the balcony.

Colonnades

14.5.12 In this discussion a colonnade is defined as a covered walkway where the cover is generally provided by overhanging upper storeys of the building. In other words the building footprint at ground level is set-back. Colonnades create shelter from the direct effects of downdraught but are exposed to horizontal winds which can be channelled along the colonnade. If the colonnade connects windward and leeward elevations of the building then a pressure-driven flow is generated through the colonnade. If the building façade at ground level is curved

then this can also be expected to accelerate the winds through the colonnade.

14.5.13 Colonnades do not necessarily provide shelter from the wind. Consequently, it may be necessary to increase resistance to air movement along the colonnade, and/or to prevent penetration of wind into the colonnade, by suitable screening.

14.6 MARUTA METHOD

General Results

14.6.1 The Maruta Method is a prediction model developed from parametric wind tunnel tests on isolated rectangular-plan models. An output from the RWDI Anemos implementation of this method is shown in 14.4 for the proposed development. The red zones indicate areas where the pedestrian-level winds are accelerated by the building, while the green zones indicate areas of shelter. The Maruta Method always indicates shelter immediately upwind of the building, whereas other design guidance suggests that tall buildings can increase the wind speeds in this area and our experience confirms this. Also the presence of neighbouring buildings may steer and funnel the wind. Accordingly, the Maruta Method results need to be interpreted and adjusted, where necessary, utilising previous experience.

14.6.2 The implementation of the Maruta data developed by RWDI Anemos gives a speed-up factor at head height which is the ratio of the wind speed affected by the presence of the building to the corresponding wind speed for a clear site. Values greater than unity, the red zone in Fig. 14.4, indicate accelerated flow while values less than unity indicate shelter. These wind speed ratios are combined with the wind speed and frequency data for Dublin and compared with the Lawson Comfort Criteria to establish the expected comfort levels around the development.

Site Specific Results

14.6.3 A detailed Maruta analysis was conducted for the Landmark Tower and the lower-rise building south of the tower, representing the tallest building on the development and the tallest, long building.

Landmark Tower

14.6.4 The overall assessment for the isolated landmark tower is shown in Figure 14.5 plotted on the option 1 plan and in Figure 14.6 plotted on

the option 2 plan. For the analysis the tower was simplified to a simple square prism with a constant cross-section up its full height which is a conservative assumption because the proposed building presents a smaller area to the wind. The north, south and west elevations are relatively sheltered and would be suitable for entrances. The corner locations 5, 6 & 8 are one category windier being suitable for leisure walking as is the centre of the east elevation because of its exposure to the winds from the Irish Sea. At the southeast corner, location 7, business walking conditions occur, because this corner is exposed to both prevailing winds and the easterly winds.

Mixed-use Building South of the Landmark Building

14.6.5 The overall assessment for the adjacent building to the south of the Landmark Tower is shown in Figure 14.7 for option 1 and 14.8 for option 2. The geometry of the building was simplified to a rectangular block, but separate analyses were performed on block heights of 36m and 28m, representing the north and south extremities of the block respectively.

14.6.6 The results are broadly similar to those for the Landmark building with sheltered west façade and a sheltered east façade, but with leisure walking conditions around the north and south elevations and a business walking condition near the southeast corner.

Effect of the Other Proposed Buildings

14.6.7 Both the landmark tower and the adjacent block to the south are expected to be sheltered by the other buildings of the proposed development (options 1, 2, 1a & 2a). The wind is expected to be lifted upwards by the development but there are relatively wide open spaces between buildings. Options 1 and 2 include a relatively narrow diagonal street across the site connecting southwest to the landmark tower, but this street is significantly wider for options 1a and 2a. The wider street is expected to be a windier than the narrow street with conditions suitable for standing/entrance use and leisure walking near the ends. The narrower street of options 1 and 2 is expected to be suitable for sitting with standing or possibly walking conditions near the ends.

14.6.8 The tapered streets of options 1 and 2 have the potential to moderately accelerate the wind blowing in the direction of the taper. The courtyards of options 1a and 2a create streets of uniform width across the site which will not accelerate the wind that blows along the street.

14.6.9 The courtyard options are also less permeable to the wind with fewer

direct routes through the site than options 1 and 2. The courtyards themselves will be generally sheltered but with gusty conditions because of the intermittent way in which the wind can blow down into the courtyard. Leisure walking conditions may be generated on the northeast corner of the southeast courtyard for options 1a and 2a, but more generally we would expect standing/entrance and sitting conditions.

14.6.8 The open space between the landmark building and the adjacent buildings to the south and southwest is also likely to induce a down-flow for the prevailing winds because of the low pressure in this region.

14.6.9 The overall impact of the above effects is not expected to significantly alter the results reported in Figures 14.5 to 14.8 because the shelter is compensated by the localised accelerations described above.

14.7 BASELINE CONDITIONS

14.7.1 It is often the case that a new development dramatically alters the pedestrian activity on site and consequently a comparison of the original wind conditions with those on the developed site can be meaningless. For example wind conditions currently suitable for pedestrian walking and which remain suitable for pedestrian walking after development leads to the conclusion that there is negligible impact due to the development. However, if on the new development the location of interest is outside a main entrance then the impact is adverse and will require remedial action. This is an important consideration when defining and applying baseline conditions.

The Current Wind Conditions on Site

14.7.2 Analysis of the meteorological data for the existing open site indicates that the existing conditions on site are likely to be tolerable for pedestrian standing or entrances. The implication of this result is that, after development, if the site has a number of locations where the conditions are tolerable for (say) leisure walking, then these are likely to be perceived to be ‘windy’ relative to general conditions in the area.

The Current Wind Conditions around the Site (on Neighbouring Properties)

14.7.3 Although it is our understanding that the ‘right of light’ has no equivalent for wind, it is desirable, as part of a good neighbour policy, to minimise adverse changes to the wind conditions on neighbouring buildings due to a development. In general the development may lead

to increased wind speeds on adjacent properties for some wind directions but increased shelter for other directions.

Comparison of the Wind Conditions with the Desired Conditions

14.7.4 In the assessment of the proposed development, comparison is made between the wind conditions expected on the developed site and the desired wind conditions. This is generally the most useful baseline for comparison because it is an assessment which indicates whether the wind conditions are suitable for the intended pedestrian activity at a location.

14.8 CONDITIONS AROUND THE PROPOSED DEVELOPMENT

Landmark Tower

14.8.1 Both options displayed similar results. Based on the Maruta analysis for the isolated building using annual meteorological data, the comfort conditions around the landmark tower are illustrated in Figures 14.5 and 14.6. The results show that the wind conditions are tolerable for business walking at one location but otherwise tolerable for leisure walking or better.

14.8.2 The windiest condition is at location 7 which represents the corner of the landmark building with a combination of greater exposure to the south westerly winds and also the water at the north and east. Business walking conditions are predicted here. The remaining corners are more sheltered from the winds over the water and are suitable for leisure walking.

14.8.3 The measurement locations in the centres of each elevation would be preferred locations for primary and secondary entrances because they are away from the effects of corner winds. Positions 1 and 2 are nearest the riverbank, and experience conditions appropriate for leisure walking or better. Locations 1, 3, and 4 are suitable for standing or entrances because they are sheltered by the neighbouring buildings and the landmark building.

Mixed Use Building

14.8.4 The Maruta analysis of the mixed use building of both options displayed comparable results. The east and west elevations were found to be tolerable for standing or entranceways. The north and south elevations were tolerable for leisure walking or better, with the

southeast corner tolerable for business walking. In option 2 results showed that conditions in the performance square away from the building were tolerable for standing. Conditions became suitable for leisure walking around the southeast corner.

14.8.5 The less favourable conditions of the north and south elevations of the building are mainly due to the accelerations of the prevailing winds from the west as they flow around these elevations.

14.8.6 The similarity in conditions around the southeast corners of the landmark tower and the adjacent building is not too surprising when the exposure of these buildings to prevailing winds easterly winds from the Irish Sea are considered.

Surround Buildings

14.8.7 As mentioned there are two different building layouts proposed for the Grand Canal Docks in Dublin. A desk study assessment was made of the resulting wind environments.

Option 1

- The riverside elevation of the site is exposed to the winds over the watery fetch. Leisure walking conditions are expected around the northern corners of the buildings but with standing/entrance conditions away from these areas. However, the perimeter buildings will have a beneficial effect in sheltering the inner areas of the site.
- The open space to the south of the landmark tower is sheltered by buildings to the south, west and north. Conditions in this area are expected to range between business walking to standing with the windier conditions occurring near the corners.
- The diagonal roadway aligned with the prevailing wind direction is a relatively narrow channel but with an open space at its south west end. Pressurisation of the southwest end of this street is expected to generate leisure walking conditions, but further along the street conditions will be more benign and suitable for standing or better.
- There are designated areas for active and retail ground floor usage throughout the development. These activities generally require relatively benign wind conditions suitable for sitting in the summer months and more generally standing/entrance usage. Both these activities are in the bottom half of the Lawson Comfort Criteria Scale and to achieve the most benign wind conditions may require landscaping to create localised shelter. These are

sensitive areas in terms of the potential commercial success of these units.

- Smaller buildings to the south provide limited shelter from south, but encourage the wind to blow up and over the site although southerly winds are relatively infrequent.

Option 2

- Similar conditions are expected to those described for option 1.
- There is less shelter provided by the shorter buildings from the north water fetch, but the smaller buildings also have a reduced impact on the wind which therefore reduces corner winds relative to those for option 1.

Option 1a

- The diagonal street is expected to experience standing/entrance conditions along much of its length, but with local leisure walking conditions near the ends of the street because of the impact of prevailing winds from the south west and the open fetch to the northeast
- The open, public space around the Landmark Tower is sheltered from prevailing winds but is exposed to the winds from the east and the Irish Sea. The proximity of this space to water may increase pedestrian tolerance to windy conditions but conditions suitable for leisure walking are expected in this area and perhaps windier than this near the corners of buildings around the public space.
- The courtyards will be relatively sheltered areas but because they are quite wide this will permit the wind top intermittently blow down into the downwind sides of the courtyard with gusty leisure walking conditions expected in the winter, but more generally standing and sitting conditions in other areas and in the summer.

Option 2a

- Generally the wind conditions are expected to be similar to those of option 1a.
- The main difference is along the east perimeter of the site where the east wall of the courtyard south of the Landmark Tower is replaced by a separate rectangular building. This building shelters the building to the west from the direct effects of easterly winds but the conditions around this part of the site is not expected to differ greatly from the leisure walking and standing conditions expected around this side of options 1a.

Other Considerations

14.8.8 In general, individual buildings may be more exposed to adverse wind effects prior to completion of all development on the site because there is reduced shelter where adjacent buildings have not yet been constructed. The significance of these issues will need to be assessed taking account of the amount of time that these intermediate exposure levels are expected to persist.

14.9 MITIGATION MEASURES

14.9.1 At the time of writing the detailed phasing of the development was not known and so detailed proposals for mitigation of strong wind effects cannot be given. Nevertheless, there are some general points that should be borne in mind by the design team.

14.9.2 The strongest winds around the site occur at the corners and it would be prudent to site entrances in more central areas away from these corner flows.

14.9.3 On the main part of the site there is insufficient detail at this stage in the scheme development to give precise guidance. However, the microclimate in the open spaces could be enhanced by suitable landscaping where the optimum shelter during the summer months is beneficial to the need to create more benign wind conditions to encourage pedestrians to sit and take full advantage of the amenities.

14.9.4 Screening the larger open space west of the tower in options 1a and 2a should be considered in order to locally enhance the microclimate in this space. Although sheltered from the direct effects of the prevailing winds, there is the prospect of some funnelling along the diagonal street leading into the southwest corner of the square and its exposure to winds from the east and north east. This screening could include landscaped mounds, planting or more structural screening to create oases of shelter where pedestrians could sit.

14.10 CONCLUSIONS

14.10.1 In conclusion:

- The pedestrian level wind conditions are consistent with the range of intended pedestrian use around the site. Specific mitigation measures are not proposed at this stage because of the generic form of the buildings, but by incorporating suitable planting throughout the open spaces area enhancements are

expected particularly during the summer months when trees are in full leaf. A wind tunnel test will permit the degree of localised shelter to be identified and the efficacy of any screens tested as the detail design progresses. The critical areas are expected to focus on the more benign pedestrian activities e.g. entrances and sitting zones which are both important to the success of the development.

- The landmark tower was analysed as an isolated building. The results showed that the corner zones were the windiest areas and conditions were generally suitable for leisure walking or better, but with a business walking conditions at the more exposed southeast corner.
- The public space to the west of the tower is an area which for prevailing winds will be at a relatively low pressure being in the wake of the adjacent low-rise buildings of the masterplan. This low-pressure has the potential to induce a greater downdraught from the tower, relative to the isolated tower scenario. However, conditions around the south elevation are expected to remain within the reported levels ranging from standing to business walking.
- The mixed use building south of the landmark tower was also analysed as an isolated building. The geometry of the building was simplified to a rectangular block and separate analyses were performed on block heights of 36m and 28m, representing the north and south elevations respectively. Standing or entrance conditions were found along the east and west elevations. Leisure walking conditions were generally found at the north and south elevations, but with business walking at the south east corner.
- An indicative layout of the Grand Canal Dock site shows buildings to the south and west of the proposed landmark building. Finalised details of these buildings are not available at the time of writing but it is expected that the landmark building and the adjacent block to the south will benefit from additional shelter.
- Winds from the southwest may be channelled towards the west and south elevations of the corporate plaza, but the relative depth and length of the channel is unlikely to generate a strong air jet onto the open area.

Table 14.1: Lawson Comfort Criteria

DESCRIPTION	LETTER	THRESHOLD
Roads and Car Parks	A	6% > B5
Business Walking	B	2% > B5
Pedestrian Walk-through	C	4% > B4
Pedestrian Standing	D	6% > B3
Entrance Doors	E	6% > B3
Sitting	F	1% > B3

Table 14.2: The Beaufort Force Land Scale

BEAUFORT FORCE	HOURLY-AVERAGE WIND SPEED (m/s)	DESCRIPTION OF WIND	NOTICEABLE WIND EFFECT
0	< 0.45	Calm	Smoke rises vertically
1	0.45 - 1.55	Light Air	Direction shown by smoke drift but not by vanes
2	1.55 - 3.35	Gentle Breeze	Wind felt on face; leaves rustle; wind vane moves
3	3.35 - 5.60	Light Breeze	Leaves & twigs in motion; wind extends a flag
4	5.60 - 8.25	Moderate Breeze	Raises dust and loose paper; small branches move
5	8.25 – 10.95	Fresh Breeze	Small trees, in leaf, sway
6	10.95 - 14.10	Strong Breeze	Large branches begin to move; telephone wires whistle
7	14.10 - 17.20	Near Gale	Whole trees in motion
8	17.20 - 20.80	Gale	Twigs break off; personal progress impeded
9	20.80 - 24.35	Strong Gale	Slight structural damage; chimney pots removed
10	24.35 - 28.40	Storm	Trees uprooted; considerable structural damage
11	28.40 - 32.40	Violent Storm	Damage is widespread; unusual in the U.K.
12	> 32.40	Hurricane	Countryside is devastated; only occurs in tropical countries

Table 14.3: BREVe2 Mean Factors at 2m and 10m Above Ground at the Site

Option	Height	Direction											
		0	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**	**300**	**330**
1 & 2	**10m**	0.832	0.924	1.129	1.215	0.878	0.804	0.587	0.57	0.57	0.558	0.773	0.886
	2m	0.665	0.739	0.878	0.972	0.473	0.539	0.429	0.417	0.417	0.408	0.417	0.708

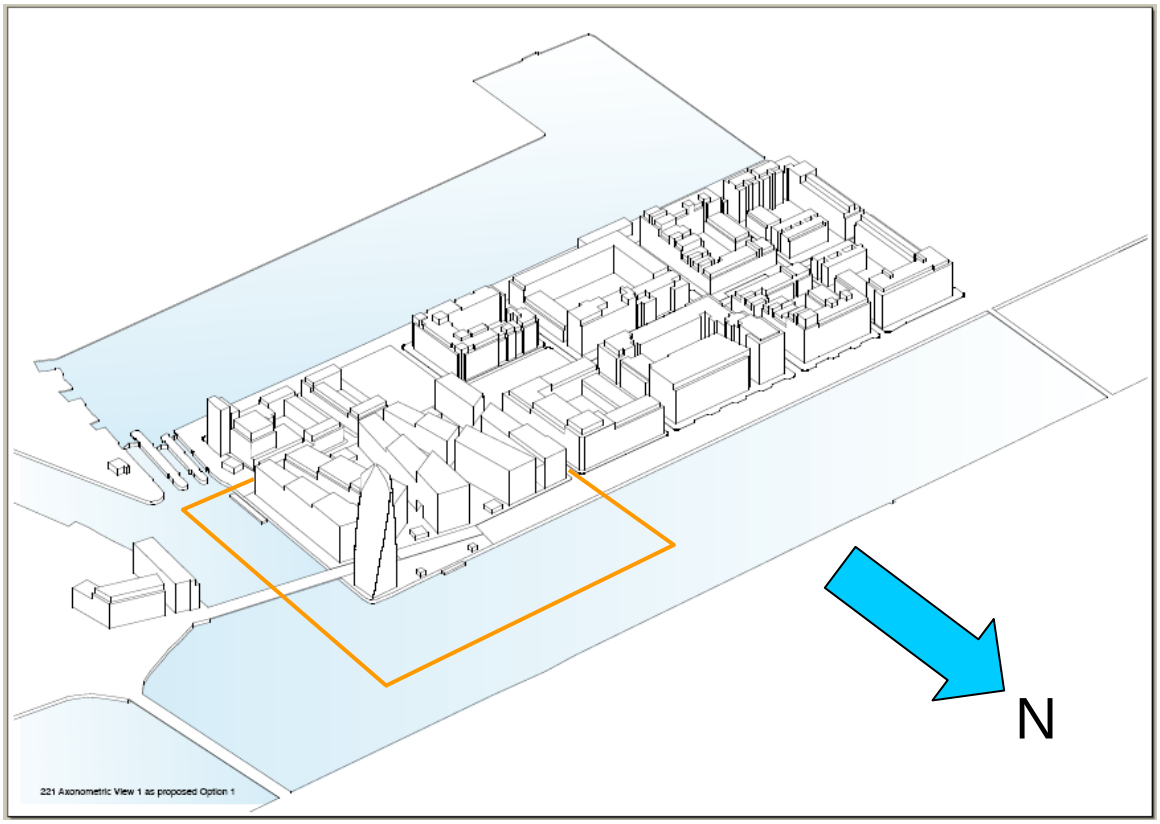


Figure 14.1: Model of the Proposed Grand Canal Dock Scheme (Option 1)

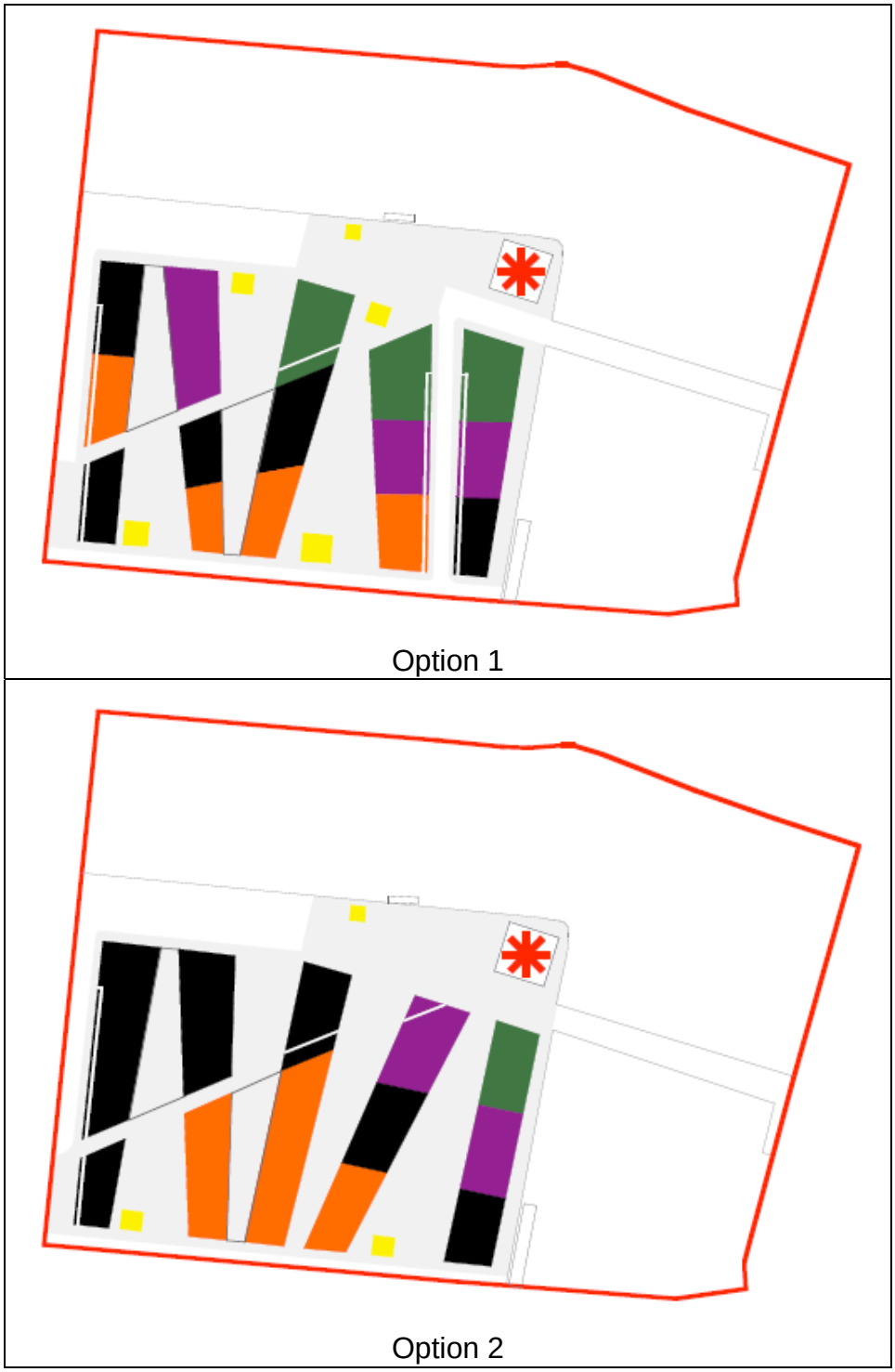


Figure 14.2: Layouts of Proposed Grand Canal Dock Scheme

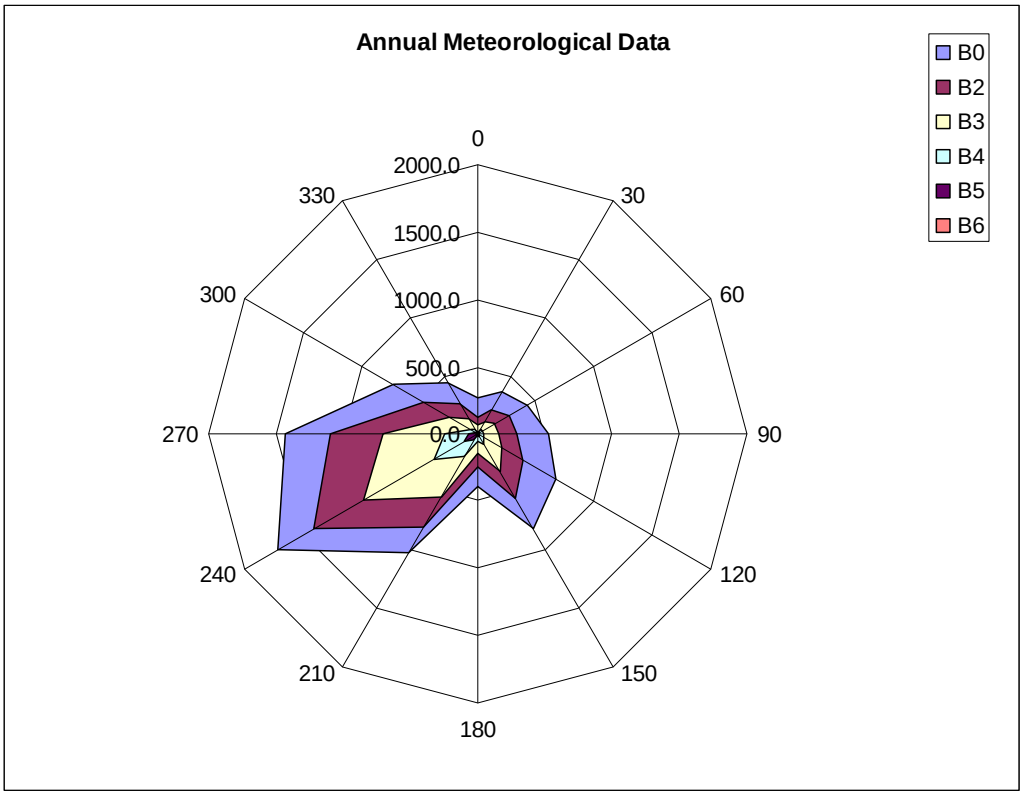


Figure 14.3: Annual Wind Rose for Dublin Airport Data (in Beaufort force) (Hours of Wind the Stated Beaufort Range is Exceeded)

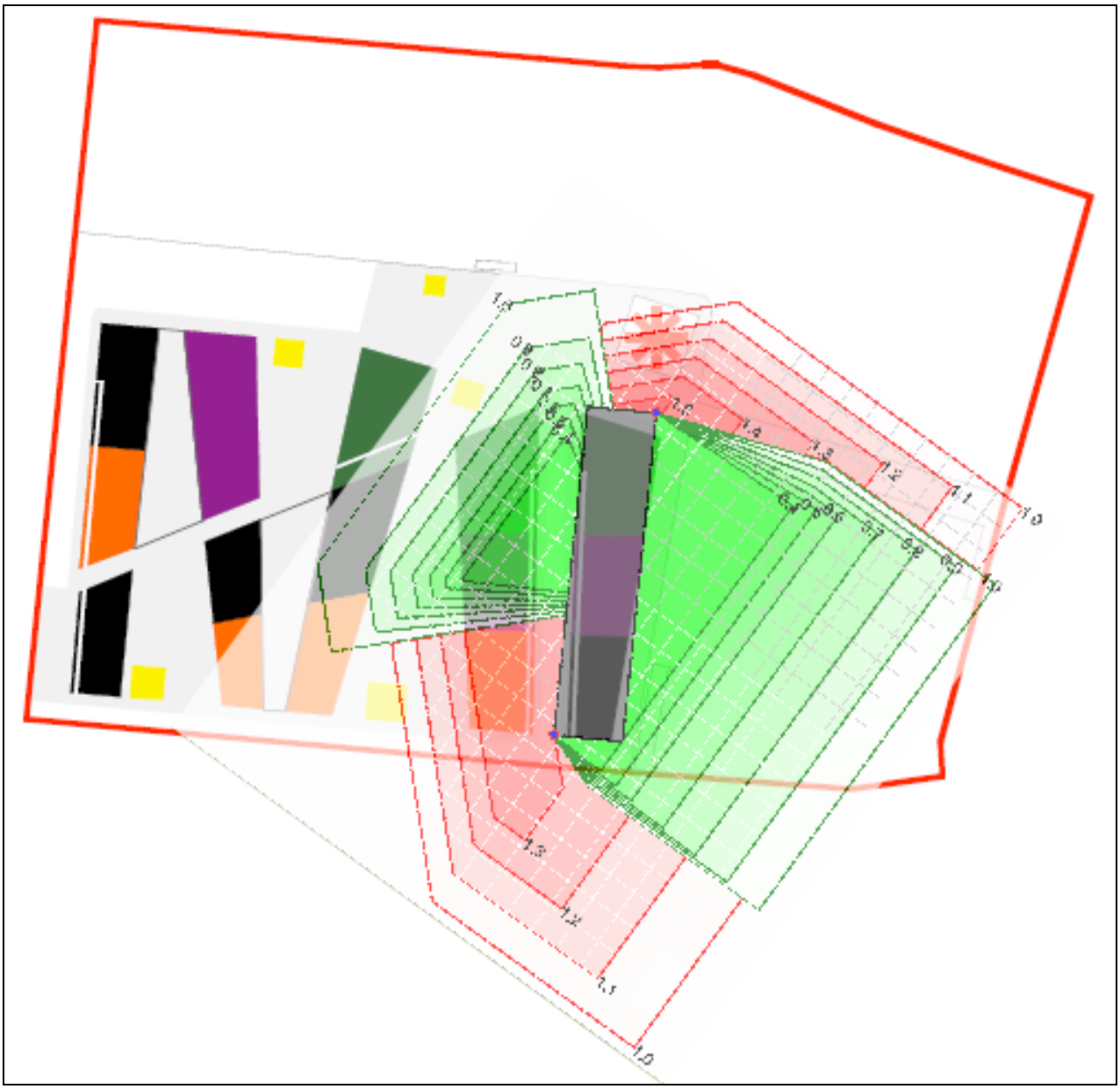


Figure 14.4: Maruta Method Output of Grand Canal Dock Site Analysis

Figure 14.5: Expected Comfort Levels of Landmark Tower Based on Isolated Maruta Analysis (Option 1)

Figure 14.6: Expected Comfort Levels of Landmark Tower Based on Isolated Maruta Analysis (Option 2)

Figure 14.7: Expected Comfort Levels of Mixed Use Building Based on Isolated Maruta Analysis (Option 1)

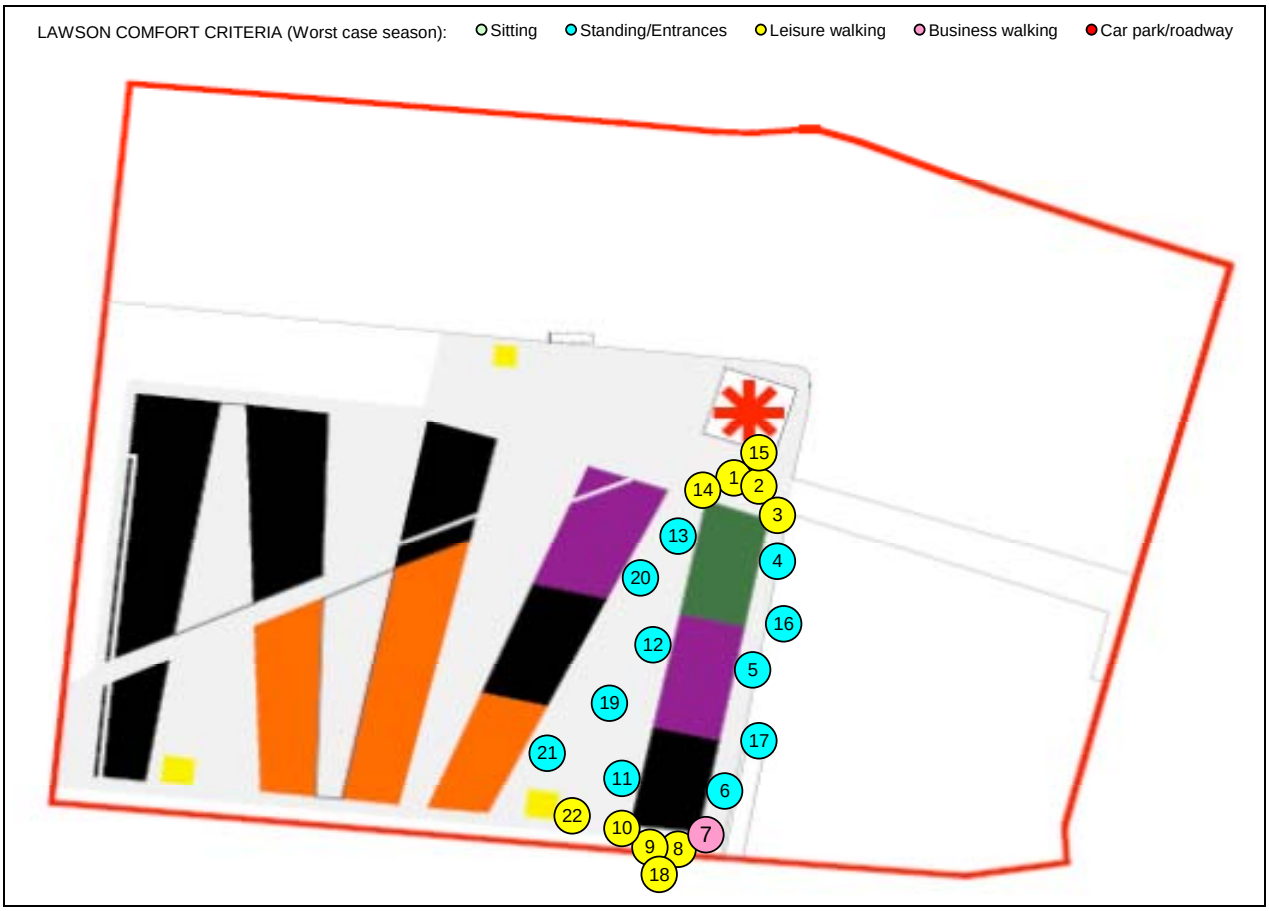


Figure 14.8: Expected Comfort Levels of Mixed Use Building Based on Isolated Maruta Analysis (Option 2)

15.0 MATERIAL ASSETS

15.0 MATERIAL ASSETS

15.1 INTRODUCTION

15.1.1 This section deals with the issue of utilities such as gas supply, electricity and telecommunications that are available in the area of the proposed development.

Electricity Supply

15.1.2 The current ESB infrastructure in the area of the proposed site may need to be upgraded to account for increased loads in the area caused by the new developments. A 110Kv substation will be required. A detailed survey of existing ESB infrastructure will need to be carried out in advance of construction and proposals put forward as to how developments will be adequately served in terms ESB supply.

15.1.3 The specification of building material will minimise the impact and consumption of energy on the national and global environments.

Gas Supply

15.1.4 The gas supply to the site may also require upgrading from the existing supply. A detailed survey of existing gas infrastructure will need to be carried out in advance of construction and proposals put forward as to how developments will be adequately served in terms of gas supply.

15.1.5 The gas pressure reduction and metering plant is located at the intersection of Forbes Street and Sir John Rogerson's Quay. Re-location should be investigated and every effort should be made to enable it to be successfully integrated into the development.

15.1.6 There will be individual gas meters provided locally to the blocks for each tenant. The location of these meters must be accessible by Bord Gais for meter reading purposes.

Telecommunications

15.1.7 As the development will be occupied by a mix of commercial and residential use, it is not envisaged that the demand on the telecommunication infrastructure will be excessive.

16.0 INTERACTIONS

16.0 INTERACTIONS

16.1 An analysis of the various topics covered in this report shows that certain factors are inter dependant on each other. These interactions are dealt with under each subsection of this EIS.

16.2 The quality of air and noise is very much influenced by traffic volumes. This interaction has been examined closely in each subsection of this evaluation and mitigation measures recommended where appropriate.

16.3 There is also an interaction between air quality, noise, traffic and human beings. Humans are the most sensitive receptors in the study area and will be affected by these factors, particularly during the construction phase of the proposed redevelopment of the area. This study recommends appropriate measures to ensure that these impacts, whilst short term will be minimised as much as possible.