Proposed High Rise Hotel
Tigné Peninsula - Sliema

EIA Consultants’ Reports

Appendix Two

06 May 2016

Prepared by ERSLI Consultants on behalf of GAP Developments plc
Cultural Heritage Study for the Environmental Planning Statement of the Proposed Retention of the historic existing facades of the Fort Cambridge barracks building and demolition of the existing southwest facade and internal structure. Proposed excavation and construction of a new high-rise hotel Class 3B including all ancillary facilities and amenities. Site at, Triq Tigné c/w, Triq il-Ponta Ta' Dragut, Sliema, Malta TRK 162247 (EA00030/15)

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1. INTRODUCTION

1.1 Terms of Reference

In compliance with Maltese legislation and within the framework of planning policies, the Malta Environment and Planning Authority (MEPA) requires that an Environmental Planning Statement is carried out with respect of the proposed development at the Fort Cambridge barracks in Tigné, Sliema. This “involves the retention of most of the existing Fort Cambridge barracks façade, the demolition of the existing internal structures, and the development of a new high-rise 5-star, 368-roomed hotel” (Fort Cambridge Hotel Development Brief 2015: 60).

Archaeology Services Co-operative Ltd (ASC) has been commissioned to carry out the base line studies relative to cultural heritage by GAP Developments and ESRLI. This report is based on the Terms of Reference issued by MEPA in February 2016. A method statement dated 9th February was compiled by ASC and approved by the relevant authorities.

1.2 Location and Brief Description of the Site

The proposed area of development are the barracks to the south of Fort Cambridge that were used as Officers’ Quarters as part of the Tigne Barracks Complex. Together with parts of Fort Cambridge, these were adapted into part of the Holiday Inn Crowne Plaza in the 1980s. In 2008, the hotel was partially replaced by a luxury apartment complex and these barracks fell into disuse.

The report focuses on the area of development as well as an area of influence as indicated in Figure 1 below. The area of influence proposed and approved in the Method Statement, is based on an approximate radius of 150m around the site of the proposed development, comprising Fort Cambridge and the fabric of the buildings in the southern area of the proposed development. Given the nature of the development, the cultural landscape of the Inner and Outer Harbour Area will be considered.
Figure 1: Areas covered by this cultural heritage assessment
2. REPORT COMPILATION METHOD

2.1 Methodology of Study

An Environmental Planning Statement is required to cover the area and its surroundings. Such an evaluation is required to provide information regarding provisions for environmental protection including, among others, the protection of archaeological and cultural (both vernacular and rural, including rubble walls, huts, wells, irrigation channels, ancient quarrying sites and farmhouses) features.

This report is based on findings from what is technically referred to as Ground Reconnaissance. This method of investigation primarily involves actual fieldwork, and incorporates the consultation of documentary sources and place-name evidence [Renfrew & Bahn 1991: 63]. The fieldwork carried out consisted of a site-surface survey, or field-walking, in order to locate and record the whereabouts of sites and features. No aerial reconnaissance or sub-surface surveys, including excavations, were carried out.

This report is the result of a site-surface survey supplemented by desktop research. This work was carried out in April 2016 by qualified archaeologists from ASC. The report compilation method was developed after an initial site visit to examine the general landscape of the area.

The survey was undertaken by Kurt Balzan BA Archaeology and English, Diploma Public Administration; Daniel Borg BA (Hons) Archaeology, MA; Marlene Borg BA (Hons) Archaeology, MA; Ernest Vella BA (Hons) Archaeology, MA; of Archaeology Services Co-operative Ltd. On-site surveys were carried out on 3, 7 and 9 April 2016.
2.2 Desk-Top Research

The general works of Abela (1647) and Wettinger (2000) were consulted, as well other publications related to Sliema mostly Zammit 1930 and Zammit 2000. Other consulted works have been listed in the bibliography. Given that the area is characterised by Fort Cambridge, Tigne Barracks and other military installations, the works of Spiteri (1991) and Samut-Tagliaferro (1982) were referred to in great detail. The photography of Ellis (2010) was also an important reference work regarding the change in landuse of the area.

The Annual Reports on the Workings of the Museums Department (MARs), published from 1904 onwards, were also examined, providing no references for the area in question.

Survey sheets starting from 1898 to 1915 available at the Chief Draughtsman’s Office of the Works Department were also consulted to study the changes in landscape and to date some of the features. Given that the area was regulated by the British Forces in Malta, Sheet 54 of 1914, is blank where the Fort was located. However, a number of place names were retrieved.

2.3 Site Survey

The site survey covered the surrounding area of the proposed development, which is practically an urban area. The survey was limited to surface investigation, leaving out any possible cultural heritage buried beneath the ground. We therefore cannot exclude the possibility that archaeological remains do exist beneath the surface of the site surveyed.

Given the nature of the area being assessed, the site survey varied from the conventional surveys usually carried out for such studies. During the site survey the following cultural features were considered:

- architectural structures and the remains of structures;
- important public and private buildings with particular architectural features;
- particular architectural features in present structures that suggest specific importance.

2.4 Recording Systems

Any feature considered to be of cultural interest was recorded on the sheets described above including all the information required as detailed in Appendix 1.

2.5 Statutory Protection
The importance of the conservation of the identified sites and features has been identified with reference to relevant legislation standards, guidance and practices. These include the Structure Plan for the Maltese Islands that refer to the grading of archaeological sites and buildings, Development Planning Act 1992, the Cultural Heritage Act and the Northern Harbour Local Plan.

2.5.1 Cultural Heritage Act (2010, Cap 445)

This Act provides overall protection to “all movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance and includes information or data relative to cultural heritage pertaining to Malta or to any other country” (section 2). In section 3 it also specifies that “For the purposes of this Act, an object shall not be deemed to form part of the cultural heritage unless it has existed in Malta, including the territorial waters thereof, or in any other country, for fifty years, or unless it is an object of cultural, artistic, historical, ethnographic, scientific or industrial value, even if contemporary, that is worth preserving”.

“No person shall make any interventions on such cultural property or classes thereof without first having obtained a permit therefore from the Superintendent” (Section 44.3). Applications are determined subject to the results of prior investigation: “Before determining an application under subarticle (3) hereof the Superintendent may require such information including the results of such tests, examinations or inspection by such persons accredited under this Act for the purpose as may be required by the Superintendent” (Section 44.4).

The restrictions on archaeological excavations is stated in Section 43(1) whereby “Archaeological or palaeontological excavations or explorations on land as well as in the territorial waters or in the contiguous zone of Malta can only be made by the Superintendent, or with written permission of the Superintendent”. Chance discoveries of archaeological remains are also regulated by Section 43(2), “Any person who, even accidentally, discovers any object, site or building to which this Act applies in accordance with article 3, shall immediately inform the Superintendent, keep the object found in situ, and shall not for a period of six working days after informing the Superintendent proceed with any work on the site where the object of cultural property is discovered”. The details about rights and obligations by all parties in the eventuality of an archaeological discovery are described in Sections 43(3), 43(4), 43(5), 43(6), 43(7).
2.5.2 Structure Plan Policies

The Structure Plan contains policies that refer to the grading of archaeological sites and buildings.

Policy ARC 1 states that in Local Plans within Rural Conservation Areas the Planning Authority may identify and designate Areas and Sites of Archaeological Importance. Structure Plan Policy ARC 2, indicates that if an area is considered to be of top priority conservation (Class A), no development will be allowed that would adversely affect the natural setting of these monuments or sites. A minimum buffer zone around the periphery of the site will need to be established in which no development will be allowed. Features identified as Class B are regarded as very important and should be preserved at all costs. Adequate measures to be taken to preclude any damage from immediate development. For features that are listed as Class C, every effort must be made for preservation, but may be covered up after proper investigation, documentation and cataloguing. Provision for subsequent access shall be provided. Class D features are similar to numerous others and must be properly recorded and catalogued before covering or destroying. Class E has been introduced in the Northwest Local Plan (approved in 2006). This deals with a site or area in which the Superintendence of Cultural Heritage or MEPA may have some archaeological interest. Should MEPA or the Superintendence have such an interest, the applicant proposing development in that location will be required to undertake an investigation, including excavation, if necessary. If following investigation, the Superintendence of Cultural Heritage considers the site to be of archaeological value, MEPA will normally refuse development permission if the proposed development would lead to the destruction of the site, or require the development to be modified so that the archaeological value of the site is protected.

The permissible effects of the proposed development on archaeological remains are regulated by policy ARC 3 that states that “development affecting ancient monuments and important archaeological areas and sites, including areas and sites having such potential, will normally be refused if there is an overriding case for preservation. Where there is no overriding case for preservation, development of such sites will not normally be permitted until adequate opportunities have been provided for the recording and, where desirable, the excavation of such sites”.

All other archaeological features listed in the catalogue may be included in the National Protective Inventory of the Planning Authority according to policy ARC 7 for which protection is granted by means of policy ARC 6.

Rural buildings and rubble walls are protected by the Rural Conservation Areas policies and policy UCO 7. Policy UCO 7 establishes the grading of listed buildings in Urban Conservation Areas and regulates works that are acceptable in such buildings.
In the case of architectural heritage the following protection levels apply:

**Grade 1** buildings are of outstanding architectural or historical interest that shall be preserved in their entirety. Demolition or alterations which impair the setting or change the external or internal appearance, including anything contained within the curtilage of the building, will not be allowed. Any interventions allowed must be directed to their scientific restoration and rehabilitation. Internal structural alterations will only be allowed in exceptional circumstances where this is paramount for reasons of keeping the building in active use.

**Grade 2** protection applies to buildings of some architectural or historical interest or which contribute to the visual image of an Urban Conservation Area. Permission to demolish such buildings will not normally be given. Alterations to the interior will be allowed if proposed to be carried out sensitively and causing the least detriment to the character and architectural homogeneity of the building.

**Grade 3** buildings have no historical importance and are of relatively minor architectural interest. Demolition may be permitted provided the replacement building is in harmony with its surroundings.

### 2.5.3 Scheduling

In the area of study and its immediate surroundings there are a number of scheduled properties that reflect the urban texture of the area within the system of the Harbour Fortifications. These are listed in Table 1 and shown in Figure 2.

<table>
<thead>
<tr>
<th>Property address</th>
<th>GN no</th>
<th>Category</th>
<th>Feature</th>
<th>Level</th>
<th>Site Survey number</th>
<th>Reference to Figure 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4, Triq il-Ponta ta’ Dragut cw/Triq Thornton</td>
<td>GN666/06</td>
<td>Architecture</td>
<td>Dwelling</td>
<td>Grade 2</td>
<td>FRT16/003</td>
<td>1</td>
</tr>
<tr>
<td>22, Triq Locker cw/Triq Thornton</td>
<td>GN666/06</td>
<td>Architecture</td>
<td>Dwelling</td>
<td>Grade 2</td>
<td>FRT16/004</td>
<td>1</td>
</tr>
<tr>
<td>1, Triq il-Ponta ta’ Dragut cw/Triq Locker</td>
<td>GN666/06</td>
<td>Architecture</td>
<td>Dwelling</td>
<td>Grade 2</td>
<td>FRT16/005</td>
<td>1</td>
</tr>
<tr>
<td>Triq Tigne, Sliema</td>
<td>GN829/07</td>
<td>Engineering</td>
<td>Wall post box</td>
<td>Grade 2</td>
<td>FRT16/006</td>
<td>2</td>
</tr>
<tr>
<td>Triq ix-Xatt ta’ Tigne</td>
<td>GN700/95</td>
<td>Architecture</td>
<td>Nazzarenu Church</td>
<td>Grade 1</td>
<td>n/a</td>
<td>3</td>
</tr>
<tr>
<td>Triq ix-Xatt ta’ Tigne</td>
<td>GN700/95</td>
<td>Engineering</td>
<td>Sea Water Distilling Station</td>
<td>Grade 1</td>
<td>FRT16/008</td>
<td>4</td>
</tr>
<tr>
<td>Il-Ponta ta’ Tigne</td>
<td>GN133/01</td>
<td>Military</td>
<td>Fort Tigne</td>
<td>Grade 1</td>
<td>n/a</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 1:** List of Scheduled Sites in the area of proposed development
Within a close proximity to the area of development are two scheduled sites. Both properties have been scheduled as a Grade 2 property. The first (marked as 1 on Figure 2) are 3 properties (FRT16/003, FRT16/004, FRT16/005) which have a similar architecture design dating to the Inter-war period. Their style has been found in other properties in the area of proposed development and have been included in the Catalogue of Features, where it is being recommended that they are also protected with a Grade 2 Level.

The distillation station, which was essential for the water provision in the 1880s, has been protected with a Grade 1 Level, given that it is a unique element in Maltese industrial heritage. Fort Tigne, which lies at the tip of the peninsula, has also been protected with a Grade 1 Level, due to its importance in the fortification system of the Harbour Area. The level of protection of two other fortifications (Fort Cambridge – FRT16/001 and Garden Battery – FRT16/010) is being proposed as Grade 1 as well.

Figure 2: Scheduled Sites in relation to the area of proposed development

Apart from scheduling, the Tigne Peninsula, where the area of proposed development is located, also forms part of the Area of High Landscape Value related to the Harbour Fortifications as listed in GN133 of 2001 (indicated in Figure 3). This means that the whole area forms part of “a cultural area of conservation value that encompasses an array of diverse components considered to be culturally significant. Distinct geographical areas or properties uniquely representing the combined work of nature and of man”. Therefore the location and cultural assets relate to the peninsula’s strategic location at the mouth of Marsamxett Harbour and at the entrance to the Grand Harbour.
2.5.4 The European Landscape Convention (Florence Convention)

The Florence Convention signed by all members of the Council of Europe, and therefore by Malta as well, clearly defines landscape and is aware that “sustainable development based on a balanced and harmonious relationship between social needs, economic activity and the environment” must be achieved (European Landscape Convention 2000: 1). It also maintains that “the landscape is an important part of the quality of life of people everywhere” and that it is a “key element of individual and social well-being and that its protection, management and planning entails rights and responsibilities for everyone” (European Landscape Convention 2000: 1).

According to this Convention landscape “means an area, as perceived by people, whose character is the results of the action and interaction of natural and/or human factors” and covers “natural, rural, urban and peri-urban areas” (European Landscape Convention 2000: 2).

**Figure 3:** Scheduled Sites in relation to the areas being assessed.
2.5.5 The Burra Charter (The Australia ICOMOS charter for the conservation of places of cultural significance)

The Burra Charter provides guidance for the conservation and management of places of cultural significance. It states that “Places of cultural significance enrich people’s lives, often providing a deep and inspirational sense of connection to community and landscape, to the past and to lived experiences… They are irreplaceable and precious”. Such places must therefore be conserved for present and future generations.

The Charter promotes a vigilant approach to change: “do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained”. Places of cultural significance are made up of fabric, that is all physical materials constituting them like building interiors, excavated material, fixtures and components. Such fabric should be disturbed as little as possible, even for study and documentation purposes.

2.5.6 The Northern Harbour Local Plan

The area being assessed is affected by the Northern Harbour Local Plan published in 2006. NHSJ15 – Development of New Hotels in Sliema – identifies the Fort Cambridge area as a possible location for a new hotel and refers to its Development Brief, which is also part of the North Harbour Local Plan. The policy justifies a development of a hotel in the area only if “The proposed development is not likely to create significant adverse impacts on the local amenity” and if “The scale of the proposed development is consistent with the building height limitation and the character of the area”.

2.6 Difficulties

This study presented a number of constraints related to the nature of the area being developed. The Officers’ quarters (FRT16/001) whose façade is to be retained has been altered with its integration in the Holiday Inn Crowne Plaza, whereby many alterations have taken place on the interior. Given that the site is inaccessible due to the years of abandonment and ensuing vandalism, and considering that the Architects’ Firm, DeMicoli Associates, had already carried out a detailed photographic survey showing what amendments have been carried out to the original structure based on an old plan found at the National Archives, the survey of the area of proposed development was mainly based on this previous study.

On the other hand, the area around it is highly developed, making it difficult sometimes to identify the different ‘layers’ in the urbanisation process. Although at first impression the site seems to be made up of modern architecture, it is in fact, dotted with remnants of buildings from the late 19th and early 20th century as well.
3. **Cultural Landscape Assessment**

Archaeological research is increasingly concerned with historical landscapes. The whole of our landscape, rural and urban, is a vast historical document. Such approaches aim at the preservation of historically important landscapes, especially when relating to arrangements of archaeological remains within the landscape. The historical landscape considers not only the important sites, but also the ‘flora, fauna, topography, geology and scenery, as well as spiritual matters such as aesthetics, artistic and literary associations, folklore and tradition.’ [Darvill et al. 1993: 571].

3.1 Toponymy

A number of place-names have been identified from the survey sheet or other literature in the proposed area of development and its immediate surroundings (refer to **Figure 4**). Toponomy, can be a very useful tool to reconstruct pasts as they give a hint of past land uses, tenure names, type of vegetation, and also topographical features that existed in the area. Below is a list of these place-names and related information according to the tunnel segment.

![Figure 4](image-url)
<table>
<thead>
<tr>
<th>Place Name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Il-Fortina</td>
<td>No reference was found to this place name, but its literal translation is the diminutive of fort, therefore it refers to a small fort.</td>
</tr>
<tr>
<td>Qui-Si-Sana</td>
<td>No document was found referring to this place name, but a literal translation would be “Here one finds health”. This possibly refers to when people resorted to the seaside for fresh air and relief from respiratory problems (personal communication with Charles Xuereb, April 2016).</td>
</tr>
<tr>
<td>Il-Bajja ta’ Ghar id-Dud</td>
<td>This place name, refers to a cave on the shore, which according to Guillaimier (2005: 815) was also referred to as “Ghar Lume”.</td>
</tr>
<tr>
<td>Il-Ponta ta’ Dragut</td>
<td>According to Guillaimier (2005: 815), the entrance tip to the Grand Harbour is named after Dragut, who in the Siege of 1565 set up a battery there to attack the harbour fortifications. He also mentions the hearsay that Dragut was killed here. Wettinger (2000: 603) refers to Xagħra ta’ Dragut, and links it to the same place name, which was a garigue outcrop before it was replaced by Fort Tigne.</td>
</tr>
<tr>
<td>That il-Kritien</td>
<td>This place name was found in Zammit (1930: 18) when he refers to the location of the sea water distillation plant in Triq ix-Xatt ta’ Tigne (FRT16/008). This seems to relate to “Qortin” which is the word for “headland” in Maltese (Wettinger 2000: 447), referring to the peninsula. Aquilina 1990 (116), gives the plural of Qortin as Qraten; Qrejten is also a small qortin. The Q and K are usually interchanged in Maltese language.</td>
</tr>
<tr>
<td>Santa Marija tal-Qortin</td>
<td>This place name denoted by Wettinger (2000: 537) as a minor locality is found in Abela (1647: 91) who refers to the chapel located on the promontery that ends at Dragut Point.</td>
</tr>
<tr>
<td>Santa Marija ta’ Sliema</td>
<td>Wettinger (2000: 518) quotes documents from the Apostolic Visit of Mons. Bartholomeo Rull in 1758, which list the church at Tigne of the Blessed Virgin ta’ Cortin [sic] also known as ta’ Sliema.</td>
</tr>
</tbody>
</table>
3.2 Historical Importance of the Area

Given the place name referred to by Wettinger (2000: 603) “Xaghra ta’ Dragut”, Tigne Peninsula was most probably garigue open to the elements and the strong North-Easterly winds until well into the 18th century. This is also confirmed by the place name “That il-Kritien” mentioned by Zammit (1930: 18). It became important once the Harbour Area gained its strategic role in the defence of the Maltese Islands and with the building of Fort Tigne in the last years of the 18th century.

Before that, in the 16th century, there seems to have been a small chapel on the promontory dedicated to La Madonna Del Buon Viaggio. Mariners used to say a “Hail Mary” on seeing this chapel, leading to the place name Sliema. At this point, one must point out that although this tradition with mariners is common, Wettinger (2000: 537) links the place name to the Arabic male personal name Salâma or to the Jewish surname Salama.

A first-hand account reproduced by Cassar Pullicino (1988: 32-36) that was written in 1827 by ‘Julian Scribble’ recalls of when the author, using a pseudonym, crossed to St Julian’s from Valletta. He mentioned that on approaching Sliema, one could see peasants working in the salt pans found at Tigne and Ghar id-Dud. He also describes simple dwellings that were built by the British residents as a place of retirement. He makes it a point to emphasise that these were inaccessible as if the residents wanted to jealously keep the place to themselves. This is also what Zammit (1930: 16-17) points out when he describes the opening of roads like Rue D’Argens in 1845 and Prince of Wales Str (today’s Triq Manwel Dimech) in 1862. Before that Sliema was inaccessible and mainly uninhabited.

With the opening of these streets and the ferry service to-and-from Valletta in 1881, Sliema became more popular both with the British as well as the Maltese middle classes of Valletta (Vassallo 2004: 7). Previous to that, apart from the humble summer residences mentioned above, there were two palaces - Palazzo Capua on the hilltop and another palace in the Tigne area belonging to Captain Hughes Hallet. In the 1888 Malta directory, Mrs and Miss Hughes-Hallett resided at Palazzo Sliema, Sliema (url: http://website.lineone.net/~remosliema/malta_1888.htm). This palace is no longer standing, although in the area of influence of this baseline study a street named Hughes-Hallett is found. The chapel at Tigne no longer served the community, and a larger church was built farther inland (Stella Maris Chapel) in 1853.

Possibly the summer residences along the coastline which are visible in OSS Sheet 54 are dated to this time. During the survey a number of these houses have been noted to be still intact. Their dating has been made possible by a niche of the Madonna of Mount Carmel (FRT16/014) that has an inscription dated to 1876. Such houses (shown in Figure 5 in relation to OSS Sheet 54) are FRT16/015, FRT16/016 and FRT16/017. They all seem to have a simple façade with an open balcony above the doorway, and consist of two storeys. Other houses may be still extant in the area of influence but have not been noted due to the modern accretions. Given their date and state of preservation, FRT16/014 and FRT16/017 are being proposed to be schedule as a Grade 2 property, while due to the many accretions and alterations which seem to have been incurred by FRT16/016, a Grade 3 level of protection is being proposed.
Figure 5: The location of the simple summer residences (FRT16/015, FRT16/016 and FRT16/017 in relation to the area of proposed development (FRT16/001) superimposed on OSS Sheet 54.

The opening of new roads coincided with a great expansion of new facilities that occurred between 1870 and 1900 as the British increased their defences and took control of strategic locations around the Malta to accommodate the ever increasing garrison. The harbour defences were further strengthened in view of the fast development of armament technology. This period thus saw the building of new forts, gun batteries, hospitals and barracks (Samut-Tagliaferro, 1982: 46). This can be attested in the Sliema area with the building of the Sliema Point Battery in 1872, the armament of Fort Tigne in 1878 and the construction of Fort Cambridge in 1880 (FRT16/002) to host the 100 ton gun and the erection of the Garden Battery (FRT16/010) in 1894 (Samut-Tagliaferro, 1982: 48; Spiteri 1991: 263,463).

Fort Cambridge (FRT16/002) was built between 1878 and 1886 to serve as a counterpart to Fort Rinella, situated more or less equidistant on the other side of the Grand Harbour. Fort Cambridge, was basically identical to Fort Rinella, with the only difference being that these plans were inverted to form a mirror image of the other (Figures 6 to 8). These forts were constructed to hold the 100-ton Armstrong gun (Figure 9), consisting of the usual defensive features which included the ditch, counterscarp, and casemated barracks to accommodate a garrison (Thake & Hughes 2005: 128 & Spiteri 1991: 411). These fortresses were a response to the Italian navy who, in 1877, had commissioned four heavily armour-clad vessels each armed by a 100-ton gun. These had led to a rethinking of the defensive situation in Malta which at the time had nothing to counteract these vessels (Spiteri 1991: 411).
Figure 6: Top Plan of Fort Cambridge 2015 (Anon. 2011a)

Figure 7: Basement Plan and Ground Plan of Cambridge Plan (Anon. 2011b)
Figure 8: General Layout of Fort Cambridge Battery drawn by Stephen Spiteri (1991: 412)

Figure 9: The 100-ton gun before being placed into position at Fort Cambridge (Ellis 2010:91)
Although there were other minor differences, the focal feature in both the Rinella and Cambridge Forts was the 100-ton gun, together with the mechanism needed to load and operate the heavy gun and the underground stores (Spiteri 1991: 417). These 100-ton guns turned out to be unpopular since most of the time they were unreliable. 27th June 1904 was the last day when the 100-ton gun at Fort Cambridge participated in firing practice. The gun was not removed from its battery well into the 1950s when it was sold for scrap metal (Spiteri 2005: 418 & Thake & Hughes 2005: 128).

In the 1970s part of the Fort was converted into a restaurant. This was then taken down and rebuilt to accommodate an indoor and outdoor swimming pool as well as a lido for the Holiday Inn Crowne Plaza Hotel (Anon. 2010; Micallef 2014 Camilleri 2015 & Cooke 2013) (refer to Figures 10 and 11).

![Aerial view of Fort Cambridge before it was converted into a swimming pool for the Holiday Inn Crowne Plaza Hotel (Spiteri 1991)](image)

**Figure 10**: Aerial view of Fort Cambridge before it was converted into a swimming pool for the Holiday Inn Crowne Plaza Hotel (Spiteri 1991)
The Fort is presently undergoing complete restoration as part of the Fort Cambridge development project (Camilleri 2015 & Cooke 2016).

Three years after the completion of Fort Cambridge, the British military saw the need to add another feature in the area. The Garden Battery (FRT16/010) was built between 1889 and 1894 and is situated between the open ground of Fort Tigne and Fort Cambridge. The Battery formed part of the eastern coastal defence of the Grand Harbour. It linked the ditches of Fort Tigne and Fort Cambridge and consisted of a long and narrow pentagonal work with the salient angle pointing outwards to the sea. Its purpose seems to have been to seal off all the intervening ground between the two fortifications. The Battery was protected both from its seafront and rear (Figures 12 and 13). Spiteri notes that the Battery had no flanking defences neither scarp and counterscarp galleries nor caponiers (Spiteri: 463-466).
The Battery had three concrete sea facing gun emplacements for 6-inch guns which were adjoined by underground magazines and gun crew shelters. In 1906 the Battery was to be rearmed to host two 9.2-inch guns however this proposal was soon discarded when a new Battery was built at Tigne Point (refer to Figure 14) (Spiteri: 463-466).
The Battery was thought to have been mostly destroyed during World War II and eventually, the battery ditch was filled in to make way for new buildings which extended over the glacis and gun emplacements. However in 2005, excavations work in the area for a tunnel in connection with the Tigne Point Project, uncovered extensive parts of the Battery which included the three gun emplacements and their ancillary stores. This discovery brought a complete overhaul of the plans for the north side of the development which had to be changed. After consultation with MEPA, Fondazzjoni Wirt Artna, AOM Consultants, Midi plc architectural advisers and Professor Alex Torpiano, it was decided that the Battery be integrated into the heritage route proposed for Tigne Point and Fort Cambridge (Massa 2006; Anon. 2012; Cini 2004).

Both these features (FRT16/002 and FRT16/010) are being proposed for a Grade 1 Level of Protection just like their counterpart in Fort Rinella, protected as a Grade 1 property by GN 930/02. Moreover 15 of the 16 scheduled batteries in the Maltese Islands have been granted the same protection of a Grade 1 Scheduled Property (as per Malta Scheduled Property Register in www.mepa.org.mt).

With the passing of the ‘1890 Barracks Act’, new Barracks were built with modernised facilities to accommodate the British garrison. Throughout the period 1895 – 1900, the Tigne area saw the demolishing of the old Crimea type huts and the erection of three new blocks which were to be utilised as married quarters for the soldiers. These were followed by the soldiers’ quarters Block A and B, which were completed towards the end of the century, and finally the building of the Officers’ Mess.
opposite (FRT16/001) Fort Cambridge between 1903 and 1905 (Samut-Tagliaferro, 1982: 51-52).

These buildings were designed by the Royal Engineers who followed strictly the “Barrack Synopsis” in use at the time. Infarct all the buildings followed an identical plan according to strict typological standards with facades that showed elements of “a happy marriage of Victorian and vernacular architecture” (Samut-Tagliaferro, 1982:56-57) (refer to Figures 15 to 17).

Figure 15: Front and Side Elevations of the Tigne Officers Mess (Public Works Department archive)
Figure 16: Elevations and Sections of the Tigne Officers Mess (Public Works Department archive)

Figure 17: Ground Floor Plan of the Tigne Officers Mess (Public Works Department archive)
The Tigne officers’ mess was built between 1903 and 1905. It is situated at the corner of Tigne Street overlooking Fort Cambridge. The building was designed according to the standard Officers’ Mess designs that were used during this period, it being “military in character with symmetry of plan and façade” (refer to Figure 18). Samut-Tagliaferro notes that this building was almost identical to the one which existed at St. Andrews.

![Figure 18: Ground Floor Plan of the Tigne Officers Mess (Public Works Department archive)](image)

The building served as an Officers’ Mess for a number of British Regiments. In 1915 the building was used as a military hospital. This occasion was commemorated by a marble plaque. According to Samut-Tagliaferro this plaque was to be preserved in the main foyer of the new hotel when this building was demilitarized and converted into a bedroom block in the 1980’s. In the 1970s the building was used for military purposes for the last time by the Royal Malta Artillery.

Its design made it remarkably suitable for the conversion into a bedroom block to be integrated with the Qui-Si-Sana Tourist Complex. For this transition the military character of the building had to be removed (Samut-Tagliaferro, 1982:56-57). This involved the removal of the main porch in the north façade (Figures 19 and 20) and the main and subsidiary staircases and the converting of the existing rooms into double bedrooms with ensuites (Samut-Tagliaferro, 1982: no pagination). Samut-Tagliaferro also notes that many of the RSJ and Frank ceilings were replaced, new service shafts were built and loadbearing walls on the ground floor opened to provide the large public areas (Samut-Tagliaferro, 1982: no pagination).
Figure 19: Old Military Facade of the Tigne Officer Mess still existent in 1970 when it was still used by the RMA (Samut-Tagliaferro, 1982)

Figure 20: Tigne officers Mess with extra storey during its demilitarisation in to a bedroom block for the Qui-si-Sana Tourist Complex (Samut-Tagliaferro, 1982)

Where it not for these alterations, the Tigne Officers’ Mess would merit a Grade 1 Level of Protection as was the case with the ones in Pembroke protected by GN 880/09. However, due to these irreversible changes, its character has definitely been altered. Nonetheless, given its importance and given that many of the other Barracks in the area have been altered, it is hereby being suggested that it is given a Grade 2 Level of Protection.
The amount of British servicemen in the area required that a chapel would be built (FRT16/009). The foundation stone of the St Luke’s Garrison Chapel was laid in January 1910 (Figure 21). It was used by the Anglican Officers and soldiers stationed in Tigne. It has three entrances and a porch at the front. A belfry was added later. The chapel was used until 1979. In the next 20 years it was used for drama, concerts and Carnival dances. When the Tigne barracks were passed on to Midi, the chapel was extensively restored to its current state. The chapel merits a Grade 2 Level of Protection.

Figure 21: The laying of the foundation stone of St Luke’s Garrison Chapel by Sir Leslie Rundle in 1910
(http://www.m3p.com.mt/media/wiki/e/e8/StLukesChapel01.jpg)
With the arrival of the British services in the area and the improved accessibility, population increased, attracting also a number of recreational facilities, including the shooting club at the foot of today’s Dingli Str., 59 shops that served the community in 1881 (Zammit 2000: 109) and a number of hotels that sprouted in the area from as early as 1851 (Zammit 2000: 112-113). The area became so populated that even the Malta Union Club decided to move to Sliema and opened its present venue in 1889. It conveniently located itself overlooking a parade ground in Ghar id-Dud where weekly military band performances were held (http://www.maltaunionclub.com/info/history/history.html).

This rise in population together with a number of successive dry winters led to a particular dry spell and lack of fresh water in Sliema. This led the British Government to urgently build a sea water distillation plant that was functioning in 1880 (FRT16/008). Together with the plant a large reservoir was dug. The distilling station was part of the scheme created by Captain T.J. Tresidder from the Royal Engineers to prepare a comprehensive drainage system in 1884 (Thake & Horden 2005: 89).

The building has both classical and Victorian elements. Thake and Hughes point out that “the low classical pediment that projects over the façade and the stepped rusticated quoins at the corner were intended to project an image of an efficient and reliable facility” (Thake & Horden 2005: 89). According to Zammit (1930: 19) it functioned for two years only, when piped water was brought over from B’Kara. In fact, a fountain was erected to commemorate the event in St. Anne Square. As from the 1930s, this was already being used as a printing press. This feature has been scheduled as a Grade 1 Property by GN 700/95.

The building boom continued during the Inter-War Period where more the population growth of Sliema increased by 25.36% between 1901 and 1911 as compared to the national rate of 14.52% (Vassallo 2004: 11). The introduction of public transport in the area in the 1920s, led to a further increase in the population, leading to a further increase in accommodation. This led to the building of terraced houses like FRT16/003, FRT16/004 and FRT16/005. Given their art deco characteristics and state of conservation, these have been protected by MEPA as a Grade 2 property. On this basis, the similar houses FRT16/018 and FRT16/013 (Figure 22) are being proposed with the same level of protection.

Apartments with a similar architectural style were also noted in the area of influence. In fact FRT16/011, FRT16/012 and FRT16/019 are also built in a similar style as the above features (refer to Figure 22). Therefore the same level of protection is being proposed.
In close proximity to the area of proposed development is a particular block of apartments (FRT16/007) which is built in severe Art Deco style typical of the 1930s. Its Italian names “Maronna”, “Licinia” and “Lavinia” are defiant to the strong British military presence in the area. Such a building is being proposed to be scheduled as a Grade 2 property due to its particular nature. A wall post box (FRT16/006) was installed on the façade and has been scheduled by MEPA as a Grade 2 cultural asset.
3.3 The Cultural Landscape

All archaeological and historical sites and features form part of the landscape which surrounds them, and any survey of the cultural heritage has to study a site’s context as well as the site itself. No cultural future is isolated from its geographical features and the other cultural features which surround it, and on which it depends, to varying degrees. Every site is a piece of local history, embedded in its immediate cultural landscape and relating to the area around it [Barker 1993:254]. The phrase "cultural landscape" does not mean a special type of landscape, but rather a way of seeing landscapes that emphasizes the interaction between human beings and nature over time. The main value of the cultural heritage in the area lies in the information it can yield regarding past settlement patterns, as well as the indications regarding land-use patterns.

The cultural landscape of the Tigne Peninsula is made up of a large number of stratigraphic layers that have been built upon and cut into over time. The garigue headland, the salt pans of the late 18th century and Marian chapel, gave way to Fort Tigne (1793-1975). Apart from the Fort, the rest of the peninsula remained the same as attested by Ellis’ photo reproduced in Figure 23 until 1895.

Figure 23: The immediate area outside Fort Tigne was still barren up to 1895 (Ellis 2010:Pl.69)

The addition of the barracks (Figure 24) led to development in the area at an exponential rate with the seafront budding with summer residences, leading to the building of the Nazzarenu Church (Figure 25).
Figure 24: The barracks in the Tigne Peninsula (Ellis 2010: Pl.70)

Figure 25: Nazzarenu Church and the Triq ix-Xatt ta’ Tigne in the late 19th century (Ellis 2010: 75)
After the Second World War, the Harbour Area as a whole underwent major reconstruction. The same accounts for Tigne where apartments started to replace the terraced fields or older buildings.

Tourism in the area increased and so did the demand for tourist accommodation, leading to the construction of a large number of hotels, among which was the Holiday Inn Crowne Plaza that encroached into Fort Cambridge (FRT16/002) and led to major alterations of the Tigne Barracks Officers’ Mess (FRT16/001). Access to Fort Tigne became a necessity when the barracks were being used as residences and Fort Tigne housed a Reverse Osmosis Plant. This led to the covering up and partial demolition of the Garden Battery (FRT16/010). Currently (refer to Figure 26), these accretions are being removed and the military structures of the area being restored (as the case of Fort Tigne) or being put to a different use (as the case of Tigne Barracks; refer to Figure 27).

**Figure 26:** Modern accretions into British military structures at Tigne

| Holiday Crowne Plaza accretions to Fort Campbell (FRT16/002) have been removed in 2005 and original parts of the fort are being currently reconstructed. | Parts of Garden Battery (FRT16/010) re-exposed with the building of Tigne Point tunnel |
Figure 27: Inclusion of the Tigne Barracks facades into Tigne Point development
The urban sprawl and recent developments (in the last 30 years) has led to the de-contextualisation of the military barracks of the Tigne Peninsula. This is especially the case for the Officers' Mess (the area of proposed development), which has not only been physically separated by the Fort Cambridge Development but also almost encroached upon (as shown in Figure 28).

Figure 28: The Officer's Mess (FRT16/001) in relation to the Fort Cambridge Development

One must consider this urbanisation process in a wider context of the cultural landscape. The strategic location of Tigne Peninsula at the mouth of the Grand Harbour, places its cultural landscape in the wider one of the Harbour Area. As such, one has to consider the Harbour Area as a whole, when considering the impacts of the proposed development.

The photomontages provided in the Project Description Statement of the proposed development suggest possibilities in which the landscape will be visually affected. However, the characteristic of the military role Tigne Peninsula played in the defence of the Harbour Area has to be considered as well. Moreover, the restorative element of the peninsula leading to the building of summer residences there, which gradually gave rise to today’s thriving entertainment, commercial and tourism activity, needs to be preserved through the humble residences like FRT16/015 and the more lavish ones like FRT16/019 that still exist.
4. IMPACTS AND MITIGATIONS

The main and direct impact of this proposed development is on the Officers’ Mess (FRT16/001), which will be dismantled and reconstituted into the lower floors of a high-rise hotel. As such, while its fabric has been damaged by its use in the hotel, its context and mere existence as a free-standing structure will be forever lost. On the other hand, one has to keep in mind, that the current state of the structure provides danger to the community, is adversely affecting the urban fabric of the area and is leading to further damage being done to the structure itself by the natural elements as well as by human intervention. Should the development take place, apart from the usual precautions of monitoring works, a museum/heritage trail of the area, including Fort Tigne and Garden Battery among other, should be put into place by the developer. This will make sure that the context of the cultural assets in the area is not only partially preserved but also appreciated and experienced by the local community as well as by visitors to the area and hotel guests in particular. Also one has to be sure that Elements like plaques (as for instance the 1915 plaque commemorating the change in use from an officers mess in to a military hospital) that could have been preserved in the previous hotel be preserved and displayed in the interpretation center/museum. Any other material or architectural elements salvaged from the dismantling of barracks interior, in order to preserve the Cultural elements.

The restoration of Fort Cambridge (FRT16/002) should ensue and authorities should ensure that it is done in the most beneficial way to the Fort. Once works are concluded, it should be open to the public, possibly in relation to the museum/trail mentioned above.

The building of a high-rise hotel will create more shadows in the narrow streets like Triq Sant’Antnin, Triq Pace and Triq Matthew Pulis. These streets house a number of dwellings from the late 19th and early 20th century, that have become a rare sight in Sliema. Such shadows as well as the rise of modern structures, will further drain the area from the little remaining character of a summer residence which Sliema once was in the 19th century. Through the design and materials applied in the proposed development, the project should ensure that the shadow effect is reduced to the minimum.

The cultural landscape of the area will not only be visually affected since the proposed development will be the focal point of Tigne, but the barracks and the military heritage of the area which still exists (Fort Cambridge) will be further de-contextualised.

Further impacts and proposed mitigations are listed in Table 2 below.
<table>
<thead>
<tr>
<th>Description of likely impacts</th>
<th>Magnitude and significance of impacts</th>
<th>Duration of impacts</th>
<th>Extent of impacts</th>
<th>Direct/Indirect impacts</th>
<th>Nature of impacts</th>
<th>Reversibility of impacts</th>
<th>Sensitivity of receptors to impacts</th>
<th>Probability of occurrence of impacts</th>
<th>Confidence limits to impact prediction</th>
<th>Scope for mitigation of Impacts</th>
<th>Residual impacts</th>
</tr>
</thead>
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- 37 -
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<td>Further change in its context and cultural landscape</td>
</tr>
<tr>
<td><strong>Summary of mitigation measures and monitoring</strong></td>
<td>Restoration, accessible to the public and creation of a museum/heritage trail in the area</td>
<td></td>
<td></td>
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<tr>
<td>Description of likely impacts</td>
<td>Magnitude and significance of impacts</td>
<td>Duration of impacts</td>
<td>Extent of impacts</td>
<td>Nature of impacts</td>
<td>Reversibility of impacts</td>
<td>Sensitivity of receptors to impacts</td>
<td>Probability of occurrence of impacts</td>
<td>Confidence limits to impact prediction</td>
<td>Scope for mitigation of Impacts</td>
<td>Residual impacts</td>
<td></td>
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<td>-----------------</td>
<td></td>
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<tr>
<td>Name of affected resource: Niche (FRT16/014)</td>
<td>Medium</td>
<td>Permanent Niche</td>
<td>Indirect</td>
<td>Adverse</td>
<td>Irreversible</td>
<td>Niche</td>
<td>High</td>
<td>High</td>
<td>Yes</td>
<td>Further change in its context and cultural landscape</td>
<td></td>
</tr>
<tr>
<td>Summary of mitigation measures and monitoring</td>
<td>Scheduling</td>
<td></td>
<td></td>
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<tr>
<td>Name of affected resource: Cultural Landscape</td>
<td>Very high</td>
<td>Permanent Cultural Landscape</td>
<td>Direct</td>
<td>Adverse</td>
<td>Irreversible</td>
<td>Cultural Landscape of Tigne Peninsula, Sliema, North Harbour Area, Harbour Area</td>
<td>Very high</td>
<td>Very high</td>
<td>Yes</td>
<td>Further change in its context and cultural landscape</td>
<td></td>
</tr>
<tr>
<td>Summary of mitigation measures and monitoring</td>
<td>Restoration, accessible to the public and creation of a museum/heritage trail in the area</td>
<td></td>
<td></td>
<td></td>
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Appendix I: Catalogue of Cultural Features
Location
Il-Fortina, Il-Ponta ta’
Tigne, Sliema

Category
Military

Site Description (Address)
Officers Quarters of Tigne Barracks at Il-Fortina, Il-Ponta ta’
Tigne, Sliema

Eastings
5572

Northings
7416

Period
1903-1905

SS No1
5474

SS No2

SS No3

SS No4

Description
The Tigne Officers’ Quarters was built between 1903 and 1905. It is situated at the corner of Tigne Street overlooking Fort Cambridge which was built in 1880. The building was designed according to the standard Officers’ Quarters designs that were used during this period, it being “military in character with symmetry of plan and façade”. Samut-Tagliaferro notes that this building was almost identical to the one which existed at St. Andrews.

The building served as an Officers’ Quarters for a number of British Regiments. In 1915 the building was used as a military hospital. In the 1980s it was internally altered to accommodate the Holiday Inn Crowne Plaza hotel.

Present Utilisation
None

Comments
Surveyed from the exterior only

Site
**Condition**  
Dilapidated and Vandalised

**Degree of Protection**  
None

**Proposed Protection**  
Grade 1

**Basic Bibliography**  

**Compiled by**  
KDB, DB, MB, EV

**Date of Survey**  
06.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Il-Fortina, Il-Ponta ta’ Tigne, Sliema</td>
<td>Military</td>
<td>Fort Cambridge at Il-Fortina, Il-Ponta ta’ Tigne, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northing</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5582</td>
<td>7417</td>
<td>1880</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Fort Cambridge was built in 1880 to host the 100 ton gun and protect the mouth of the Grand Harbour together with its counterpart on the other side of the Harbour in Fort Rinella. In the 1980s, the Fort had been integrated into the tourist hotel, Holiday Inn Crowne Plaza, and several accretions were added. The fort is now being restored.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No4</th>
<th>SS No3</th>
<th></th>
</tr>
</thead>
</table>

| Date of survey sheet: | 1992 |

Present Utilisation
None

Comments
Inaccessible
Condition
Currently being Restored

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
**Location**
Il-Fortina, Il-Ponta ta’ Tigne, Sliema

**Category**
Civil Dwelling

**Site Description (Address)**
4, Triq il-Ponta ta’ Dragut cw/Triq Thornton, Sliema

**Eastings**
5574

**Northings**
7420

**Period**
Inter-War Period

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Two-storey house with an entrance reached by a flight of steps supported by Tuscan columns. Though rather austere in its embellishment, the corner has gabled windows. Recently another storey and a penthouse have been added.</td>
</tr>
</tbody>
</table>

**Present Utilisation**
Residential

**Comments**

**Date of survey sheet:** 1992

**Site Diagram**

[Site diagram with reference numbers and coordinates]
Condition
Good

Degree of Protection
Grade 2, GN 666/06

Proposed Protection

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
<th>Present Utilisation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Il-Fortina, Il-Ponta ta’ Tigne, Sliema</td>
<td>Civil Dwelling</td>
<td>22, Triq Locker cw/Triq Thornton, Sliema</td>
<td>Residential</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Period</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5573</td>
<td>7421</td>
<td></td>
<td>Two-storey house with an entrance reached by a flight of steps supported by Tuscan columns. It is rather austere in its embellishments like FRT16/003 but it has ornate wrought iron works. Its stone balconies have a semi-circular motif design.</td>
</tr>
</tbody>
</table>

Date of survey sheet: 1992

Site

![Site Image]
Condition
Good

Degree of Protection
Grade 2, GN 666/06

Proposed Protection

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
Location
Il-Fortina, Il-Ponta ta’ Tigne, Sliema

Category
Civil Dwelling

Site Description (Address)
1, Triq il-Ponta ta’ Dragut cw/Triq Locker, Sliema

Eastings 5572
Northings 7419

SS No1 5474
SS No2
SS No4
SS No3

Description
Two-storey house with a grand entrance reached through a porch flanked by Tuscan columns, supporting an open stone balcony. The balconies have a semi-circular motif design.

Date of survey sheet: 1992

Present Utilisation
Residential

Comments

Site
Condition
Good

Degree of Protection
Grade 2, GN 666/06

Proposed Protection

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq Tigne, Sliema</td>
<td>Engineering</td>
<td>Wall Post Box at Triq Tigne, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5567</td>
<td>7416</td>
<td>1936-1952</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>SS No3</th>
<th>SS No4</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description**
A George VI wall post box mounted on a wall in Triq Tigne. Freshly painted in red, it has the Royal Crest and the initials "GR".

**Date of survey sheet:** 1992

**Present Utilisation**
Letter Box

**Comments**

**Site**

[Map Image]
Condition
Good

Degree of Protection
Grade 2, GN829/07

Proposed Protection

Basic Bibliography
Magro Conti, J., 2007, 'From Pillar to Post', Xplain, MEPA.

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
Location
Triq Tigne c/W Triq Sant'Antnin, Sliema

Category
Civil Dwelling

Site Description (Address)
Block of Residential Dwellings at Triq Tigne cw/Triq Sant'Antnin, Sliema

Eastings
5567

Northings
7414

Period
Inter-War Period

SS No1
5474

SS No2

SS No3

SS No4

Date of survey sheet:
1992

Description
A block of residential units which have Art Deco characteristic with the Italian names of "Maronna", "Lavinia" and "Licina" embossed on the doorways. While embellishment is kept at a minimum it is very particular, especially the open balcony/terrace in the corner, with straight balustrades, as well as the wrought iron railings of the open balconies and the iron decoration inset in the wooden doorways.

Present Utilisation
None

Comments
Surveyed from the exterior only. Site is abandoned.
Condition
Poor

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
After consecutive dry winters, water became so scarce in the Sliema area that the British Government saw to the building of a water distillation station "Taht ta' Kritien" (Zammit 1930: 18). Apart from the building, a large reservoir was dug in the area to hold the distilled water. Apparently this was not a successful enterprise since in 1882, the Government brought water in pipes from Birkirkara. Commemorating this event a fountain was erected in the nearby St Anne Square. By the 1930s, the station was already being used as a Printing Press.
Condition
Good condition on the exterior

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
06.04.2016
St Luke's Garrison Chapel at Triq Censu Xerri, Sliema

Description
The foundation stone of the chapel was laid in January 1910. It was used by the Anglican Officers and soldiers stationed in Tigne. It has three entrances and a porch at the front. A belfry was added later. The chapel was used until 1979. In the next 20 years it was used for drama, concerts and Carnival dances. When the Tigne barracks were passed on to Midi Consortium for the Manoel Island and Tigne project, the chapel was restored.

Present Utilisation
None

Comments
Surveyed from the exterior only
Condition
Good condition on the exterior

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
Location
Il-Fortina, Il-Ponta ta’ Tigne, Sliema

Category
Military

Site Description (Address)
Garden Battery at Il-Fortina, Il-Ponta ta’ Tigne, Sliema

Eastings
5595

Northings
7410

Period
1894

SS No1
5474

SS No2

SS No3

SS No4

Description
The Garden Battery was built between 1889 and 1894 and is situated between the open ground of Fort Tigne and Fort Cambridge. The Battery formed part of the eastern coastal defence of the Grand Harbour. It linked the ditches of Fort Tigne and Fort Cambridge and consisted of a long and narrow pentagonal work with the salient angle pointing outwards to the sea. Its purpose seems to have been to seal off all the intervening ground between the two fortifications. The Battery was protected both from its seafront and rear. The Battery was thought to have been mostly destroyed during World War II and eventually, the battery ditch was filled in to make way for new buildings which extended over the glacis and gun emplacements. However in 2005, excavations work in the area for a tunnel in connection with the Tigne Point Project, uncovered extensive parts of the Battery which included the three gun emplacements and their ancillary stores.

Present Utilisation
None

Comments
Surveyed from the exterior only

Site
Condition
Poor

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq Il-Ponta ta' Dragut cw/Triq Mc Iver, Sliema</td>
<td>Civil Dwelling</td>
<td>Block of Apartments at Triq il-Ponta ta' Dragut cw/Triq Mc Iver, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5580</td>
<td>7423</td>
<td>Inter-War Period</td>
</tr>
</tbody>
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<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Block of apartments with open balustraded balconies and wooden apertures, dating to the inter-war period. The four-storied apartments have a bevelled corner and a number of garages that compensate for the gradient in the street.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No4</th>
<th>SS No3</th>
</tr>
</thead>
</table>

Date of survey sheet: 1992

Present Utilisation
Residential

Comments
Surveyed from the exterior only
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
**Location**
Triq Sant'Antnin cw/Mc Iver, Sliema

**Category**
Civil Dwelling

**Site Description (Address)**
Block of Apartments at Triq Sant'Antnin cw/Mc Iver, Sliema

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northingss</th>
</tr>
</thead>
<tbody>
<tr>
<td>5578</td>
<td>7427</td>
</tr>
</tbody>
</table>

**Period**
Inter-War Period

**SS No1**
5474

**SS No2**

**SS No3**

**SS No4**

**Date of survey sheet:** 1992

**Description**
Block of apartments with recessed balustraded balconies on the southwestern façade and open recessed balustraded balconies on the southeast. The quoins are rendered in fake rustication and each floor is separated by a moulding. On the third floor the moulding is further embellished with dentils, indicating that a certain point, this was the top floor. In later years, another two stories were added imitating the similar design.

**Present Utilisation**
Residential

**Comments**
Surveyed from the exterior only

**Site**
![Site Map](image)
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
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<tbody>
<tr>
<td>Triq Locker, Sliema</td>
<td>Civil Dwelling</td>
<td>Terraced House at Triq Locker, Sliema</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northing</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5571</td>
<td>7421</td>
<td>Inter-War Period</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Terraced house with an elaborate colonnaded entrance with Tuscan columns supporting a six-windowed wooden balcony. The louvered-windows on both sides of the entrance have an embossed frame and a pediment and dentils. On the roof is a chimney, indicating a fire place, typical of the period.</td>
</tr>
</tbody>
</table>

| Date of survey sheet: | 1992 |

Present Utilisation
Residential

Comments
Surveyed from the exterior only

Site

![Site Diagram]
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
Location
Triq Sant'Antnin, Sliema

Category
Religious

Site Description (Address)
Niche of the Madonna of Mount Carmel at Triq Sant'Antnin, Sliema

Eastings
5559

Northings
7409

Period
c.1876

SS No1
5474

SS No2

SS No3

SS No4

Date of survey sheet: 1992

Description
Elaborate devotional niche dedicated to the Madonna of Mount Carmel. The niche is flanked by a round column on each side supporting a broken pediment with dentils. The niche stands on a moulded shell. The statue of the Madonna is holding the infant Jesus on her right arm, while both figures are holding the scapular. The one being held by the Madonna is very elaborate. The statue of the Madonna has a starred metal halo. The painted statues in the niche are enclosed in an iron frame which is surrounded by light bulbs, covering the statues with glass. Beneath the niche is a marble inscription granting an indulgence to the faithful by Mons Pace Forno and is dated to 3rd July 1876.
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
AGNS. ARCHIEP. E VEICOVO DI MACH.
PR. CAETANO FACCIO FORNO CONSEGLIO
40 CIORNI D’INDUGERZA.
A CHI RECITERÀ UN’AVE MARIA.
CON DECRETO DEL 3 LUGLIO 1573.
Location
Triq Sant'Antnin, Sliema

Category
Civil Dwellings

Site Description (Address)
Houses in Triq Sant'Antnin, Sliema

Eastings
5560

Northings
7410

Period
c.1876

SS No1
5474

SS No2

SS No3

SS No4

Date of survey sheet:
1992

Description
Houses along the eastern side of Triq Sant'Antnin all built in a similar style with a plain façade and open balcony with iron railings. One of the houses holds a niche (FRT16/014) dedicated to the Madonna of Mount Carmel with an inscription dating to 1876. The similar style of the dwellings, indicates they were built at the same time in the second part of the 19th century, when Sliema was slowly gaining popularity. In fact the houses are visible in the 1914 OSS Sheet 054.

Present Utilisation
Residential/Commercial

Comments
Surveyed from the exterior only

Site
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography
1914 OSS Sheet 054

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq Zimmerman</td>
<td>Civil Dwellings</td>
<td>Two-storey terraced houses at Triq Zimmerman Barbaro, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northing</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5558</td>
<td>7415</td>
<td>Late 19th century</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Two-storey terraced houses with a front open porch, and a balcony. Along the years, several accretions have been added to these houses, while others have been replaced by modern apartments. The houses are visible in the 1914 OSS Sheet 054.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No4</th>
<th>SS No3</th>
</tr>
</thead>
</table>

Date of survey sheet: 1992

Present Utilisation
Residential

Comments
Surveyed from the exterior only

Site
Condition
Fair

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography
1914 OSS Sheet 054

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
Location
Triq il-Patruna, Sliema

Category
Civil Dwellings

Site Description (Address)
Two-storey terraced houses at Triq il-Patruna, Sliema

Eastings
5560

Northings
7407

Period
Late 19th century

SS No1
5474

SS No2

SS No3

SS No4

Description
Two-storey houses with a simple façade in an alley. These houses are typical of summer residences that were found in the local coastal areas, with an open balcony above the doorway. Originally they had little embellishments, but along the years a number of accretions were added.

Present Utilisation
Residential

Comments
Surveyed from the exterior only

Site
Condition: Fair
Degree of Protection: None

Proposed Protection: Grade 3

Basic Bibliography: 1914 OSS Sheet 054

Compiled by: KDB, DB, MB, EV
Date of Survey: 09.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq Pace cw/Triq Censu Xerri, Sliema</td>
<td>Civil Dwelling</td>
<td>Two-storey wide-fronted terraced house at Triq Pace cw/Triq Censu Xerri, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northing</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5576</td>
<td>7400</td>
<td>Inter-War Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Wide-fronted terraced houses with five apertures on the façade in Triq Pace. Its architecture is similar to the scheduled houses FRT16/003, FRT16/004 and FRT16/005, apart from two arched corner windows which are supported by two pilasters.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No4</th>
<th>SS No3</th>
</tr>
</thead>
</table>

Date of survey sheet: 1992

Present Utilisation
Residential

Comments
Surveyed from the exterior only

Site
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
<table>
<thead>
<tr>
<th>Location</th>
<th>Category</th>
<th>Site Description (Address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq Hughes Hallett, Sliema</td>
<td>Civil Dwellings</td>
<td>Four-storey apartment block at &quot;Ritz Flats&quot;, Triq Hughes Hallett, Sliema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>5571</td>
<td>7429</td>
<td>Inter-War Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No1</th>
<th>SS No2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5474</td>
<td></td>
<td>Four-storey apartment with a protruding open balcony supported by two pilasters on each side. The lintel on the entrance has the name &quot;Ritz Flats&quot; in relief. A large louvered arched window flanks the doorway.</td>
</tr>
</tbody>
</table>

Present Utilisation
Residential

Comments
Surveyed from the exterior only

Date of survey sheet: 1992
Condition
Good

Degree of Protection
None

Proposed Protection
Grade 2

Basic Bibliography

Compiled by
KDB, DB, MB, EV

Date of Survey
09.04.2016
Fort Cambridge Hotel

Noise & Vibration Report

Prepared by:

..............................................
Christian Calleja Dip.Ind.Elec. AMIOA
<table>
<thead>
<tr>
<th>Version</th>
<th>Revision</th>
<th>Date</th>
<th>Purpose/Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>R01</td>
<td>27/04/16</td>
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</tr>
<tr>
<td>01</td>
<td>R02</td>
<td>04/05/16</td>
<td>Criteria update.</td>
</tr>
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1 Present Situation

1.1 Introduction

The area is a constantly trafficked area with light duty. A noise and vibration monitoring exercise was done to establish the present site levels.

Several positions were used to measure the noise levels, the VDV (Vibration Dose Values) according to BS 6472 and PPV (Peak Particle Velocity) to compare to BS 7385. The monitoring positions are shown in Figure 1 below.

Figure 1 Monitoring locations at nearest receptors.

1.2 Assessment criteria

This project needs to be evaluated against criteria to cover:

- Criteria to protect the immediate environment and residents once the project is operating,
• Criteria to protect the immediate environment and residents from noise whilst the Hotel is being constructed,
• Criteria to protect the immediate environment and residents from vibration whilst the Hotel is being constructed,
• Criteria to protect the immediate properties from vibration whilst the Hotel is being constructed.

1.2.1 Operational criteria

Since no definite parameters for new development impact criteria exist in the planning process the procedure set in I-INCE Publication Number: 11-1 Guidelines for Community Noise Impact Assessment and Mitigation Final Report of the I-INCE Technical Study Group on Community Noise: Environmental Noise Impact Assessment and Mitigation (TSG 6) 2011 March are followed. Whereby, the new development must fit within the area’s present noise climate. The most critical time period in the development area would be the night time levels present in the area i.e. the noise sources from the development must be at least 3 dBA within the present night L_{Aeq,1 hour} at the receivers.

1.2.2 Construction noise criteria

The standard being used to evaluate construction noise is BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.

There are three methods of assessment presented within BS 5228 but would not always make sense for the Maltese context, primarily as it is not tied to local legislation and secondarily there is no offerings for noise insulation or temporary re-housing to nearby residents.

The methods offered are:

• What is termed as the ABC method, whereby the area limits would be established from location measurements and a fit under criteria set under categories A, B or C of Table E1 of said standard – see Figure 2.
- The fixed level method which was set by the Wilson Committee noise report as presented to the UK Parliament in 1963 and reproduced below in Figure 3.
- The ‘5dBA’ change whereby the daytime construction period noise level limit is set at 65dBA and the pre-construction ambient plus the construction noise would be considered significant if the change is 5dBA or more.

Table E.1  Example threshold of significant effect at dwellings

<table>
<thead>
<tr>
<th>Assessment category and threshold value period</th>
<th>Threshold value, in decibels (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Category A A)</td>
</tr>
<tr>
<td>Night-time (23.00–07.00)</td>
<td>45</td>
</tr>
<tr>
<td>Evenings and weekends B)</td>
<td>55</td>
</tr>
<tr>
<td>Daytime (07.00–19.00) and Saturdays (07.00–13.00)</td>
<td>65</td>
</tr>
</tbody>
</table>

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

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

NOTE 3  Applied to residential receptors only.

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

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

---

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. The noise can be measured with a simple sound level meter, as we hear it, in A-weighted decibels (dBA) – see note below. Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;
- 75 decibels (dBA) in urban areas near main roads in heavy industrial areas.

These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments – and when working outside the normal hours say between 19.00 and 22.00 hours – the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10 dBA may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours."

Figure 3 Chosen criteria reproduced from BS 5228-1:2009
The assessment criteria for construction noise chosen is the fixed level method, whereby the level limit at the receivers would be of 70 dBA $L_{eq,1\text{ hour}}$ for daytime construction noise levels. (Note from the results that even under the ABC method the area would fit within this limit.)

### 1.2.3 Construction vibration criteria for effects on humans

The criteria against which the human vibration doses will be assessed are set by the same standard under which the monitoring has been conducted i.e. BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting.* The VDV limits from said standard are shown in Figure 4.

<table>
<thead>
<tr>
<th>Place and time</th>
<th>Low probability of adverse comment $v_{1.75}$</th>
<th>Adverse comment possible $v_{1.75}$</th>
<th>Adverse comment probable $v_{1.75}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential buildings</td>
<td>0.2 to 0.4</td>
<td>0.4 to 0.8</td>
<td>0.8 to 1.6</td>
</tr>
<tr>
<td>16 h day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential buildings</td>
<td>0.1 to 0.2</td>
<td>0.2 to 0.4</td>
<td>0.4 to 0.8</td>
</tr>
<tr>
<td>8 h night</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE** For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 h day.

*Figure 4 Table 1: Criteria from BS 6472-1:2008*
1.2.4 Construction vibration criteria for limiting building damage


The results of the prediction are assessed according to BS 7385-2:1993 Evaluation and measurement for vibration in buildings —Part 2: Guide to damage levels from groundborne vibration i.e. the results are compared to Figure 5 below.

<table>
<thead>
<tr>
<th>Line (see Figure 1)</th>
<th>Type of building</th>
<th>Peaks component particle velocity in frequency range of predominant pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reinforced or framed structures: Industrial and heavy commercial buildings</td>
<td>50 mm/s at 4 Hz and above</td>
</tr>
<tr>
<td>2</td>
<td>Unreinforced or light framed structures: Residential or light commercial type buildings</td>
<td>15 mm/s at 4 Hz increasing to 20 mm/s at 10 Hz</td>
</tr>
</tbody>
</table>

NOTE 1 Values referred to are at the base of the building (see 6.3).
NOTE 2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.0 mm (zero to peak) should not be exceeded.

**Figure 5 BS 7385-2:1993 levels for onset of cosmetic damage.**

The guide values in Figure 5 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Figure 5 -Table 1 may need to be reduced by up to 50 %.NOTE There are insufficient cases where continuous vibration has caused damage to buildings to substantiate these guide values but they are based on common practice.
1.3 Noise

The noise levels measured on site at the positions in Figure 1 are listed below. Actual measurement time histories, spectra and statistics are shown in Figures 2 to 9.

<table>
<thead>
<tr>
<th>Monitoring Positions</th>
<th>L_{A_{max}}^{day}</th>
<th>L_{A_{eq, 1 hour}}^{day}</th>
<th>L_{A_{90}}^{day}</th>
<th>L_{A_{10}}^{day}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position 1</td>
<td>93.5</td>
<td>63</td>
<td>52.4</td>
<td>64.5</td>
</tr>
<tr>
<td>Position 2</td>
<td>95.2</td>
<td>61.7</td>
<td>51.8</td>
<td>62.9</td>
</tr>
<tr>
<td>Position 3</td>
<td>89.9</td>
<td>62.2</td>
<td>46.2</td>
<td>65.8</td>
</tr>
<tr>
<td>Position 4</td>
<td>88.1</td>
<td>62.6</td>
<td>52</td>
<td>64.9</td>
</tr>
</tbody>
</table>

The resulting levels are typical of light duty road side levels.
Figure 6 Overall levels and spectra at Position 1.

\[ L_{\text{max}} = 93.5 \, \text{dB} \]
\[ L_{\text{eq}} = 63.0 \, \text{dB} \]
Figure 7 Overall levels and spectra at Position 2.
Figure 8 Overall levels and spectra at Position 3.

$L_{\text{max}} = 89.9 \text{ dB}$

$L_{\text{Aeq}} = 62.2 \text{ dB}$
Figure 9 Overall levels and spectra at Position 4.

$L_{\text{max}} = 88.1 \text{ dB}$

$L_{\text{Aeq}} = 62.6 \text{ dB}$
Figure 10 Distributive and cumulative distribution for hour measurement at Position 1.

Figure 11 Distributive and cumulative distribution for hour measurement at Position 2.
1.4 Vibration

Two base levels needed to be established for both comparison and future reference:

- The PPV – Peak Particle Velocity (by means of geophones) as a baseline comparison for possible building damage,
- The VDV – Vibration Dose Value (direct not estimated by means of accelerometers) as a baseline for comparison for any human discomfort.
1.4.1 Building damage

Three monitoring positions were measured for PPV. All three positions gave average PPVs of less than 0.13 mm/s.

1.4.2 Human discomfort

Four monitoring positions at facades were used to measure the VDV. The results are in Figures 10 to 13. The results were then normalized for the 16 hour day and compared to the criteria in BS6472.
Figure 14 1 Hour VDV at Position 1
Figure 15 1 Hour VDV at Position 2
Figure 16 1 Hour VDV at Position 3
Figure 17 1 Hour VDV at Position 4
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Day (1 Hour) Day 16 Hr. ms(^{-1.75}) Night 8Hr.ms(^{-1.75})</td>
<td>Day 16 Hr. ms(^{-1.75}) Night 8Hr.ms(^{-1.75})</td>
<td>Day 16 Hr. ms(^{-1.75}) Night 8Hr.ms(^{-1.75})</td>
</tr>
<tr>
<td>Position 1</td>
<td>X</td>
<td>0.0299</td>
<td>0.0598 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td>0.0299 0.0598 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>0.0332</td>
<td>0.0664 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>0.0214</td>
<td>0.0428 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 2</td>
<td>X</td>
<td>0.055</td>
<td>0.11 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>0.0462</td>
<td>0.0924 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>0.0582</td>
<td>0.1164 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 3</td>
<td>X</td>
<td>0.0653</td>
<td>0.1306 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>0.061</td>
<td>0.122 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>0.0638</td>
<td>0.1276 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4</td>
<td>X</td>
<td>0.0123</td>
<td>0.0246 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>0.0105</td>
<td>0.021 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>0.0097</td>
<td>0.0194 0.2 to 0.4 0.1 to 0.2 0.4 to 0.8 0.2 to 0.4 0.8 to 1.6 0.4 to 0.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 18 Present measured and normalized 16 hour VDV at Positions 1 to 4.
2 Operational Phase

2.1 Noise

Once the Hotel is in operation the following are the expected main sources from the project:

- Noise sources on the external building fabric,
- The traffic increase to the area due to the Hotel’s daily operations.

2.1.1 External sources

The only external noise sources pertaining directly to the development are the HVAC equipment being placed either in areas either externally or in spaces requiring direct air exchange with outside the building fabric. These sources are listed in Figure 15 along with their contributions to the nearest receivers or NSPs (Noise Sensitive Places/ Persons) to the relative source. None of the sources make any significant contributions to the NSP external façade free field noise levels.

<table>
<thead>
<tr>
<th>Level on Fort Cambridge Hotel</th>
<th>Combined Source 1 SPL @ 1m w/Local Directivity corr.</th>
<th>Combined Source 2 SPL @1m w/Local Directivity corr.</th>
<th>Combined Source 3 SPL@ 1m w/Local Directivity corr.</th>
<th>Expected levels at nearest receiver in dBA w/o any screening.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>77</td>
<td>76</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>77</td>
<td>77</td>
<td></td>
<td>40.13</td>
</tr>
<tr>
<td>Level 4</td>
<td>75</td>
<td>75</td>
<td></td>
<td>36.98</td>
</tr>
<tr>
<td>Level 11</td>
<td>79</td>
<td>73</td>
<td>77</td>
<td>37.26</td>
</tr>
<tr>
<td>Level 17</td>
<td>83.8</td>
<td></td>
<td></td>
<td>39.61</td>
</tr>
<tr>
<td>Level 19</td>
<td>81</td>
<td></td>
<td></td>
<td>36.73</td>
</tr>
<tr>
<td>Level 23</td>
<td>77</td>
<td></td>
<td></td>
<td>30.54</td>
</tr>
<tr>
<td>Level 29</td>
<td>75</td>
<td></td>
<td></td>
<td>27.26</td>
</tr>
<tr>
<td>Level 33</td>
<td>73</td>
<td></td>
<td></td>
<td>24.10</td>
</tr>
<tr>
<td>Level 40</td>
<td>72.8</td>
<td></td>
<td></td>
<td>22.29</td>
</tr>
</tbody>
</table>

*Figure 19 External or leading onto the exterior HVAC Noise sources.*
2.1.2 Traffic

From the TIA supplied - *TN 165547 Fort Cambridge High-Rise Hotel Tas Sliema Volume 1 Version 1 dated October 2015* - the projected development traffic in comparison to projected traffic increase for the area is shown in Figure 16.

<table>
<thead>
<tr>
<th>Access</th>
<th>Peak hour</th>
<th>Scheme traffic</th>
<th>2025 Network traffic</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq il-Ponta ta’ Dragut car park access</td>
<td>Weekday AM</td>
<td>30+15</td>
<td>218+14</td>
<td>19.40%</td>
</tr>
<tr>
<td></td>
<td>Weekday PM</td>
<td>27+30</td>
<td>158+11</td>
<td>33.70%</td>
</tr>
<tr>
<td></td>
<td>Weekend AM</td>
<td>27+21</td>
<td>196+17</td>
<td>22.50%</td>
</tr>
<tr>
<td></td>
<td>Weekend PM</td>
<td>23+23</td>
<td>178+12</td>
<td>24.20%</td>
</tr>
<tr>
<td>Triq Tigné car park access</td>
<td>Weekday AM</td>
<td>11+47</td>
<td>128+3+9</td>
<td>41.40%</td>
</tr>
<tr>
<td></td>
<td>Weekday PM</td>
<td>6+19</td>
<td>120+9+4</td>
<td>18.80%</td>
</tr>
<tr>
<td></td>
<td>Weekend AM</td>
<td>3+25</td>
<td>162+8+9</td>
<td>15.60%</td>
</tr>
<tr>
<td></td>
<td>Weekend PM</td>
<td>0+19</td>
<td>126+7+6</td>
<td>13.70%</td>
</tr>
<tr>
<td>Triq Tigné drop-off</td>
<td>Weekday AM</td>
<td>41+34</td>
<td>186</td>
<td>40.30%</td>
</tr>
<tr>
<td></td>
<td>Weekday PM</td>
<td>19+25</td>
<td>125</td>
<td>35.20%</td>
</tr>
<tr>
<td></td>
<td>Weekend AM</td>
<td>25+25</td>
<td>171</td>
<td>29.20%</td>
</tr>
<tr>
<td></td>
<td>Weekend PM</td>
<td>19+22</td>
<td>131</td>
<td>31.30%</td>
</tr>
</tbody>
</table>

*Figure 20 Predicted traffic increase around the project.*

The highest increase from the development is the 41.4 % increase in traffic at the Triq Tigne Car Park access. This will result in an increase of a basic day $L_{Aeq}$ of 1.5 to 2 dBA. This could safely be considered a slight change but not a noticeable change in level.

2.2 Vibration

The development in its own nature does not create any sources of direct or indirect vibration to the surrounding areas.

2.3 Mitigation

The development will have to look into screening the HVAC equipment on the lower levels from the nearby residences by means of absorbent louvres. Particularly to reduce the noise from Level 3.
3 Construction Phase

3.1 First Phase - Demolition

The first phase of the construction is the demolition of the internal walls and roof whilst protecting the external façade. During this first phase a tower crane will be set up (see Figure 17 as provided by architects), to move material from the interior of the façade to the loading bay as proposed in the same Figure 17. The roof will be chased into slabs and removed. After which the internal walls will be manually dismantled and removed from site.

3.1.1 Traffic

According to the CMP provided dated 14th March 2016, the construction related traffic will be operating according to Figure 17. It is being suggested that the number of truck trips or movements during the demolition phase would be of three trucks per day.

Figure 21 Proposed bay for work trucks.
3.1.2 Noise

The expected sources of noise during the demolition phase are:

- The cutting of the roof into manageable slabs,
- The operation of the smaller tower crane,
- The use of chutes and movement of the dismantled inner walls to the designated truck loading bays.

All of the above works can be fitted within the 65 dBA L_Aeq working day limit.

3.1.3 Vibration

No direct vibrational sources are expected at this stage or phase of the work. Albeit the architects propose ensuring the trucks idle their engines for the least possible time. It is quite likely that the running of the engines creates an issue on the ‘inside’ of the surrounding houses. This occurs when the idling noise couples with particularly shaped buildings and/or what is termed as ‘high frequency’ floors. These types of floors are present in at least three houses in the vicinity of the proposed parking bay.

3.1.4 Mitigation

Once work starts on the retained façade support, it is suggested that all openings on the façade are boarded or completely covered with a limp material solid curtain. This will provide a barrier for work conducted on the internal walls and the other phases. It is also suggested that the truck parking bay is shielded by a temporary brick wall on the West side of the proposed bay. The wall should be the three-quarter height of the highest truck, and the length of the proposed bay. This will reduce the possibility of air coupled vibration should trucks need to idle for prolonged periods. This will make a difference to some of the older buildings on Triq Locker/ Triq Sant Antnin, which buildings have older roofs and construction which lends itself to easier resonant effects.
The use of chutes whilst dismantling the internal walls is being proposed. It is being suggested that should metal receivers be used (skips or bulk rubble containers) that the containers/receivers are covered with looser material prior to bulkier material be dropped from height.

3.2 Second Phase - Excavation

After the inner walls have been cleared the next phase in construction work would be the excavation to accommodate the four basement levels. This will cover the inner footprint of the building, and will be excavated in layers of 1.5m.

3.2.1 Traffic

The architects are expecting 25 truck trips per day for the removal of material from site to the dedicated quarry. This will increase the hourly $L_{Aeq}$ by 1.9 dBA.

3.2.2 Noise

The main sources of noise are expected to be:

1. the rock cutting saws,
2. tracked excavators,
3. a tower crane,
4. a trencher,
5. Material dumping into the trucks.

Items 1, 2 and 4 will be screened from the immediate residents and their impact is expected to be circa 3 to 4 dBA increase on the present day levels. In the case of the material dumping into trucks, it expected to screen the loading bay.
The predicted vibration and groundborne noise from the activities of the excavation phase are listed in Figure 18. These predictions are only for ground level at the nearest positions to the site on that road. Predictions for other floor levels are not possible as no amplification factors for Maltese house construction are available. The predictions do not consider any mitigation.

<table>
<thead>
<tr>
<th>Nearest residence on road:</th>
<th>r (slope distance)</th>
<th>Ground floor level groundborne noise dBA</th>
<th>Vres (Resultant PPV) mm/s</th>
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</thead>
<tbody>
<tr>
<td>Triq Locker</td>
<td>20.18</td>
<td>56.53</td>
<td>3.62</td>
</tr>
<tr>
<td>Triq St. Antnin</td>
<td>23.93</td>
<td>52.54</td>
<td>2.90</td>
</tr>
<tr>
<td>Triq Punta ta Dragut</td>
<td>19.64</td>
<td>57.17</td>
<td>3.75</td>
</tr>
<tr>
<td>Triq Tigne</td>
<td>17.98</td>
<td>59.24</td>
<td>4.21</td>
</tr>
</tbody>
</table>

These resulting predictions would likely give adverse comment probable according to the BS6472 table below in Figure 19. But will not likely cause any building damage according to the table in Figure 20 according to BS 7385.

This is quite normal as the residents would perceive the vibration well before the onset of cosmetic building damage.

<table>
<thead>
<tr>
<th>Dwelling Type</th>
<th>Low Probability of Adverse Comment</th>
<th>Adverse Comment Possible</th>
<th>Adverse Comment Probable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential or Office (day)</td>
<td>&gt; 0.56 mm/s</td>
<td>&gt; 1.12 mm/s</td>
<td>&gt; 2.24 mm/s</td>
</tr>
</tbody>
</table>

Note: Conversion from VOV to ppv assumes continuous sinusoidal vibration at a frequency of 8Hz or greater.

Figure 23 Typical acceptable daytime vibration limits in terms of Peak Particle Velocity.
3.2.4 Mitigation

It is being proposed that the excavation is started by means of rotary cutters below the internal façade wall. It is suggested that the first saw cut followed by a trench around the whole perimeter. The trench is to be kept clean and void of material all times. This process should be repeated every time the overall level goes down due to the restricted 1.5 meter layer removal.

The central area material at each layer removal should be worked from East to West i.e. the work face should always face east.

3.3 Third Phase - Construction

The third phase of the construction involves the transportation and placement of prefabricated steel girders to form the inner tower framework,

3.3.1 Traffic

Although no direct mention of the expected truck deliveries / movements during the construction period are suggested by the architects, it is assumed that the figure of 25 movements per day would be expected. Other mobile crane machinery in conjunction with the main inner tower crane for the duration of the cladding, finishing etc. would also be operating on site.
3.3.2 Noise

If the construction operations are limited to normal hours and limiting the site to the normal construction site levels at the NSPs of 65dBA $L_{Aeq,12\text{ hour}}$. Most of the noise sources will be increasing distance from the receptors in due progress of the construction.

3.3.3 Vibration

There are no significant vibrational sources expected at this stage of the construction.

3.3.4 Mitigation

Most of the required mitigational procedures during the construction phase are proposed by the architects within the CMP. These procedures are being reproduced here:

- Use of electric torque wrenches to bolt the steel structures.
- Off-site pre-fabrication will be used for the structural steel structure; and as much as is possible for use of pre-fabricated concrete structural and architectural elements;
- All plant and equipment to be used for the works to be properly maintained, silenced where and as appropriate, and operated to prevent excessive noise and switched off when not in use and where practicable;
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around site will be conducted in such a manner as to minimise noise generation.
- Noise complaints, or exceeding of noise levels, will be reported to the Contractor and the contractor’s representative will be required to immediately investigate and take the necessary remedial action;
- Wherever possible, plant and equipment will be switched off when not in use;
- No demolition or excavation works will be carried out in summer in compliance with MMRA regulations “Break time for excavation and demolition”.

Fort Cambridge Hotel Noise Report
TRK 162247

Retention of the Historic Existing Facades of the Fort Cambridge Barracks Building and Demolition of the Existing Southwest Facade and Internal Structures, Proposed Excavation and Construction of a New High-Rise Hotel Class 3B Including all Ancillary Facilities and Amenities, Sliema

AIR QUALITY STUDY

Version 1: October 2015
Report Reference:

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Quality Assurance

Retention of the Historic Existing Facades of the Fort Cambridge Barracks Building and Demolition of the Existing Southwest Facade and Internal Structures, Proposed Excavation and Construction of a New High-Rise Hotel Class 3B including all Ancillary Facilities and Amenities, Sliema Air Quality Study
October 2015

Report for: GAP Developments plc

Revision Schedule

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<td>Submitted to client</td>
<td>Rachel Decelis</td>
<td>Rachel Xuereb</td>
<td>Adrian Mallia</td>
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Management System
MCCA
MSA EN ISO 14001:2004
Reg. No. 8002

Environmental
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Systems

4191

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INTRODUCTION

1. This study addresses the potential impacts of air emissions from the operational aspects of proposed redevelopment of Fort Cambridge at Triq Il- Ponta Ta' Dragut, Sliema, to provide for a high-rise hotel. The development is hereinafter referred to as ‘the Scheme’.

2. The Scheme involves the construction of a new 40-storey hotel, including ancillary facilities and amenities. The existing historic facades of the Fort Cambridge barracks building will be retained, whereas the existing southwest facade and internal structures will be demolished. The location of the Scheme site is shown in Figure 1.

3. The project is proposed by GAP Developments plc, hereinafter referred to as ‘the Applicant’.

4. The key issue for the assessment is:

   **Key Issue:**
   - Effects of air emissions arising from operation of the Scheme on sensitive receptors

Objectives of the Assessment

5. The objectives of the air quality study are to:
   - Quantify the expected air emissions from traffic resulting from operation of the Scheme, and assess their impact on air quality;
   - Assess cumulative impacts from developments in the area; and
   - Propose mitigation measures to reduce the impact, if any, of traffic emissions resulting from operation of the Scheme.

6. The air quality assessment focuses on the potential impacts on air quality as a result of vehicular traffic arising from the operation of the Scheme. Construction road traffic has been scoped out of this assessment since the daily threshold of 200 heavy vehicle movements\(^1\) will not be exceeded; preliminary figures obtained from the Traffic Impact Assessment, which was prepared concurrently with this study, indicate that heavy vehicle movements will be as follows:
   - 6.5 truck loads per day during the demolition phase (one month); and

- 25 truck loads per day during the excavation phase (three months).

**Legislation and Guidance**

7. Guidance on air quality related to traffic emissions in the Maltese context is available in the following national legislation:
   - **Legal Notice 478 of 2010: Ambient Air Quality Regulations** (SL 504.100).

8. For PM$_{10}$, the legislation sets an annual limit value of 40 $\mu$g/m$^3$, and a daily limit value of 50 $\mu$g/m$^3$ not to be exceeded more than 35 times in a calendar year.

9. The annual mean limit for NO$_2$ is 40 $\mu$g/m$^3$, whereas maximum hourly concentrations of NO$_2$ must not exceed 200 $\mu$g/m$^3$ – this value cannot be exceeded more than 18 times annually.
Figure 1: Location of the Scheme site
ASSESSMENT METHODOLOGY

Terms of Reference

10. Although no Scheme-specific Terms of Reference (ToR) have been provided by MEPA as yet because the EIA process has not started, MEPA ToR on air quality assessment are typically as follows:

3.0 A DESCRIPTION OF THE SITE AND ITS SURROUNDINGS (I.E., ENVIRONMENTAL BASELINE)

The existing environmental features, characteristics and conditions, in and around the proposed development site as well as in all locations likely to be affected by the development or by ancillary interventions and operations, are to be identified and described in sufficient detail, with particular attention to the aspects elaborated further in the next sections.

The consultants should also identify (and justify) wherever relevant:

1. The geographic area (e.g. viewshed or other area of influence) that needs to be covered by each study;
2. The relevant sensitive receptors vis-à-vis the environmental parameter under consideration (e.g. residential communities, other users, natural ecosystems, specific populations of particular species, or individual physical features);
3. The location of the reference points or stations (e.g. viewpoints, monitoring stations, or sampling points) to be used in the study; and
4. Other methodological parameters of relevance, also noting that the assessment will normally require both desk-top studies and on-site investigations (including visual observations and sampling, as relevant).

Air Quality

This study should clearly establish the current background levels of pollution (including dust). This should include a clear comparison to the relevant reference and limit values as specified in the relevant legislation as well as in any other relevant guidance documents. Details on prevailing wind and climate conditions should also be included, amongst other relevant parameters.

The methodology to be used should be submitted for the Environment Protection Directorate’s evaluation prior to commencement of the studies. The Air Quality Study shall be conducted in accordance with the Appendix to these terms of reference.

4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL RISKS

All likely significant effects and risks posed by the proposed project on the environment during all relevant phases (including construction / excavation / demolition, operation and decommissioning) should be assessed in detail, taking into account the information emerging from Sections 1, 2 and 3 above. Apart from considering the project on its own merits (i.e. if taken in isolation), the assessment should also take into account the wider surrounding context and should consider the limitations and effects that the surrounding environmental constraints, features and dynamics may exert on the proposed development, thereby identifying any incompatibilities, conflicts, interferences or other relevant implications that may arise if the project is implemented.

In this regard, the assessment should address the following aspects, as applicable for any category of effects or for the overall evaluation of environmental impact, addressing the
worst-case scenario wherever relevant:

1. An exhaustive identification and description of the envisaged impacts;
2. The magnitude, severity and significance of the impacts;
3. The geographical extent/range and physical distribution of the impacts, in relation to:
   • site coverage; the features located in the site surroundings; whether the impacts are
     short-, medium- or long-range; and any transboundary impacts (i.e. impacts affecting
     other countries);
4. The timing and duration of the impacts (whether the impact is temporary or permanent;
   short-, medium- or long-term; and reasonable quantification of timeframes);
5. Whether the impacts are reversible or irreversible (including the degree of reversibility
   in practice and a clear identification of any conditions, assumptions and pre-requisites
   for reversibility);
6. A comprehensive coverage of direct, indirect, secondary and cumulative impacts,
   including:
   • interactions (e.g. summative, synergistic, antagonistic, and vicious-cycle effects)
     between impacts;
   • interactions or interference with natural or anthropogenic processes and dynamics;
   • cumulation of the project and its effects with other past, present or reasonably
     foreseeable developments, activities and land uses and with other relevant baseline
     situations; and
   • wider impacts and environmental implications arising from consequent demands,
     implications and commitments associated with the project (including: displacement
     of existing uses; new or increased development pressures in the surroundings of
     the project; and impacts of any additional interventions likely to be triggered or
     necessitated by situations created, induced or exacerbated by the project);
7. Whether the impacts are adverse, neutral or beneficial;
8. The sensitivity and resilience of resources, environmental features and receptors vis-à-vis
   the impacts;
9. Implications and conflicts vis-à-vis environmentally-relevant plans, policies and
   regulations;
10. The probability of the impacts occurring; and
11. The techniques, methods, calculations and assumptions used in the analyses and
    predictions, and the confidence level/limits and uncertainties vis-à-vis impact
    prediction.

The impacts that need to be addressed are detailed further in the sub-sections below.

4.1 Effects on the environmental aspects identified in Section 3

The assessment should thoroughly identify and evaluate the impacts and implications of the
project on all the relevant environmental aspects identified in Section 3 above, also taking
into account the various considerations outlined in the respective sections.
5.0 REQUIRED MEASURES, IDENTIFICATION OF RESIDUAL IMPACTS, AND MONITORING PROGRAMME

5.1 Mitigation Measures

A clear identification and explanation of the measures envisaged to prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project during all relevant phases including construction, operation and decommissioning [see Section 1.2.3 above].

As a general rule, mitigation measures for construction-phase impacts should be packaged as a holistic Construction Management Plan (CMP). Whilst the detailed workings of the CMP may need to be devised at a later stage (e.g. after the final design of the project has been approved and/or after a contractor has been appointed), the key parameters that the CMP must adhere to for proper mitigation need to be identified in the EIA. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit], where relevant.

Mitigation measures for accident / risk scenarios should be packaged as a holistic plan that includes the integration of failsafe systems into the project design as well as well-defined contingency measures.

The recommended measures should be feasible, realistically implementable to the required standards and in a timely manner, effective and reliable, and reasonably exhaustive. They should not be dependent on factors that are beyond the developer’s and MEPA’s control or which would be difficult to monitor, implement or enforce. The actual scope for, and feasibility of, effective prevention or mitigation should also be clearly indicated, also identifying all potentially important pre-requisites, conditionalities and side-effects.

5.2 Residual Impacts

Any residual impacts [i.e. impacts that cannot be effectively mitigated, or can only be partly mitigated, or which are expected to remain or recur again following exhaustive implementation of mitigation measures] should also be clearly identified.

5.3 Additional Measures

Compensatory measures (i.e. measures intended to offset, in whole or in part, the residual impacts) should also be identified, as reasonably relevant. Such measures should not be considered as an acceptable substitute to impact avoidance or mitigation.

If the assessment also identifies beneficial impacts on the environment, measures to maximise the environmental benefit should also be identified.

In both instances, the same practical considerations as indicated vis-à-vis mitigation measures should also apply.

5.4 Monitoring Programme

A realistic and enforceable programme for effective monitoring of those works envisaged to have an adverse or uncertain impact. The monitoring programme should include:

1. Details regarding type and frequency of monitoring and reporting, including spot checks;
2. The parameters that will be monitored, and the monitoring indicators to be used;
3. An effective indication of the required action to address any exceedances, risks, mitigation failures or non-compliances for each monitoring parameter;
4. An evaluation of forecasts, predictions and measures identified in the EPS; and
5. An indication of the nature and extent of any additional investigations (including EIAs or ad hoc detailed investigations, if relevant) that may be required in the event of any contingencies, unanticipated impacts, or impacts of larger magnitude or extent than predicted.

The programme should address all relevant stages, as follows:
(a) Where relevant, monitoring of preliminary on-site investigations that may entail significant disturbance or damage to site features (e.g. geological sampling or any works that require prior site clearance);
(b) Monitoring of the construction phase, including the situation before initiation of works (including site clearance), during appropriate stages of progress, and after completion of works;
(c) Monitoring of the operational phase, except where otherwise directed by MEPA (e.g. where monitoring would be more appropriately integrated into an operating permit); and
(d) Where relevant, monitoring of the decommissioning phase, including the situation before initiation of works, during appropriate stages of progress, and after completion of works.

APPENDIX: TERMS OF REFERENCE FOR AIR QUALITY

Legal background:
Regulation 29 of LN 478 of 2010 grants MEPA the power to issue guidance notes on the conduction of Air Quality Studies which are required by any Regulations issued under the Environment and Development Planning Act. including the EIA Regulations (LN 114 of 2007).

Part II of Schedule 7 to LN 478 of 2010 sets the following (legally binding limit values): an annual limit value of 40 μg/m³ for PM10, a daily limit value for PM10 of 50 μg/m³ which can not be exceeded on more than 35 calendar days, an annual limit value 40 μg/m³ for NO2 and an hourly limit value of 200 μg/m³, which can not be exceeded more than 18 times per calendar year.

Regulations 19 and 20 of LN 78 of 2010 give MEPA the responsibility to ensure that the above mentioned limits are complied with across Malta and Gozo.

The Air Quality study shall be conducted as follows:

1. Base Line Studies
   a. The baseline levels of PM10 and NO2 shall be established through in-situ monitoring.
   b. Baseline levels of PM10 shall be determined using the reference method (MSA EN 12341:2000) for the determination of PM10.
   c. The consultants should use the reference method for the sampling and measurement of PM10;
   d. The design criteria for the samplers shall be as per Annex B to the said standard and shall be as per Section IV of Annex IX: MSA EN 12341: 2000.
Table 1: Design criteria for the samplers.

<table>
<thead>
<tr>
<th>Type of Sampler</th>
<th>Flow rate</th>
<th>Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-volume sampler (LVS-PM10 reference head)</td>
<td>2.3 m$^3$.hr$^{-1}$ or 38.3dm$^3$.min$^{-1}$.</td>
<td>Operated at a constant rate of 2.3 m$^3$.hr$^{-1}$ ± 2%. Circular: Ø ≥ 47 mm and Ø ≤ 50 mm</td>
</tr>
<tr>
<td>High volume sampler (HVS-PM10 reference head)</td>
<td>68 m$^3$.hr$^{-1}$ or 1.133 m$^3$.min$^{-1}$.</td>
<td>Operated at a constant rate of 68 m$^3$.hr$^{-1}$ ± 2%. Rectangular 203 mm x 254 mm</td>
</tr>
</tbody>
</table>

e. The resolution of the balance used for the weighing of filters sampled using an LVS shall be at least 10 μg.

f. The filters should be conditioned for at least 48 hours at 50% relative humidity (+ or - 5%) and at 20 ºC (+ or - 1 K).

g. The filters should be weighed at least twice for concordance with a time lag of at least 12 hours between the two weightings.

h. Flow rates are at ambient volumes not at normalized volumes. The weighing shall take place in the same climate controlled room.

i. Consultants can use alternative sampling and measurement methods if they demonstrate to MEPA's satisfaction, equivalence to the above mentioned method. Equivalence shall be determined using the European Commission's method for the determination of equivalence; any other method shall be deemed unacceptable. MEPA will accept certificates of equivalence issued by third parties, which have been based on the method herein.

j. Compliance with non-European standards does not satisfy the requirements above.

k. Regarding the siting of the sampler, the consultant shall submit a method statement indicating the location of the sampler. However MEPA may at its discretion ask the consultant to change the location of the sampler.

l. The sampling time shall be no less than 6 weeks and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by MEPA to the consultant.

Baseline levels of NO$_2$

m. Baseline levels of NO$_2$ shall be determined using EN 14211:2005. The consultant may use passive diffusive tubes if it is shown that the latter are equivalence to the reference method.

n. If the consultant opts for passive diffusion tubes, he shall forward at least 1 article in a peer reviewed journal which shows that the equivalence of these tubes has been demonstrated in at least 1 EU Member State. Equivalence should preferably, also have been demonstrated in Malta.

o. The consultant shall submit a method statement indicating the location of the sampler. However MEPA may at its discretion ask the consultant to change the location of the sampler.

p. The sampling time shall be no less than 6 weeks and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by MEPA to the consultant.

q. The consultant shall also take traffic counts at all the main junctions near the site. The number
and location of the counters are to be approved by MEPA.

r. The traffic count shall take into consideration the vehicle type and the legislation class.

s. The consultant shall use an appropriate model in order to scale the traffic counts obtained during the 6 week period to AADT.

2. **Modeling**

   a. Once the baseline levels have been obtained the consultant shall determine the impact of the project on air quality through dispersion modeling.

   b. The consultant shall identify the sensitive receptors in the area.

   c. The following models are deemed acceptable by MEPA:

   \[
   \text{IMMIS}^{\text{SM}} \\
   \text{BREEZE Roads.} \\
   \text{ADMS-Urban}
   \]

   d. The consultant shall use the emission factors in the latest version of the Handbook of emission factors for road transport emissions. The average age of the Maltese vehicle fleet shall be taken as 13 years.

   e. The consultant shall estimate the ambient background levels. The following approach shall be deemed acceptable.

   ![Figure 1](image.png)

   **Figure 1**: Horizontal profile for PM$_{10}$ concentration, Lenschow et al. (2001) – *Atmospheric Environment* 35, 29-33.

   f. The rural background can be captured through the use of the GAINS-EMEP model at a resolution of 50km * 50km, the urban background can be captured through the use of a model such as CHIMERE at a resolution of 7km * 7km. The background levels of both PM$_{10}$ and NO$_2$ shall be established using an approach similar to figure 1 above.

   g. The predictions of the model shall be assessed by comparing the modeled data to the monitoring data provided by the baseline studies. The modeled data must not deviate by more than ±20%.

   h. The consultant shall use the model to project the PM$_{10}$ and NO$_2$ levels into the future, when the project is fully operational.

   i. The consultant shall model two distinct scenarios: A) without the project and B) with the project.
j. The model shall display its output as a contour map and the concentrations at the sensitive receptors in point 21 shall be clearly labeled.

k. Any assumptions must be clearly stated by the consultant.

l. The equation below shall be applied to determine the number of daily exceedances: \( N = 3.8633A - 79.9522 \), this shall be determined for both scenarios.

m. For NO₂ the consultant shall assume that the annual mean is always exceeded before the allowed number of hourly exceedances.

3. **Significance Criteria.**

The following criteria of significance shall be used by the consultant to determine the significance of the impact:

(i) For annual levels of NO₂/PM₁₀ in \( \mu g/m³ \).

<table>
<thead>
<tr>
<th>Baseline annual levels of NO₂/PM₁₀</th>
<th>Change in annual NO₂/PM₁₀ levels due to scheme (( \mu g/m³ )).</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥0.4 ( \mu g/m³ ) but &lt;2 ( \mu g/m³ )</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥2 ( \mu g/m³ ) but &lt;4 ( \mu g/m³ )</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td>≥4 ( \mu g/m³ )</td>
<td>Substantial adverse</td>
</tr>
<tr>
<td>≥36 but &lt;40 ( \mu g/m³ )</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥30 but &lt;36 ( \mu g/m³ )</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;30 ( \mu g/m³ )</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

(ii) For daily exceedances of the PM₁₀ limit value in number of days.

<table>
<thead>
<tr>
<th>Baseline exceedance of daily PM₁₀ limit values (number of days)</th>
<th>Change in the number of days of exceedance of the daily PM10 limit value as a result of the scheme (days).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceeded on more than 35 days.</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥32 to &lt;35 exceedances.</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥26 to 32 exceedances.</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;26 exceedances.</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

**Method Statement**

11. A method statement was submitted to MEPA in August 2015; a copy is included in Appendix I.

---

² Thunis et al. (2012). *Linking the European scale modelling with urban and street scales. Institute for Environment and Sustainability.*
Traffic Data

12. The traffic data used in this assessment was from a Traffic Impact Assessment (TIA) prepared concurrently with this study.

13. The traffic figures used in this assessment are shown in Table 1; the corresponding roads are labelled in Figure 2.

14. The use of these traffic figures were agreed to with MEPA during the preparation of the TIA.

15. Three traffic scenarios were considered for the years 2020 (base year) and 2025 (base year plus five years):

   - Scenario 1: Baseline, excluding the Scheme but including the traffic growth predicted as a result of other approved projects in the area, namely the Metropolis Development Project in Gzira, the MIDI office / residential blocks in Sliema, the Piazzetta Redevelopment project in Sliema and The Point, also in Sliema;

   - Scenario 2: Baseline traffic (as in scenario 1), plus traffic generated as a result of the Scheme; and

   - Scenario 3: Scenario 2, plus traffic generated as a result of the proposed mixed use development in Townsquare, Sliema. The latter project has not yet been approved by MEPA but is included to provide an indication of the future cumulative impacts that would be generated were that project also to be approved.

16. It is to be noted that the Applicant already has MEPA approval (under development planning permit PA 04144/06) for offices at the Scheme site. The annual average daily traffic (AADT) generated by these offices had been predicted at 530 vehicles, in comparison to an AADT of 1,527 vehicles generated by the Scheme; therefore the net additional AADT is 997. However, in order to present a worst-case scenario for the air quality assessment, an AADT of 1,527 was used in scenarios 2 and 3.

Baseline Air Quality Study

17. Knowledge of the current baseline air quality is principally required in order to calibrate the air dispersion model (as requested by MEPA); dispersion modelling is used to predict future air quality at the Scheme and at the nearest sensitive receptors, both without and with the Scheme.

18. A baseline monitoring site was selected following two site surveys in the area. The location was just outside the Scheme site, at a height of 2 – 3 m from ground level and a distance of around 5 m from the edge of Triq il-Ponta ta’ Dragut (Figure 3). The samplers were placed on top of the low roof, as shown in Figure 4.
# Table 1: Predicted traffic growth

<table>
<thead>
<tr>
<th>Road name (Figure 2)</th>
<th>Current AADT (2015)</th>
<th>AADT (2020) Scenarios</th>
<th>AADT (2025) Scenarios</th>
<th>% Heavy vehicles</th>
<th>Average vehicle speeds (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triq ix-Xatt ta’ Qui Si Sana (Junction A)</td>
<td>10,808</td>
<td>12,859</td>
<td>13,049</td>
<td>13,439</td>
<td>7.6%</td>
</tr>
<tr>
<td>Triq Locker – east (Junction B)</td>
<td>421</td>
<td>442</td>
<td>442</td>
<td>465</td>
<td>2.4%</td>
</tr>
<tr>
<td>Triq il-Ponta ta’ Dragut – east (Junction C)</td>
<td>2,105</td>
<td>2,212</td>
<td>2,557</td>
<td>2,325</td>
<td>2.4%</td>
</tr>
<tr>
<td>Triq il-Ponta ta’ Dragut – west, where it merges with Triq Locker – west (Junction D)</td>
<td>3,061</td>
<td>3,217</td>
<td>3,562</td>
<td>3,381</td>
<td>2.4%</td>
</tr>
<tr>
<td>Triq Tigne’ (Junction D)</td>
<td>1,811</td>
<td>1,903</td>
<td>2,328</td>
<td>2,000</td>
<td>2.6%</td>
</tr>
<tr>
<td>Triq Sant’ Antnin (Junction E)</td>
<td>2,145</td>
<td>2,254</td>
<td>2,824</td>
<td>2,369</td>
<td>2.4%</td>
</tr>
<tr>
<td>Triq ix-Xatt ta’ Tigne’ (Junction E)</td>
<td>16,576</td>
<td>20,487</td>
<td>22,197</td>
<td>21,376</td>
<td>6.3%</td>
</tr>
<tr>
<td>Triq Censu Xerri (Junction F)</td>
<td>1,811</td>
<td>1,903</td>
<td>2,326</td>
<td>2,000</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

3 Annual average daily traffic.
Figure 2: Road links considered in this study
Figure 3: Monitoring location for air quality baseline study
19. Monitoring was carried out for a period of six weeks, from 22\textsuperscript{nd} August 2015 to 3\textsuperscript{rd} October 2015.

20. Measurement of PM\textsubscript{10} was carried out in accordance with the reference method SM EN 12341: 2014. Sampling was carried out using a low-volume sampler equipped with a size selective inlet and drawing in ambient air with a constant flow rate of 2.3 m\textsuperscript{3}/h over a period of 24 hours per sample; the sampler is a reference sampler for PM\textsubscript{10} according to EN 12341. Samples were collected on pre-weighed quartz fibre filters supplied by a laboratory accredited to both EN ISO IEC 17025 and EN 12341:2014. After sampling, the filters were also conditioned and weighed at the same accredited laboratory.

21. NO\textsubscript{2} was measured using an automated gas analyser that can continuously measure NO and NO\textsubscript{2} by chemiluminescence according to EN 14211. Measurements were made every 15 minutes.

22. Meteorological data (wind speed and direction) was also collected.
Modelling

Dispersion Model

23. BREEZE Roads was used to model emissions of NO\textsubscript{x} and PM\textsubscript{10} from traffic under both baseline conditions and conditions when the Scheme is operational. The years 2020 (base year of operation) and 2025 were used as the reference years.

24. BREEZE Roads was developed in the US and is used extensively in the UK and other countries. It is an air dispersion modelling suite that predicts air quality impacts of a number of pollutants including NO\textsubscript{x} and PM. It is specifically designed to model pollutant concentrations that are emitted from moving and idling motor vehicles at or alongside roadways and roadway intersections.

Background Values

25. Urban background values are required since BREEZE Roads only predicts impacts on air quality occurring due to the emissions from traffic. These traffic emissions then need to be added to background air quality levels to predict the overall level of emissions.

26. Background values were derived as follows:
   - NO\textsubscript{2}: Value obtained from MEPA’s rural monitoring station at Gharb, in agreement with MEPA\textsuperscript{4};
   - PM\textsubscript{10}: Value obtained from MEPA’s rural monitoring station at Għarb, corrected to the reference method and with Saharan dust episodes removed; MEPA had already agreed to the use of this value in another recent similar project\textsuperscript{5}.

Traffic Emission Factors

27. Emission factors are required to predict emissions from future vehicle fleet compositions. It is assumed that vehicle emission rates are similar to those in the UK and hence the same emissions factors were used. These factors are based on a toolkit published by Defra\textsuperscript{6} that mirrors the past and present vehicle fleet in the UK. The factors were however, adjusted in line with the age distribution of Maltese fleet compared to the UK fleet.

\textsuperscript{4} Mark Scerri (MEPA), 13\textsuperscript{th} October 2015. This value was used since the baseline monitoring data showed very low levels of NO\textsubscript{2}.


\textsuperscript{6} The toolkit makes use of emission factors published by the UK Department for Transport (derived from actual vehicle emissions) together with information on fleet composition on different road types. The toolkit is developed by the Highways Agency, AEA, Bureau Veritas and air quality consultants, together with contributions from CERC.
28. The UK average vehicle age is 7 years, compared to Malta’s 13 years (as per MEPA ToR). This implies that currently, the Maltese emission factors are 6 years behind those of the UK. Therefore the emission factors of the current fleet (2015) are equivalent to the UK emission factors of 2009.

29. Nonetheless in future average vehicle age is expected to decrease and emissions from vehicles be reduced. At a European level, reduction in vehicle emissions is expected due to the Green Vehicles Strategy, the Transport White Paper and the Review of the European Air Quality Policy. Locally, there are other policies such as the Vehicle Registration Tax and Circulation Tax, the Vehicle Scrapping Scheme and the MEPA Air Quality Plan for the Maltese Islands that will help reduce emissions from transport.

30. Therefore two scenarios were considered for the 2020 and 2025 predictions: the first scenario assumed an average vehicle age of seven years (similar to the current average vehicle age in the UK), whereas the second scenario assumed an average age of ten years (midway between the current UK and Malta vehicle fleet ages).

31. The percentage of the predicted concentration of NO\textsubscript{x} that is in the form of NO\textsubscript{2} was estimated using UK guidance\(^7\) that takes account of the prevailing background pollutant concentrations.

**Meteorological Data**

32. Meteorological data for the most recent full year available (2014) was obtained from the Malta International Airport.

**Sensitive Receptors**

33. The nearest air sensitive receptors along the road links in Figure 2 are shown in Figure 5 and Table 2.

34. The land uses in the area are primarily residential, commercial and recreational. The receptors were selected to ensure adequate coverage of the range of sensitive receptors impacted by traffic from different roads, taking into account the applicability of air quality objectives, as per UK guidance.\(^8,9\)


Table 2: Air sensitive receptors

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Playground</td>
</tr>
<tr>
<td>2</td>
<td>Residential</td>
</tr>
<tr>
<td>3</td>
<td>Hotel (the Scheme) and residential</td>
</tr>
<tr>
<td>4</td>
<td>Residential</td>
</tr>
<tr>
<td>5</td>
<td>Restaurant, residences, pedestrians and retail</td>
</tr>
<tr>
<td>6</td>
<td>Residential</td>
</tr>
</tbody>
</table>
Figure 5: Air sensitive receptors
**Model Calibration**

35. The model was calibrated against the monitoring data, in accordance with MEPA guidance. This aims to ensure that the resulting total concentration (road traffic plus background) matches the measured concentration at a location that is similar to where predictions are being made.

36. Provided that the model calibration factor used is appropriate for the location of the development, and for future years, this method will provide reliable estimates of the impacts on air quality from the Scheme and reduce uncertainties.

**BASELINE AIR QUALITY**

**Monitoring Data**

37. The results of the monitoring over the six-week period are presented in Appendix 2 and Appendix 3, and yielded a daily average of:

- NO$_2$: 5.9 μg/m$^3$; and
- PM$_{10}$: 25 μg/m$^3$.

38. During this period, the NO$_2$ hourly limit value of 200 μg/m$^3$ was never exceeded (the permitted number of exceedances is 18 in one year). In terms of PM$_{10}$ exceedances, the PM$_{10}$ daily limit value of 50 μg/m$^3$ was exceeded on 1 day (the permitted number of exceedances is 35 in one year).

39. Using the scaling factors provided by MEPA$^{10}$, the following annual averages were calculated:

- NO$_2$: 6.2 μg/m$^3$; and
- PM$_{10}$: 21 μg/m$^3$.

40. By comparison, the annual limit value for NO$_2$ and PM$_{10}$ is 40 μg/m$^3$. Therefore the measured data shows that the monitoring location is compliant with the annual limit value for NO$_2$ and PM$_{10}$.

41. For NO$_2$ it is assumed that if the annual mean limit value is not exceeded then the short term limit value, which allows for 18 exceedances of 200 μg/m$^3$ as an hourly mean, will also be achieved. Therefore, since the annual mean limit value is not exceeded, it is assumed that the allowed number of hourly exceedances is not exceeded either.

42. To predict daily exceedances of PM$_{10}$, the equation provided by MEPA ($N = 3.8633A - 79.952$) was used. This gives 1 exceedance over one year at the monitoring location under baseline conditions, fewer than the 35 allowed number of exceedances.

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$^{10}$ Mark Scerri (MEPA), 12th October 2015. NO$_2$ factor: 1.0438; PM$_{10}$ factor: 0.8573.
exceedances.

**Background Data**

43. The derived background values at the monitoring location (obtained as explained above) were as follows:

- $\text{NO}_2$: 2.9 $\mu g/m^3$; and
- $\text{PM}_{10}$: 17 $\mu g/m^3$.

44. The background values are compliant with the annual and hourly limits for $\text{NO}_2$, and the annual and daily limits for $\text{PM}_{10}$.

**Model Calibration**

45. The outputs of the dispersion model were added to the background values, and the results calibrated against the on-site monitoring data.

46. A calibration factor of 2.1 was used for $\text{NO}_2$ and $\text{PM}_{10}$. It is common practice in the UK to assume that the factors that give rise to model under-prediction of $\text{NO}_2$ also apply to $\text{PM}_{10}$. However, using a calibration factor of 2.1 for $\text{PM}_{10}$ gave a shortfall of 3.7 $\mu g/m^3$; therefore this amount was also added to all $\text{PM}_{10}$ predictions.

**DETERMINING IMPACT SIGNIFICANCE**

47. The significance criteria in Table 3 and Table 4 were used to assess the significance of impacts arising from traffic generated by the Scheme on air quality.

**Table 3: Criteria of significance: NO$_2$/PM$_{10}$ annual levels**

<table>
<thead>
<tr>
<th>Baseline annual levels of NO$<em>2$/PM$</em>{10}$</th>
<th>Change in annual NO$<em>2$/PM$</em>{10}$ levels due to Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;40 $\mu g/m^3$</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥36 to &lt;40 $\mu g/m^3$</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥30 to &lt;36 $\mu g/m^3$</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;30 $\mu g/m^3$</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

**Table 4: Criteria of significance: PM$_{10}$ daily limit exceedances**

<table>
<thead>
<tr>
<th>Baseline exceedance of daily PM$_{10}$ limit</th>
<th>Change in the number of days of exceedance due to Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceeded on more than 35 days</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥32 to &lt;35 exceedances</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥26 to 32 exceedances</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;26 exceedances</td>
<td>Negligible</td>
</tr>
</tbody>
</table>
ASSESSMENT OF IMPACTS

48. Table 5 to Table 7 compare the predicted air quality in 2020 and 2025 at the sensitive receptors in the baseline scenario (Scenario 1, without the Scheme) to the air quality with the Scheme (Scenario 2).

49. Additionally, Table 8 to Table 10 compare the baseline air quality with Scenario 3; as mentioned, Scenario 3 also considers the traffic generated as a result of the proposed mixed use development in Townsquare, Sliema. Scenario 3 therefore shows cumulative impacts, that is the Scheme emissions together with the emissions as a result of traffic from the proposed Sliema Townsquare project.

50. The data is the above tables is based on the calibrated model, and includes background air quality levels. The output of the dispersion model is presented in Appendix 4.

51. The results show that the impact from Scheme traffic on NO₂ annual ambient air concentrations, using the significance criteria provided by MEPA, is negligible under all scenarios considered. Additionally, since the annual mean is not exceeded under any scenario, it is likely that the allowed number of hourly exceedances will not be exceeded either.

52. With respect to PM₁₀ ambient air concentrations, the results also show that the impact from Scheme traffic on PM₁₀ annual averages and exceedances of the daily limit is negligible under all scenarios considered.

53. The results show that the additional impact from the Sliema Townsquare project on NO₂ and PM₁₀ ambient air concentrations would also be negligible.

MITIGATION

54. Although the results show a negligible impact on ambient air quality, the TIA recommends sustainable travel planning measures that reduce employees’ dependence on private cars for their journey to work. These measures would also be beneficial from an air quality perspective, and therefore their implementation is recommended.

RESIDUAL IMPACTS

55. There are unlikely to be significant traffic-related air quality residual impacts following the completion of the Scheme.

56. Impacts on air quality are summarised in Table 11.

FUTURE MONITORING REQUIREMENTS

57. No monitoring of air quality is recommended since the air quality assessment has shown that traffic emissions as a result of the operations will have a negligible impact on PM₁₀ and NO₂.
### Table 5: Predicted NO₂ annual average concentrations (μg/m³) – Scenarios 1 (baseline) and 2 (with Scheme)

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Playground on Triq ix-Xatt ta' Qui Si Sana</td>
<td>7.4</td>
<td>7.5</td>
<td>0.1</td>
<td>Negligible</td>
<td>6.4</td>
<td>6.4</td>
<td>0.1</td>
<td>Negligible</td>
<td>5.8</td>
<td>5.8</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>2: Residences on Triq ix-Xatt ta' Qui Si Sana / Triq Locker</td>
<td>9.3</td>
<td>9.4</td>
<td>0.1</td>
<td>Negligible</td>
<td>7.8</td>
<td>7.9</td>
<td>0.1</td>
<td>Negligible</td>
<td>7.0</td>
<td>7.0</td>
<td>0.1</td>
<td>Negligible</td>
</tr>
<tr>
<td>3: Hotel and residences on Triq il-Ponta ta' Dragut / Triq Locker</td>
<td>5.9</td>
<td>6.1</td>
<td>0.3</td>
<td>Negligible</td>
<td>5.3</td>
<td>5.5</td>
<td>0.2</td>
<td>Negligible</td>
<td>5.0</td>
<td>5.1</td>
<td>0.2</td>
<td>Negligible</td>
</tr>
<tr>
<td>4: Residences on Triq Tigne' / Triq Censu Xerri</td>
<td>5.6</td>
<td>6.0</td>
<td>0.4</td>
<td>Negligible</td>
<td>5.1</td>
<td>5.4</td>
<td>0.3</td>
<td>Negligible</td>
<td>4.8</td>
<td>5.0</td>
<td>0.2</td>
<td>Negligible</td>
</tr>
<tr>
<td>5: Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta' Tigne'</td>
<td>13.3</td>
<td>14.1</td>
<td>0.7</td>
<td>Negligible</td>
<td>11.0</td>
<td>11.5</td>
<td>0.6</td>
<td>Negligible</td>
<td>9.6</td>
<td>10.1</td>
<td>0.5</td>
<td>Negligible</td>
</tr>
<tr>
<td>6: Residences on Triq Censu Xerri</td>
<td>5.1</td>
<td>5.4</td>
<td>0.2</td>
<td>Negligible</td>
<td>4.7</td>
<td>4.9</td>
<td>0.2</td>
<td>Negligible</td>
<td>4.4</td>
<td>4.6</td>
<td>0.1</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

### Table 6: Predicted PM₁₀ annual average concentrations (μg/m³) – Scenarios 1 (baseline) and 2 (with Scheme)

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme</th>
<th>Change as a result of Scheme</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Playground on Triq ix-Xatt ta' Qui Si Sana</td>
<td>21.1</td>
<td>21.1</td>
<td>0.0</td>
<td>Negligible</td>
<td>21.1</td>
<td>21.1</td>
<td>0.0</td>
<td>Negligible</td>
<td>21.1</td>
<td>21.1</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>2: Residences on Triq ix-Xatt ta' Qui Si Sana / Triq Locker</td>
<td>21.3</td>
<td>21.4</td>
<td>0.0</td>
<td>Negligible</td>
<td>21.3</td>
<td>21.3</td>
<td>0.0</td>
<td>Negligible</td>
<td>21.3</td>
<td>21.3</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>3: Hotel and residences on Triq il-Ponta ta' Dragut / Triq Locker</td>
<td>21.0</td>
<td>21.0</td>
<td>0.0</td>
<td>Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.0</td>
<td>Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>4: Residences on Triq Tigne' / Triq Censu Xerri</td>
<td>20.9</td>
<td>21.0</td>
<td>0.0</td>
<td>Negligible</td>
<td>20.9</td>
<td>20.9</td>
<td>0.0</td>
<td>Negligible</td>
<td>20.9</td>
<td>20.9</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>5: Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta' Tigne'</td>
<td>21.9</td>
<td>22.0</td>
<td>0.1</td>
<td>Negligible</td>
<td>21.8</td>
<td>21.9</td>
<td>0.1</td>
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<td>21.8</td>
<td>21.9</td>
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<td>Negligible</td>
</tr>
<tr>
<td>6: Residences on Triq Censu Xerri</td>
<td>20.9</td>
<td>20.9</td>
<td>0.0</td>
<td>Negligible</td>
<td>20.9</td>
<td>20.9</td>
<td>0.0</td>
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<td>20.9</td>
<td>20.9</td>
<td>0.0</td>
<td>Negligible</td>
</tr>
<tr>
<td>Receptor</td>
<td>Scenario 1: Baseline</td>
<td>Scenario 2: With Scheme</td>
<td>Change as a result of Scheme</td>
<td>Impact</td>
<td>Scenario 1: Baseline</td>
<td>Scenario 2: With Scheme</td>
<td>Change as a result of Scheme</td>
<td>Impact</td>
<td>Scenario 1: Baseline</td>
<td>Scenario 2: With Scheme</td>
<td>Change as a result of Scheme</td>
<td>Impact</td>
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<td>1: Playground on Triq ix-Xatt ta' Qui Si Sana</td>
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<td>2</td>
<td>2</td>
<td>0</td>
<td>Negligible</td>
</tr>
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<td>2: Residences on Triq ix-Xatt ta' Qui Si Sana / Triq Locker</td>
<td>3</td>
<td>3</td>
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<td>Negligible</td>
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<td>3: Hotel and residences on Triq il-Ponta ta' Dragut / Triq Locker</td>
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<td>0</td>
<td>Negligible</td>
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<td>Negligible</td>
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<td>1</td>
<td>0</td>
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</tr>
<tr>
<td>4: Residences on Triq Tigne' / Triq Ċensu Xerri</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Negligible</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>0</td>
<td>Negligible</td>
</tr>
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<td>5: Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta' Tigne'</td>
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<td>Negligible</td>
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<td>6: Residences on Triq Ċensu Xerri</td>
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<td>1</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

Using the equation provided by MEPA: \( N = 3.8633A - 79.952 \).
Table 8: Predicted NO₂ annual average concentrations (μg/m³) – Scenarios 1 (baseline) and 3 (with Scheme and Sliema Townsquare project)

<table>
<thead>
<tr>
<th>Receptor Description</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme and Sliema Townsquare</th>
<th>Change</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme and Sliema Townsquare</th>
<th>Change</th>
<th>Impact</th>
<th>Scenario 1: Baseline</th>
<th>Scenario 2: With Scheme and Sliema Townsquare</th>
<th>Change</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playground on Triq ix-Xatt ta’ Qri Si Sana</td>
<td>7.4 8.5</td>
<td>1.0</td>
<td>Negligible</td>
<td>6.4 7.1</td>
<td>0.8</td>
<td>Negligible</td>
<td>5.8 6.4</td>
<td>0.6</td>
<td>Negligible</td>
<td>5.5 6.0</td>
<td>0.5</td>
<td>Negligible</td>
</tr>
<tr>
<td>Residences on Triq ix-Xatt ta’ Qri Si Sana / Triq Locker</td>
<td>9.3 10.8</td>
<td>1.4</td>
<td>Negligible</td>
<td>7.8 8.9</td>
<td>1.1</td>
<td>Negligible</td>
<td>7.0 7.8</td>
<td>0.9</td>
<td>Negligible</td>
<td>6.5 7.3</td>
<td>0.8</td>
<td>Negligible</td>
</tr>
<tr>
<td>Hotel and residences on Triq il-Ponta ta’ Dragut / Triq Locker</td>
<td>5.9 6.4</td>
<td>0.5</td>
<td>Negligible</td>
<td>5.3 5.7</td>
<td>0.4</td>
<td>Negligible</td>
<td>5.0 5.3</td>
<td>0.3</td>
<td>Negligible</td>
<td>4.8 5.1</td>
<td>0.3</td>
<td>Negligible</td>
</tr>
<tr>
<td>Hotel and residences on Triq il-Ponta ta’ Dragut / Triq Locker</td>
<td>5.6 6.5</td>
<td>0.9</td>
<td>Negligible</td>
<td>5.1 5.8</td>
<td>0.7</td>
<td>Negligible</td>
<td>4.8 5.3</td>
<td>0.6</td>
<td>Negligible</td>
<td>4.6 5.1</td>
<td>0.5</td>
<td>Negligible</td>
</tr>
<tr>
<td>Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta’ Qri Si Sana</td>
<td>13.3 15.6</td>
<td>2.3</td>
<td>Negligible</td>
<td>11.0 12.7</td>
<td>1.8</td>
<td>Negligible</td>
<td>9.6 11.0</td>
<td>1.4</td>
<td>Negligible</td>
<td>8.9 10.1</td>
<td>1.3</td>
<td>Negligible</td>
</tr>
<tr>
<td>Residences on Triq Censu Xerrri</td>
<td>5.1 5.7</td>
<td>0.6</td>
<td>Negligible</td>
<td>4.7 5.2</td>
<td>0.5</td>
<td>Negligible</td>
<td>4.4 4.8</td>
<td>0.4</td>
<td>Negligible</td>
<td>4.3 4.6</td>
<td>0.3</td>
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</tr>
</tbody>
</table>
### Table 9: Predicted PM$_{10}$ annual average concentrations (μg/m$^3$) – Scenarios 1 (baseline) and 3 (with Scheme and Sliema Townsquare project)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Playground on Triq ix-Xatt ta’ Qui Si Sana</td>
<td>21.1</td>
<td>21.2</td>
<td>0.1 Negligible</td>
<td>21.1</td>
<td>21.2</td>
<td>0.1 Negligible</td>
<td>21.1</td>
<td>21.2</td>
<td>0.1 Negligible</td>
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<td>21.2</td>
<td>0.1 Negligible</td>
<td>Negligible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Residences on Triq ix-Xatt ta’ Qui Si Sana / Triq Locker</td>
<td>21.3</td>
<td>21.5</td>
<td>0.2 Negligible</td>
<td>21.3</td>
<td>21.5</td>
<td>0.2 Negligible</td>
<td>21.3</td>
<td>21.5</td>
<td>0.2 Negligible</td>
<td>21.3</td>
<td>21.5</td>
<td>0.2 Negligible</td>
<td>Negligible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Hotel and residences on Triq il-Ponta ta’ Dragut / Triq Locker</td>
<td>21.0</td>
<td>21.0</td>
<td>0.1 Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.1 Negligible</td>
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<td>0.1 Negligible</td>
<td>Negligible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: Residences on Triq Tigne’ / Triq Censu Xerri</td>
<td>20.9</td>
<td>21.0</td>
<td>0.1 Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.1 Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.1 Negligible</td>
<td>20.9</td>
<td>21.0</td>
<td>0.1 Negligible</td>
<td>Negligible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta’ Tigne</td>
<td>21.9</td>
<td>22.2</td>
<td>0.3 Negligible</td>
<td>21.8</td>
<td>22.1</td>
<td>0.3 Negligible</td>
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<td>0.3 Negligible</td>
<td>Negligible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: Residences on Triq Censu Xerri</td>
<td>20.9</td>
<td>20.9</td>
<td>0.1 Negligible</td>
<td>20.9</td>
<td>20.9</td>
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<td>Negligible</td>
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</table>
Table 10: Days when PM$_{10}$ > 50 μg/m$^3$ (days)$^1$ – Scenarios 1 (baseline) and 3 (with Scheme and Sliema Townsquare project)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Playground on Triq ix-Xatt ta’ Qui Sana</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>Negligible</td>
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<td>Negligible</td>
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<td>2</td>
<td>2</td>
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<td>Negligible</td>
</tr>
<tr>
<td>2: Residences on Triq ix-Xatt ta’ Qui Sana / Triq Locker</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>Negligible</td>
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<td>Negligible</td>
</tr>
<tr>
<td>3: Hotel and residences on Triq il-Ponta ta’ Dragut / Triq Locker</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Negligible</td>
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<td>Negligible</td>
</tr>
<tr>
<td>4: Residences on Triq Tigne’ / Triq Censu Xerri</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Negligible</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>Negligible</td>
</tr>
<tr>
<td>5: Restaurant, residences, pedestrians and retail premises on Triq ix-Xatt ta’ Tigne</td>
<td>5</td>
<td>6</td>
<td>1</td>
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<td>4</td>
<td>5</td>
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<td>6: Residences on Triq Censu Xerri</td>
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</table>
Table 11: Summary of impacts on air quality

<table>
<thead>
<tr>
<th>Predicted Impact</th>
<th>Beneficial / Adverse / Neutral</th>
<th>Nature, scale and type of impact</th>
<th>Policy importance</th>
<th>Probability of impact occurring</th>
<th>Significance of impact</th>
<th>Proposed mitigation measures</th>
<th>Significance of residual impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Const’n / Oper’n</td>
<td>Extent of impact (Nat / Local / Site)</td>
<td>Direct / Indirect</td>
<td>S-term / L-term</td>
<td>Perm / Temp</td>
<td>Revers / Irrevers</td>
<td>(Internat. / National / Local)</td>
</tr>
<tr>
<td>Impact of vehicle emissions on sensitive receptors – change in NO₂ and PM₁₀ annual averages and number of daily PM₁₀ exceedances</td>
<td>Adverse</td>
<td>Oper’n</td>
<td>Local</td>
<td>Direct</td>
<td>L-term</td>
<td>Perm</td>
<td>Revers</td>
</tr>
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Appendix 1: Method Statement
AIR QUALITY STUDY FOR THE PROPOSED HIGH-RISE HOTEL AT FORT CAMBRIDGE, SLIEMA

AIR QUALITY METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the air quality assessment as part of the requirements emerging from the screening letter for the proposed redevelopment of Fort Cambridge at Triq Il- Ponta Ta' Dragut, Sliema, to provide for a high-rise hotel. The development is hereinafter referred to as ‘the Scheme’.

2. The Scheme entitled ‘Retention of the historic existing facades of the Fort Cambridge barracks building and demolition of the existing southwest facade and internal structures, proposed excavation and construction of a new high-rise hotel Class 3B including all ancillary facilities and amenities, Sliema’ (tracking number: 162247) will involve the excavation and construction of a new 40-storey hotel, including ancillary facilities and amenities. The existing historic facades of the Fort Cambridge barracks building will be retained, whereas the existing southwest facade and internal structures will be demolished.

TERMS OF REFERENCE

3. Although no Scheme specific Terms of Reference (ToR) have been provided by MEPA as yet because the EIA process has not started, MEPA ToR on air quality assessment are typically as follows:

3.0 A DESCRIPTION OF THE SITE AND ITS SURROUNDINGS (I.E., ENVIRONMENTAL BASELINE)

The existing environmental features, characteristics and conditions, in and around the proposed development site as well as in all locations likely to be affected by the development or by ancillary interventions and operations, are to be identified and described in sufficient detail, with particular attention to the aspects elaborated further in the next sections.

The consultants should also identify (and justify) wherever relevant:

1. The geographic area (e.g. viewshed or other area of influence) that needs to be covered by each study;

2. The relevant sensitive receptors vis-à-vis the environmental parameter under consideration (e.g. residential communities, other users, natural ecosystems, specific populations of particular species, or individual physical features);

3. The location of the reference points or stations (e.g. viewpoints, monitoring stations, or sampling points) to be used in the study; and

4. Other methodological parameters of relevance, also noting that the assessment will normally require both desk-top studies and on-site investigations (including visual observations and sampling, as relevant).
Air Quality

This study should clearly establish the current background levels of pollution (including dust). This should include a clear comparison to the relevant reference and limit values as specified in the relevant legislation as well as in any other relevant guidance documents. Details on prevailing wind and climate conditions should also be included, amongst other relevant parameters.

The methodology to be used should be submitted for the Environment Protection Directorate’s evaluation prior to commencement of the studies. The Air Quality Study shall be conducted in accordance with the Appendix to these terms of reference.

4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL RISKS

All likely significant effects and risks posed by the proposed project on the environment during all relevant phases (including construction / excavation / demolition, operation and decommissioning) should be assessed in detail, taking into account the information emerging from Sections 1, 2 and 3 above. Apart from considering the project on its own merits (i.e. if taken in isolation), the assessment should also take into account the wider surrounding context and should consider the limitations and effects that the surrounding environmental constraints, features and dynamics may exert on the proposed development, thereby identifying any incompatibilities, conflicts, interferences or other relevant implications that may arise if the project is implemented.

In this regard, the assessment should address the following aspects, as applicable for any category of effects or for the overall evaluation of environmental impact, addressing the worst-case scenario wherever relevant:

1. An exhaustive identification and description of the envisaged impacts;
2. The magnitude, severity and significance of the impacts;
3. The geographical extent/range and physical distribution of the impacts, in relation to: site coverage; the features located in the site surroundings; whether the impacts are short-, medium- or long-range; and any transboundary impacts (i.e. impacts affecting other countries);
4. The timing and duration of the impacts (whether the impact is temporary or permanent; short-, medium- or long-term; and reasonable quantification of timeframes);
5. Whether the impacts are reversible or irreversible (including the degree of reversibility in practice and a clear identification of any conditions, assumptions and pre-requisites for reversibility);
6. A comprehensive coverage of direct, indirect, secondary and cumulative impacts, including:
   • interactions (e.g. summative, synergistic, antagonistic, and vicious-cycle effects) between impacts;
   • interactions or interference with natural or anthropogenic processes and dynamics;
   • cumulation of the project and its effects with other past, present or reasonably foreseeable developments, activities and land uses and with other relevant baseline situations; and
   • wider impacts and environmental implications arising from consequent demands, implications and commitments associated with the project (including: displacement of existing uses; new or increased development pressures in the surroundings of the project; and impacts of any additional interventions likely to be triggered or necessitated by situations created, induced or exacerbated by the project);
7. Whether the impacts are adverse, neutral or beneficial;
8. The sensitivity and resilience of resources, environmental features and receptors vis-à-vis the impacts;
9. Implications and conflicts vis-à-vis environmentally-relevant plans, policies and regulations;
10. The probability of the impacts occurring; and
11. The techniques, methods, calculations and assumptions used in the analyses and predictions, and the confidence level/limits and uncertainties vis-à-vis impact prediction.

The impacts that need to be addressed are detailed further in the sub-sections below.

4.1 Effects on the environmental aspects identified in Section 3

The assessment should thoroughly identify and evaluate the impacts and implications of the project on all the relevant environmental aspects identified in Section 3 above, also taking into account the various considerations outlined in the respective sections.

5.0 REQUIRED MEASURES, IDENTIFICATION OF RESIDUAL IMPACTS, AND MONITORING PROGRAMME

5.1 Mitigation Measures

A clear identification and explanation of the measures envisaged to prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project during all relevant phases including construction, operation and decommissioning [see Section 1.2.3 above].

As a general rule, mitigation measures for construction-phase impacts should be packaged as a holistic Construction Management Plan (CMP). Whilst the detailed workings of the CMP may need to be devised at a later stage (e.g. after the final design of the project has been approved and/or after a contractor has been appointed), the key parameters that the CMP must adhere to for proper mitigation need to be identified in the EIA. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit], where relevant.

Mitigation measures for accident / risk scenarios should be packaged as a holistic plan that includes the integration of failsafe systems into the project design as well as well-defined contingency measures.

The recommended measures should be feasible, realistically implementable to the required standards and in a timely manner, effective and reliable, and reasonably exhaustive. They should not be dependent on factors that are beyond the developer’s and MEPA’s control or which would be difficult to monitor, implement or enforce. The actual scope for, and feasibility of, effective prevention or mitigation should also be clearly indicated, also identifying all potentially important pre-requisites, conditionalities and side-effects.

5.2 Residual Impacts

Any residual impacts [i.e. impacts that cannot be effectively mitigated, or can only be partly mitigated, or which are expected to remain or recur again following exhaustive implementation of mitigation measures] should also be clearly identified.
5.3 Additional Measures

Compensatory measures (i.e. measures intended to offset, in whole or in part, the residual impacts) should also be identified, as reasonably relevant. Such measures should not be considered as an acceptable substitute to impact avoidance or mitigation.

If the assessment also identifies beneficial impacts on the environment, measures to maximise the environmental benefit should also be identified.

In both instances, the same practical considerations as indicated vis-à-vis mitigation measures should also apply.

5.4 Monitoring Programme

A realistic and enforceable programme for effective monitoring of those works envisaged to have an adverse or uncertain impact. The monitoring programme should include:

1. Details regarding type and frequency of monitoring and reporting, including spot checks;
2. The parameters that will be monitored, and the monitoring indicators to be used;
3. An effective indication of the required action to address any exceedances, risks, mitigation failures or non-compliances for each monitoring parameter;
4. An evaluation of forecasts, predictions and measures identified in the EPS; and
5. An indication of the nature and extent of any additional investigations (including EIAs or ad hoc detailed investigations, if relevant) that may be required in the event of any contingencies, unanticipated impacts, or impacts of larger magnitude or extent than predicted.

The programme should address all relevant stages, as follows:

(a) Where relevant, monitoring of preliminary on-site investigations that may entail significant disturbance or damage to site features (e.g. geological sampling or any works that require prior site clearance);
(b) Monitoring of the construction phase, including the situation before initiation of works (including site clearance), during appropriate stages of progress, and after completion of works;
(c) Monitoring of the operational phase, except where otherwise directed by MEPA (e.g. where monitoring would be more appropriately integrated into an operating permit); and
(d) Where relevant, monitoring of the decommissioning phase, including the situation before initiation of works, during appropriate stages of progress, and after completion of works.

APPENDIX: TERMS OF REFERENCE FOR AIR QUALITY

Legal background:

Regulation 29 of LN 478 of 2010 grants MEPA the power to issue guidance notes on the conduction of Air Quality Studies which are required by any Regulations issued under the Environment and Development Planning Act. including the EIA Regulations (LN 114 of 2007).

Part II of Schedule 7 to LN 478 of 2010 sets the following (legally binding limit values): an annual limit value of 40μg/m³ for PM₁₀, a daily limit value for PM₁₀ of 50μg/m³ which can not be exceeded on more
than 35 calendar days, an annual limit value 40μg/m³ for NO₂ and an hourly limit value of 200μg/m³, which can not be exceeded more than 18 times per calendar year.

Regulations 19 and 20 of LN 78 of 2010 give MEPA the responsibility to ensure that the above mentioned limits are complied with across Malta and Gozo.

The Air Quality study shall be conducted as follows:

1. **Base Line Studies**

   a. The baseline levels of PM₁₀ and NO₂ shall be established through in-situ monitoring.

   b. Baseline levels of PM₁₀ shall be determined using the reference method (MSA EN 12341:2000) for the determination of PM₁₀.

   c. The consultants should use the reference method for the sampling and measurement of PM₁₀.

   d. The design criteria for the samplers shall be as per Annex B to the said standard and shall be as per Section IV of Annex IX: MSA EN 12341: 2000.

<table>
<thead>
<tr>
<th>Type of Sampler</th>
<th>Flow rate</th>
<th>Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-volume sampler (LVS-PM₁₀ reference head)</td>
<td>2.3 m³.hr⁻¹ or 38.3 dm³.min⁻¹</td>
<td>Operated at a constant rate of 2.3 m³.hr⁻¹ ± 2%</td>
</tr>
<tr>
<td>High volume sampler (HVS-PM₁₀ reference head)</td>
<td>68 m³.hr⁻¹ or 1.133 m³.min⁻¹</td>
<td>Operated at a constant rate of 68 m³.hr⁻¹ ± 2%</td>
</tr>
</tbody>
</table>

**Table 1: Design criteria for the samplers.**

   e. The resolution of the balance used for the weighing of filters sampled using an LVS shall be at least 10 μg.

   f. The filters should be conditioned for at least 48 hours at 50% relative humidity (+ or - 5%) and at 20 °C (+ or - 1 K).

   g. The filters should be weighed at least twice for concordance with a time lag of at least 12 hours between the two weightings.

   h. Flow rates are at ambient volumes not at normalized volumes. The weighing shall take place in the same climate controlled room.

   i. Consultants can use alternative sampling and measurement methods if they demonstrate to MEPA’s satisfaction, equivalence to the above mentioned method. Equivalence shall be determined using the European Commission’s method for the determination of equivalence; any other method shall be deemed unacceptable. MEPA will accept certificates of equivalence issued by third parties, which have been based on the method herein.

   j. Compliance with non-European standards does not satisfy the requirements above.

   k. Regarding the siting of the sampler, the consultant shall submit a method statement indicating the location of the sampler. However MEPA may at its discretion ask the consultant to change the location of the sampler.

   l. The sampling time shall be no less than 6 weeks and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by MEPA to the
Baseline levels of NO$_2$

m. Baseline levels of NO$_2$ shall be determined using EN 14211:2005. The consultant may use passive diffusive tubes if it is shown that the latter are equivalence to the reference method.

n. If the consultant opts for passive diffusion tubes, he shall forward at least 1 article in a peer reviewed journal which shows that the equivalence of theses tubes has been demonstrated in at least 1 EU Member State. Equivalence should preferably, also have been demonstrated in Malta.

o. The consultant shall submit a method statement indicating the location of the sampler. However MEPA may at its discretion ask the consultant to change the location of the sampler.

p. The sampling time shall be no less than 6 weeks and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by MEPA to the consultant.

q. The consultant shall also take traffic counts at all the main junctions near the site. The number and location of the counters are to be approved by MEPA.

r. The traffic count shall take into consideration the vehicle type and the legislation class.

s. The consultant shall use an appropriate model in order to scale the traffic counts obtained during the 6 week period to AADT.

2. Modeling

a. Once the baseline levels have been obtained the consultant shall determine the impact of the project on air quality through dispersion modeling.

b. The consultant shall identify the sensitive receptors in the area.

c. The following models are deemed acceptable by MEPA:

   IMMIS$^\text{em}$

   BREEZE Roads.

   ADMS-Urban

d. The consultant shall use the emission factors in the latest version of the Handbook of emission factors for road transport emissions. The average age of the Maltese vehicle fleet shall be taken as 13 years.

e. The consultant shall estimate the ambient background levels. The following approach shall be deemed acceptable.
f. The rural background can be captured through the use of the GAINS-EMEP model at a resolution of 50km * 50km, the urban background can be captured through the use of a model such as CHIMERE at a resolution of 7km * 7km. The background levels of both PM$_{10}$ and NO$_2$ shall be established using an approach similar to figure 1 above.

g. The predictions of the model shall be assessed by comparing the modeled data to the monitoring data provided by the baseline studies. The modeled data must not deviate by more than ±20%.

h. The consultant shall use the model to project the PM$_{10}$ and NO$_2$ levels into the future, when the project is fully operational.

i. The consultant shall model two distinct scenarios: A) without the project and B) with the project.

j. The model shall display its output as a contour map and the concentrations at the sensitive receptors in point 21 shall be clearly labeled.

k. Any assumptions must be clearly stated by the consultant.

l. The equation below shall be applied to determine the number of daily exceedances: $N = 3.8633A - 79.9521$, this shall be determined for both scenarios.

m. For NO$_2$ the consultant shall assume that the annual mean is always exceeded before the allowed number of hourly exceedances.


The following criteria of significance shall be used by the consultant to determine the significance of the impact:

(i) For annual levels of NO$_2$/PM$_{10}$ in $\mu g/m^3$.

| Change in annual NO$_2$/PM$_{10}$ levels due to scheme (µg/m$^3$). | ≥0.4 µg/m$^3$ but <2 µg/m$^3$ | ≥2 µg/m$^3$ but <4 µg/m$^3$ | ≥4 µg/m$^3$ |
|---|---|---|
| >40 µg/m$^3$ | Slightly adverse | Moderate adverse | Substantial adverse |
| ≥36 but <40 | Slightly adverse | Moderate adverse | Moderate adverse |

1 Thunis et al. (2012). Linking the European scale modelling with urban and street scales. Institute for Environment and Sustainability.
### Baseline annual levels of NO₂/PM₁₀

<table>
<thead>
<tr>
<th>µg/m³</th>
<th>Negligible</th>
<th>Slightly adverse</th>
<th>Slightly adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥30 but &lt;36 µg/m³</td>
<td>Negligible</td>
<td>Slightly adverse</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>&lt;30 µg/m³</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

(ii) For daily exceedances of the PM₁₀ limit value in number of days.

<table>
<thead>
<tr>
<th>Baseline exceedance of daily PM₁₀ limit values (number of days)</th>
<th>Change in the number of days of exceedance of the daily PM₁₀ limit value as a result of the scheme (days).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥1 day but &lt;2 days</td>
</tr>
<tr>
<td>Exceeded on more than 35 days.</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥32 to &lt;35 exceedances.</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥26 to 32 exceedances.</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;26 exceedances.</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

### ASSESSMENT METHODOLOGY

#### Scope of Assessment

4. The air quality assessment will focus on the potential impacts on air quality from vehicular traffic arising from the operation of the Scheme.

5. Construction road traffic has been scoped out of this assessment since the daily threshold of 200 heavy vehicle movements² will not be exceeded; preliminary figures indicate that heavy vehicle movements will be as follows:
   - 6.5 truck loads per day during the demolition phase (one month); and
   - 25 truck loads per day during the excavation phase (three months).

#### Competence of Surveyors

6. The air quality assessment will be undertaken by Ms Rachel Decelis of Adi Associates Environmental Consultants Ltd.

7. Baseline studies will be undertaken by Ms Rachel Decelis of Adi Associates Environmental Consultants Ltd (PM₁₀) and Ms Sarah Debono from Ecoserv Ltd (NO₂).

8. Mr David Harvey of ADM Ltd will undertake the dispersion modelling.

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Traffic Data

9. A Traffic Impact Assessment (TIA) for the Scheme is also being prepared by Adi Associates Environmental Consultants Ltd.

10. The TIA will identify the predicted network (without the Scheme) and operational traffic growth (with the Scheme) in the vicinity of the Scheme site in the base year of operation and in the base year of operation plus five years. This data will be used to identify the predicted change in air quality as a result of the Scheme.

11. Both years’ (base year, and base year + five years) traffic data will be used, since even if traffic flows are predicted to be greater after five years of operation, traffic levels in the base year may have a higher impact on air quality given that emission from vehicles are reducing with time.

Baseline Air Quality

12. Knowledge of the current baseline is principally required in order to calibrate the air dispersion model (as requested by MEPA); dispersion modelling is used to predict future air quality at the Scheme and at the nearest sensitive receptors, both without and with the Scheme.

13. During site surveys carried out on 29th July 2015 and 11th August 2015, the most appropriate location for a baseline monitoring survey was identified as being just outside the Scheme site (Figure 1). The samplers will be placed on top of the low roof marked by an arrow in Figure 2, at a distance of not more than 10 m from the edge of Triq il-Ponta ta’ Dragut and a height of approximately 3 m from ground level on that road.
Figure 1: Baseline monitoring location
Figure 2: Location proposed for baseline monitoring
**PM$_{10}$**

14. Measurement of PM$_{10}$ will be carried out in accordance with the reference method SM EN 12341: 2014. Sampling will be carried out using a low-volume sampler equipped with a size selective inlet and drawing in ambient air with a constant flow rate of 2.3 m$^3$/h. The sampler is a reference sampler for PM$_{10}$ according to EN 12341.

15. Samples will be collected on pre-weighed quartz fibre filters supplied by a laboratory accredited to both EN ISO IEC 17025 and EN 12341:2014. After sampling, the filters will also be conditioned and weighed at the same accredited laboratory.

16. 24-hour samples will be collected over the specified period of 6 weeks (42 days).

17. The results will be scaled to a yearly average based on a factor to be forwarded by MEPA.

**NO$_2$**

18. Real-time measurements over six weeks will be made using an automated gas analyser that can continuously measure NO and NO$_2$ by chemiluminescence according to EN 14211. Measurements will be made every 15 minutes to obtain continuous sampling.

19. The results will be scaled up to a yearly average based on a scaling factor to be forwarded by MEPA.

**Meteorology**

20. Meteorological data will also be collected (wind speed and direction) to assist in the interpretation of results.

**Modelling**

21. Modelling will be used to assess the impact from vehicular traffic during the operational phase of the Scheme.

**Dispersion Model**

22. BREEZE Roads will be used to model emissions of NO$_2$ and PM$_{10}$ traffic emissions under baseline conditions, the construction phase (if required) and the operational phase. The reference years during operation will be the base year and base year plus five years.

23. Urban background values are required since BREEZE Roads only predicts impacts on air quality occurring due to the emissions from traffic included in the model. These traffic emissions then need to be added to background air quality levels to predict the overall level of emissions.

24. It is proposed to derive background values as follows:
• NO₂: Value derived by kriging MEPA’s diffusion tube data, corrected to the reference method (if necessary) and with arterial and distributor roads removed to eliminate the traffic component;

• PM₁₀: Value obtained from MEPA’s rural monitoring station at Gharb, corrected to the reference method and with Saharan dust episodes removed.

25. The background will be assumed to remain constant throughout the years modelled.

**Emission Factors**

26. Emission factors are required to predict emission from future vehicle fleet compositions. It will be assumed that vehicle emissions rates are similar to those in the UK and hence the same emissions factors will be used. These factors are based on a toolkit published by Defra\(^3\) that mirrors the past and present vehicle fleet in the UK. The factors will however, be adjusted to the Maltese scenario in line with the age distribution of Maltese fleet, and taking into consideration the percentage HGVs and average vehicle speed applicable to the specific road under assessment.\(^4\)

27. The UK average vehicle age is 7 years, compared to Malta’s 13 years (as per MEPA ToR). This implies that currently, the Maltese emission factors are 6 years behind those of the UK. Therefore the emission factors of the current fleet are equivalent to the UK emission factors of 2009.

28. Nonetheless in future average vehicle age is expected to decrease and emissions from vehicles be reduced. At a European level, reduction in vehicle emissions is expected due to the Green Vehicles Strategy, the Transport White Paper and the Review of the European Air Quality Policy. Locally, there are other policies such as the Vehicle Registration Tax and Circulation Tax, the Vehicle Scrapping Scheme and the MEPA Air Quality Plan for the Maltese Islands which will help reduce emissions from transport.

29. Therefore for traffic during operation, the assessment will consider two vehicle age scenarios – one where the average vehicle age is 7 years, and one where the average age is 10 years.

**Meteorological Data**

30. Meteorological data for the most recent year available will be obtained from the Malta International Airport.

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\(^3\) The toolkit makes use of emission factors published by the UK Department for Transport (derived from actual vehicle emissions) together with information on fleet composition on different road types. The toolkit is developed by the Highways Agency, AEA, Bureau Veritas and Air Quality Consultants, together with contributions from CERC.

\(^4\) Any possible remaining differences with regard to the Maltese fleet (in comparison to the Defra toolkit) are taken account of in the calibration factor used to bring the predictions in line with the measured data.
**Sensitive Receptors**

31. Air quality will be modelled at the principal air sensitive receptors along the affected road links; these will be selected taking into account the applicability of air quality objectives, as per UK guidance.\(^5\) Receptors will include the Scheme site itself, and residential properties.

**Model Output**

32. The output of the model, including the urban background, will be presented in tabular format. The expected concentrations at the sensitive receptors without the Scheme (baseline) and with the Scheme will be specified. As mentioned, two reference years (the base year, and the base year plus five years) and two average vehicle ages (10 years and 7 years) will be considered in the scenarios presented.

33. The modelled data, added to the urban background, will be compared to the measured data. If necessary, a calibration factor will be applied to the above scenarios to ensure that the predictions match the measured data.

34. To predict daily exceedances of PM\(_{10}\) for both scenarios, the equation provided by MEPA (\( N = 3.8633A - 79.952 \)) will be used.

35. For NO\(_2\) it will be assumed that the annual mean is always exceeded before the allowed number of hourly exceedances. Therefore if the annual mean is not exceeded, it will be assumed that the allowed number of hourly exceedances will not be exceeded either.

**Impact Significance Criteria**

36. The significance criteria in **Table 1** and **Table 2** will be used to assess the significance of impacts arising from traffic generated by the Scheme on air quality.

**Table 1: Criteria of significance: NO\(_2\)/PM\(_{10}\) annual levels**

<table>
<thead>
<tr>
<th>Baseline annual levels of NO(<em>2)/PM(</em>{10})</th>
<th>Change in annual NO(<em>2)/PM(</em>{10}) levels due to Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>(&gt;40 \mu g/m^3)</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>(36 \text{ to }&lt;40 \mu g/m^3)</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>(30 \text{ to }&lt;36 \mu g/m^3)</td>
<td>Negligible</td>
</tr>
<tr>
<td>(&lt;30 \mu g/m^3)</td>
<td>Negligible</td>
</tr>
<tr>
<td>(\geq 0.4 \text{ to }&lt;2 \mu g/m^3)</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td>(\geq 2 \text{ to }&lt;4 \mu g/m^3)</td>
<td>Substantial adverse</td>
</tr>
<tr>
<td>(\geq 4 \mu g/m^3)</td>
<td>Moderate adverse</td>
</tr>
</tbody>
</table>


\(^6\) Environmental Protection UK (2010) *Development Control: Planning For Air Quality (2010 Update)*

www.iaqm.co.uk/text/guidance/epuk/aq_guidance.pdf (Table 1).
Table 2: Criteria of significance: PM$_{10}$ daily limit exceedances

<table>
<thead>
<tr>
<th>Baseline exceedance of daily PM$_{10}$ limit</th>
<th>Change in the number of days of exceedance due to Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥1 to &lt;2 days</td>
</tr>
<tr>
<td>≥32 to &lt;35 exceedances</td>
<td>Slightly adverse</td>
</tr>
<tr>
<td>≥26 to 32 exceedances</td>
<td>Negligible</td>
</tr>
<tr>
<td>&lt;26 exceedances</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

IMPACT MITIGATION AND MONITORING

37. The air quality assessment will describe measures that can be put in place to prevent, minimise and, where possible, offset any significant adverse effects resulting from the Scheme. A monitoring programme will also be prepared, should this be required.

Adi Associates Environmental Consultants Ltd
August 2015
Appendix 2: NO₂ Baseline Monitoring Report
LABORATORY REPORT

Collection of Air Quality data in relation to an EIA for proposed development at Fort Cambridge, Sliema

Client: Adi Associates Environmental Consultants Ltd.

Period of data collection: 22 August 2015 – 3 October 2015

Reporting date: 6 October 2015

DETAILS

Ecoserv Ltd has been commissioned by ADI Associates Environmental Consultants Ltd. (hereafter ‘the Client’) to collect data on air quality in connection with an EIA for a proposed development at Fort Cambridge in Sliema. The parameters for which air quality data was required were NO\textsubscript{x} and meteorological data as per correspondence between ADI and Ecoserv dated 29 July 2015.

The air quality survey undertaken involves the \textit{in-situ} analysis of air for NO\textsubscript{x} gases (NO and NO\textsubscript{2}) and the collection of meteorological data from one station for a period of 6 weeks at the agreed site. The data gathered will be used to establish baseline levels of the pollutants for the area. This report includes the results of this survey and analyses.

METHODOLOGY

Continuous monitoring of NO\textsubscript{x} was carried out for 6 weeks (42 days) between 22 August and 3 October 2015. The monitoring equipment was installed according to the requirements of standard guidelines for air quality monitoring arising from the EU Air Quality Directive (2008/50/EC).

The equipment used was regularly monitored throughout the duration of the sampling to ensure its proper operation. The sampling location is indicated in Figure 1, and equipment set-up is shown in Figure 2.
Figure 1. Location of the AQ monitoring station at Sliema (marked with a red dot).  
(Source: Google Maps)

**NOx real-time monitoring**
Real-time measurements were made from the station indicated in Fig. 1 using an automated gas analyser that can continuously measure NO and NO₂ by chemiluminescence according to the EN standard (EN 14211) that is the reference method stated in the EU Directive on Air Quality (2008/50/EC). Measurements were made at specific time intervals (every 15 minutes) to obtain data on NOx levels continuously for the duration of the sampling.

**Meteorological data**
Data on meteorological and climatic conditions at the sampling location was collected throughout the period of study and logged at periodic intervals. The recorded parameters include: ambient temperature, relative ambient humidity, ambient pressure, wind speed and wind direction.

**RESULTS**

Ecoserv’s sample reference codes for the results presented in this report bearing reference 190-15 are outlined in Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sample reference</th>
<th>Sample type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ</td>
<td>A-059-15</td>
<td>Real-time data</td>
</tr>
<tr>
<td>Meteorological data</td>
<td>A-060-15</td>
<td>Real-time data</td>
</tr>
</tbody>
</table>
Figure 2. Photo showing the NOx and weather monitoring equipment installed on site.

**NOx results**
Due to the extent of data points, the results of NO, NO\textsubscript{2} and NO\textsubscript{x} are given in a separate digital (Excel) file submitted as an appendix with this report. This includes data points recorded every 15 minutes for the dates indicated above.

**Meteorological results**
Due to the extent of data points, the results of the ambient temperature, relative ambient humidity, ambient pressure, wind speed and wind direction are given in a separate digital (Excel) file submitted as an appendix with this report. This includes data points recorded every 15 minutes for the dates indicated above.

**Appendix**
A-059-15_Sliema NOx Data (Excel File)
A-060-15_Sliema Meteorological Data (Excel File)

Report checked by:
Antonio Candela BSc
Environmental Scientist

Report approved by:
Sarah Debono BSc (Hons), MSc
Project Manager
Appendix 3: PM$_{10}$ Baseline Monitoring Results
<table>
<thead>
<tr>
<th>Filter ID</th>
<th>Start date</th>
<th>Start time</th>
<th>End date</th>
<th>End time</th>
<th>Volume sampled (m³)</th>
<th>PM_{10} concentration (µg/m³)</th>
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</thead>
<tbody>
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</table>

Six-week average 25

\[12\] Exceedances of the daily limit value of 50 µg/m³ are underlined.

---

ADI ASSOCIATES
Appendix 4: Air Dispersion Model
### Calibration Factor for NOx and PM10

- NOx: 2.3
- PM10: 3.7 μg/m³

**UK average vehicle age:**
- 7 years

### Traffic flow data (email of 14 October 2015)

<table>
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<tr>
<th>Link No</th>
<th>Road Name</th>
<th>AADT (2015)</th>
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### HGV (%) KPH NOx PM10

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### Average vehicle speeds (kph)

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### Average vehicle age

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### TG4(00)

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<td>3.3931</td>
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### Average vehicle speeds (kph)

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### HGV (%) KPH NOx PM10

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<td>Triq Censu Xerri</td>
<td>2.6</td>
<td>25</td>
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</table>
### Model Input Data

#### NOx Background (μg/m³)
- 2.9

#### PM Background (μg/m³)
- 17.0

#### NOx Calibration factor
- 2.9

#### PM10 Background (μg/m³)
- 2.9

#### PM10 Derived from this relationship (DEFRA TG4(04))
- \( \text{PM10} = 1.535 \times (\text{NOx})^{0.7341} \)

#### PM10 after Calibration
- Total PM10 (Annual Average) after Calibration

#### PM10 model files in C\:\projects\p1516\roads_1

#### Predictions for Each Scenario

<table>
<thead>
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<th>Year</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
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<td>Predictions</td>
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#### Predictions for 2020

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<tbody>
<tr>
<td>Triq Censu Xerri</td>
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<td>After Calibration</td>
<td>Predictions for 2020</td>
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#### Predictions for 2020

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<tr>
<td>Triq Censu Xerri</td>
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<td>Predictions for 2020</td>
</tr>
<tr>
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<td>7 Years</td>
<td>After Calibration</td>
<td>Predictions for 2020</td>
</tr>
<tr>
<td>Triq Locker</td>
<td>7 Years</td>
<td>After Calibration</td>
<td>Predictions for 2020</td>
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#### Predictions for 2025

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<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
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<tbody>
<tr>
<td>Triq Censu Xerri</td>
<td>7 Years</td>
<td>After Calibration</td>
<td>Predictions for 2025</td>
</tr>
<tr>
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<td>7 Years</td>
<td>After Calibration</td>
<td>Predictions for 2025</td>
</tr>
<tr>
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<td>Predictions for 2025</td>
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#### Predictions for Each Scenario

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<td>7 Years</td>
<td>After Calibration</td>
<td>Predictions for Each Scenario</td>
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</table>
2014 Windrose from Luqa
TRK162247

RE-DEVELOPMENT AT FORT CAMBRIDGE, SLIEMA

LANDSCAPE CHARACTER & VISUAL AMENITY IMPACT ASSESSMENT

Version 1: April 2016
Quality Assurance

TRK162247 Re-Development of Fort Cambridge, Sliema Landscape and Visual Amenity Impact Assessment
April 2016

Report for: GAP Development plc

Revision Schedule

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<td>Submission to client</td>
<td>Krista Farrugia</td>
<td>Rachel Xuereb</td>
<td>Adrian Mallia</td>
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APPENDICES

Appendix 1: Base photos and photomontages
INTRODUCTION

1. This report addresses the potential impacts of the Scheme on landscape and visual amenity for inclusion as part of the Environmental Planning Statement (EPS) related to the demolition of the existing southwest facade and internal structure and proposed excavation and construction of a new high rise hotel (Class 3B) including all ancillary facilities and amenities. The Project is hereinafter referred to as “the Scheme”.

2. Assessment of landscape and visual amenity involves examination of the wide range of factors that contribute to the qualities and attributes of the existing landscape and that may contribute to the landscape of the Scheme. This involves consideration of the evolution of the landscape and the factors that have led to its current condition, from the underlying geology through to anthropogenic activities.

3. Landscape and visual impacts are distinct, albeit strongly related. Landscape impacts result from the interaction between a development and the existing landscape resources, experienced through changes to any element or combination of landscape elements. Visual impacts relate to the effect that a development would have on the amenity of sensitive receptors (those experiencing views of the site), relating to the actual or perceived visible changes to the character and quality of the landscape.

4. The key issues for the assessment are:

   **Key Issues:**
   - Effects on the landscape setting of the Scheme
   - Changes in views of key receptors

Terms of Reference

5. The Terms of Reference (ToR) issued by MEPA require that the landscape and visual amenity aspects and potential impacts on these aspects are assessed.

Objectives of the Assessment

6. The objectives of the landscape and visual amenity study were to:
   - Undertake a baseline survey and characterisation of the landscape and visual amenity at and around the Application Site, using desk top and field survey techniques;
   - Evaluate the landscape character of the Application Site and its setting;
   - Establish the Zone of Theoretical Visibility (ZTV) for the Scheme and identify the key viewpoints and receptors;
   - Input the potentially beneficial design measures to the Scheme;
   - Predict the impacts of the Scheme on the visual amenity in the ZTV;
Assess the significance of the impacts on the landscape and visual amenity of the ZTV; and

Describe the mitigation measures designed into the Scheme to minimise adverse impacts and enhance any beneficial impacts on the landscape and visual amenity.

Legislation and Policies Guidance

7. The Constitution of Malta (Section 9) declares that the State shall safeguard the landscape and the historical and artistic patrimony of the Nation. These are the only aspects of the environment referred to in the Constitution, underlining the importance of the landscape and historical heritage.

Strategic Plan for Environment and Development (SPED) 2015

8. The Strategic Plan for Environment and Development identifies that tall buildings in the Maltese landscape are becoming an issue of concern. The SPED includes a number of thematic objectives, some of which have some bearing on consideration of landscape and visual amenity conservation. In relation to socio-economic development, Thematic Objective 1 seeks to manage the available potential space and environmental resources on land and sea sustainably to ensure that socio-economic development needs are met whilst protecting the environment and limiting land take up within the Rural Area.’

9. Urban Objective 3 aims to identify, protect and enhance the character and amenity of distinct urban areas.

10. The SPED includes objectives in relation to the coastal zone and marine area. Coastal Objective 1 aims to prioritise uses that necessitate a location on the coastal zone and marine area in a manner which minimises user conflicts, does not accelerate coastal erosion, protects biodiversity, cultural heritage, landscapes and visual access to them, public access and use and increases resilience to climate change impacts.

North Harbours Local Plan 2006

11. The Local Plan designates ‘Strategic View Corridors’, through POLICY NHSE 07. The Scheme Site lies within the ‘Valletta / Marsamxett Harbour to Msida Church and towards Mdina’ Strategic View Corridor (see Figure 1).

12. POLICY NHSJ15 addresses new hotels in Sliema, considering this land use favourably in the area demarcated in Map SJ1 (see Figure 2) on condition that the following criteria are respected:

   i. The prior approval of the Malta Tourism Authority is obtained;

   ii. The proposed development is not likely to create significant adverse impacts on the local amenity;

   iii. The scale of the proposed development is consistent with the building height limitation and the character of the area;

   iv. High quality design in terms of height, volume, layout, elevations,
materials, finishes and landscaping is achieved;

v. The proposal will not compromise existing and future proposals for traffic management in the area as established in Policies NHSJ01 and NHSJ05;

vi. Development proposals are to comply with established standards for access, on-site parking provision, coach parking facilities and alighting points. In those cases where on-site parking provision is not desirable, the developer will be required to pay the appropriate level of contribution to the CPPS applicable to the relevant area; and

vii. The proposal is in conformity with all relevant Policies in this Local Plan.

13. The Scheme site lies within this designated area.

**Fort Cambridge Development Brief 2006**

14. MEPA issued a Development Brief for the Fort Cambridge site in 2006. The Development Brief provides planning objectives and guidance for development of the site. The Development Brief provides a description of the historical context of the site and the importance of the cultural heritage features within the development site boundary including in particular Fort Cambridge, the Garden Battery, and the ex-military landmark building, i.e. the Scheme Site.

15. With specific reference to the existing ex-Military Barracks building, the Brief states that the designated landmark building:

   ...is to be retained due to its historical and architectural importance, but internal alterations will be allowed. This building will act as a buffer between new higher development on the site and the surrounding residential blocks. No additional floors over the third floor will be allowed over this landmark building.

16. **Figure 2** illustrates the height limitations within the Brief area. The building height limitation of the Scheme Site is four floors. The Brief describes the following reasons for height restrictions as identified in **Figure 2**:

   a. That the building height is planned on the principle of achieving a stepping down effect of building heights from east to west;

   b. Higher buildings than as recommended would adversely affect the historical low profile design of Fort Cambridge, would contrast with the four floor height of the ex-Military Barracks and would conflict with para (a) above;

   c. In order to protect the residential environment and amenity of the immediate surrounding areas.
Planning Policy Guide on the Use and Applicability of the Floor Area Ratio (FAR), 2014

17. The Planning Policy Guide on the Use and Applicability of the Floor Area Ratio (FAR), hereafter referred to as the FAR policy identifies 6 policy objectives which includes the need to indicate appropriate strategic locations for tall buildings. Based on a number of criteria, the FAR policy identifies ten locations that can be considered for the development of tall buildings. Reference is made to the Fort Cambridge Development Brief. The Tigne peninsula is one of the identified locations that can be considered further for the development of tall buildings, and the redevelopment of the Holiday Inn Crowne Plaza Hotel is also referred to specifically. In fact, much of this site has already been developed into tall buildings for residential purposes.

Government Notice 133 of 2001

18. The Scheme site lies just outside a designated Area of High Landscape Value (AHLV) designated in accordance with Government Notice 133 of 2001 for the Harbour Fortifications (see Figure 3).

Landscape Assessment Study of the Maltese Islands 2004

19. MEPA’s Landscape Assessment Study was undertaken as part of the Structure Plan review process. The Study does not provide an assessment methodology for consideration of the impacts of a specific development; however, it does provide a useful baseline assessment of the prevailing landscape character of the Maltese Islands.

20. The Scheme Site lies within the North-East conurbation, as defined in the Landscape Assessment Study. This Landscape Character Area includes some of the most densely urbanised areas in the Maltese Islands. The lack of greenery is noted and short to medium views are described as incoherent, not least because of the various equipment that contribute to the rooftops and reduce the visual amenity of the area. Traffic congestion is mentioned as a particular problem for the area. The Gżira-Sliema area, considered as tourism settlements, in particular have seen a move towards high rise development that has dwarfed features of cultural heritage interest and resulted in an inconsistent streetscape. On the other hand, the promenades provide open views to the horizon. Embellishment of the promenades has contributed to ameliorating the local visual impact; however, regular maintenance is required to avoid degradation.

21. Fort Tigne and the north-eastern rocky coast are Landscape Character Areas that lie adjacent to the North-East conurbation. Fort Tigne forms part of the Inner Harbours Historic Coastline. The greatest landmark features of importance are the fortifications which crown the inner harbour area. The urban skyline is considered to be of international significance.

22. The rocky coast extends all the way up to Bugibba. The coastal strip is flanked by some of the most intensely developed areas in the Maltese Islands, in particular the Pembroke-St Julians-Sliema area. The Landscape Assessment identifies the undeveloped stretch of coast in the Sliema area as an enhancing feature which provides a break from the nearby development. Bays and the various colours reflected in the marine environment along
the stretch of coast are also enhancing features within the landscape. Embellishment and upgrading of the promenade is also attractive and an inviting landscape element. Gardens such as Independence Garden and the park at Qui-Si-Sana are additional enhancing features. A number of beach facilities have, however, limited access to the public in certain areas. Although there are some features of cultural heritage interest, these have largely been neglected and are in a dilapidated state. The Assessment indicates that the quality of more recent development in the vicinity of the coast is considered to be superior to that which occurred in the early 1990s. However, the extent of the urban conurbation in terms of massing and density detracts from the beauty of the coast. Extensive construction work that has been underway for a number of years has also resulted in negative effects on the visual amenity on the coastline during this time.

**Standards and guidelines**

23. In view of the fact that there are no Malta-specific landscape and visual amenity assessment guidelines, MEPA requested that the landscape and visual assessment be carried out in line with the UK’s *Guidelines for Landscape and Visual Impact Assessment 2013* (GLVIA) (Institute of Environmental Management & Assessment (IEMA) and the Landscape Institute).
Figure 1: North harbours Local Plan - Strategic View Corridors
Figure 2: Building height limitations within the Fort Cambridge Development Brief area
Figure 3: AHLV Harbour Fortifications under GN 133 of 2001
ASSESSMENT METHODOLOGY

Desk Study Methodology

Landscape Assessment

24. The landscape baseline conditions were determined through desk study and field surveys. The desk study included:

- A review of the information shown on the base map of the area;
- An analysis of aerial photographs to determine land use trends; and
- A review of existing baseline information from:
  - Literature searches;
  - Previous environmental and planning studies undertaken in the area;
  - Historic maps; and
  - Legislation and policy documents.

Landscape character, value and sensitivity

25. MEPA’s Landscape Assessment Study of the Maltese Islands was carried out as part of the Structure Plan review. This study characterised the landscape at a national level into a series of units known as landscape character areas (LCAs). It describes landscape characteristics, qualities and influences on the landscape. The landscape character area of the site and its surroundings consider MEPA’s landscape assessment study as well as the results of the desk and field studies when characterising the landscape in the area.

26. The value of the landscape receptor should also be considered. The value of a landscape character receptor is a reflection of its importance in terms of any designations that may apply, or its importance in itself as a landscape or townscape resource, which may be due to its ecological, cultural or recreational value. The higher the value of the receptor, the greater is its sensitivity to the development. Value is assessed as being high, medium, or low.

27. Landscape sensitivity is a complex issue. The GLVIA refer to consideration of a landscape’s susceptibility to change, meaning ‘...the ability of the landscape receptor...to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies.’ Landscape character sensitivity was defined in accordance with the criteria set out in Table 1.
Table 1: Landscape character sensitivity

<table>
<thead>
<tr>
<th>Landscape Character Sensitivity</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>A landscape character area / local landscape</td>
<td>A landscape character area / local landscape tract in which some</td>
<td>A landscape character area / local landscape tract in which defining</td>
<td></td>
</tr>
<tr>
<td>tract in which defining characteristics are</td>
<td>defining characteristics may be susceptible to change</td>
<td>defining characteristics are less susceptible to change</td>
<td></td>
</tr>
<tr>
<td>susceptible to change</td>
<td></td>
<td></td>
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</table>

Magnitude of Change to Landscape Resource

28. The GLVIA describe that the identification of the magnitude of change depends on (i) the size or scale of change in the landscape that is likely to be experienced as a result of each effect; (ii) geographical extent over which the landscape effects will be felt; and (iii) the duration and reversibility of the landscape effects. The magnitude of change in a landscape depends on the loss, change or addition of any feature, or any change in the backdrop to, or outlook from, a landscape that affects its character. Table 2 presents criteria for magnitude of change to a landscape resource.

Table 2: Magnitude of change to landscape resource

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Imperceptible change</th>
</tr>
</thead>
<tbody>
<tr>
<td>An obvious change in landscape characteristics and</td>
<td>Discernible changes to landscape characteristics and character</td>
<td>Small changes to landscape characteristics and character</td>
<td>A largely imperceptible change to landscape characteristics and character</td>
</tr>
<tr>
<td>character</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Visual Amenity Assessment

29. The Zone of Theoretical Visibility (ZTV) was defined using a combination of desk and field-based techniques. The extent of the viewshed (ZTV) was verified in the field along with the eleven representative viewpoints that were agreed with MEPA for the visual amenity assessment (see below). The existing views from these locations were photographed, photomontages created, and the visual amenity and changes thereto as a result of the Scheme appraised.

30. MEPA’s agreement to the location of the viewpoints was sought before the visual amenity study was undertaken. The viewpoints include:

- Short distance views;
- Medium distance views from publicly accessible locations; and
- Long distance views from high points or tourist attractions.

31. A number of views from publicly accessible locations were identified within the ZTV as shown in Figure 4. These were agreed with MEPA as a basis for assessing changes to visual amenity that may result from the Scheme. However, during the preparation of photomontages it was identified that the Scheme would not be visible
Sensitivity of Visual Receptors

32. The sensitivity of visual receptors is dependent on the location from where the receptors experience the view, their expectations, occupation or activity at the viewpoint, and the importance of the view. UK Guidelines note that the most sensitive receptors may include:

- Users of outdoor recreation facilities whose attention or interest may be focused on the landscape;
- Communities where the development results in changes to the landscape setting or valued views enjoyed by the community;
- Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience; and
- Occupiers of residential properties with views affected by the development.

33. The Guidelines also note that other receptors could include people engaged in outdoor sport or recreation other than those involving an appreciation of the landscape, people travelling through the area, and people at their place of work. The latter are regarded as the least susceptible to changes in view.

34. The following definitions are used to categorise the sensitivity of receptors:

- High sensitivity receptors: those who repeatedly re-visit the viewpoint to partake of the view. Such views are generally highly valued by the community;
- Moderate sensitivity receptors: itinerant visitors (mostly tourists) to the viewpoint; and
- Low sensitivity receptors: road users, workers, etc.

35. Residents are not included above because views from private property are not protected under planning law or other public policy, except in so far as the zoning of the land implies certainty as to the type of development that may be permitted. The rights of nearby residents are, however, somewhat protected through the planning system, since they can object to any change of land use (or airspace). The EIA process does not assess the impacts of a development on the rights or values of individuals, but rather on the public collectively, and those rights and values are as expressed in legislation and planning policy. It is for this reason that this EIS does not address the effects of loss of view from private properties, land ownership, etc.

Magnitude of Visual Change

36. Identification of the magnitude of change depends on the size or scale in change in view (relating to the extent of visibility, degree of screening, angle of view and distance from the development) and the degree of contrast or integration of any new features with existing features as well as the duration and reversibility of visual
effects. Table 3 defines magnitude of visual change.

**Table 3: Magnitude of visual change**

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Imperceptible Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A substantial change in view affecting a large number of viewers</td>
<td>A moderate change in view affecting many/some viewers</td>
<td>A smaller change in view affecting a low number of viewers</td>
<td>A small, barely perceptible or no change in view.</td>
</tr>
</tbody>
</table>

**Field Survey Methodology: Landscape**

37. A comprehensive field survey was undertaken in accordance with the *Guidelines for Landscape and Visual Impact Assessment* (IEMA and the Landscape Institute 2013). The field survey served to record objective and subjective impressions of the landscape, and details of landscape condition, land use, and management. It provided the basis for the delineation of local landscape tracts and the identification of potentially sensitive landscape receptors in accordance with the Guidelines.

38. Table 4 describes the identified landscape receptors.

**Table 4 Landscape Receptors**

<table>
<thead>
<tr>
<th>Landscape elements</th>
<th>Urban area: buildings and roads.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coastline: largely urbanised, including a promenade that wraps around the coast along Tower Road, Sliema and on to St Julian’s.</td>
</tr>
<tr>
<td>Landscape characteristics</td>
<td>Dense urban area around the coast, including at Pietà, Msida, Ta’ Xbiex, Gżira, Sliema and St Julians. The Valletta fortifications contribute to the landscape character in this area, being dominant features of the inner harbours area. Fort Manoel (on Manoel Island) also contributes to the cultural value of the landscape.</td>
</tr>
<tr>
<td>Landscape character</td>
<td>The distinct and recognisable pattern of elements that occurs consistently in the landscape, and how this is perceived. Landscape character areas have been defined and are illustrated in Figure 5.</td>
</tr>
</tbody>
</table>

**Field Survey Methodology: Visual Amenity**

39. The extent of the visibility of the Scheme Site was verified during the field survey, and the ZTV and publicly accessible viewpoints confirmed. The field survey also confirmed the areas from which the site is not visible.

40. Potential sensitive receptors identified in the course of the field survey (in order of descending sensitivity) were:

- Recreational users of areas in the vicinity of the Site, walkers and joggers;
- Tourists / visitors viewing the area from long to medium distance viewpoints;
• Road users (vehicle occupants and pedestrians); and
• Workers.
Figure 4: Zone of Visual Influence and selected viewpoints

Legend
- Site boundary
- ZTV
  - High: 27
  - Low: 0

Viewpoints
- VP1 - Plaza de Sal, Llaneras
- VP2 - Trig in Tor, La Sierra
- VP3 - Trig in West, La Sierra
- VP4 - Trig Santa Rosalia, B. Collarico
- VP5 - Trig G. Gente de M. Luisa
- VP6 - Trig A. A. Pérez de la Sierra
- VP7 - Trig J. Llorente, S. B. Valletta
- VP8 - Green George Bonilla de Pulo, La Sierra
- VP9 - Trig J. P. Andriod, B. Soares
- VP10 - Trig A. Jimenez de la Sierra
- VP11 - The Place, La Sierra

TN 162347
Port Cambridge Model

INDICATIVE ONLY - Plan to be used for direct interpretation.
Figure 5: Landscape Character Areas and Local Landscape Tracts
DETERMINING IMPACT SIGNIFICANCE

41. The significance of impacts on the landscape and visual amenity is dependent upon judgements about the value of the existing visual amenity compared to the new visual amenity that would be created, the number of people affected, the receptors’ sensitivity to change, the magnitude, duration and permanency of the changes, and subjective judgements about the degree to which these changes would matter to those concerned.

Landscape Assessment

42. The significance of landscape impacts has been defined based on the sensitivity and magnitude criteria as described in Table 1 and Table 2 above, as follows:

- **Major significance:** Large negative changes in the landscape that are out of character with the landscape. Where the extent of the negative impact on the landscape setting is large in scale or magnitude and the landscape sensitive receptor is of high sensitivity to change and/or of a high intrinsic value and, as a consequence, the integrity of the setting would be significantly altered. The impact could be of international or national importance. The impact would be of a long-term nature (or very severe short-term in the case of construction impacts), irreversible, and certain or likely to occur;

- **Moderate significance:** Discernible changes in the landscape that are out of character with the landscape. Where the extent of the negative impact on the landscape character is medium in scale and landscape sensitive receptor is of medium sensitivity to change and/or of medium intrinsic value. The impact would be of a long-term nature, irreversible and likely to occur;

- **Minor significance:** Small changes in the landscape that are out of character with the landscape. Where the extent of the negative impact on the landscape setting is small in scale or magnitude and the landscape sensitive receptor is of a low sensitivity to change or a low intrinsic value. The impact would be of local importance. The impact would be of a long or short-term nature, and likely to occur;

- **Not significant:** No perceptible changes to the landscape setting. Where the extent of the negative impact on the landscape setting is of limited importance in scale or magnitude and the landscape sensitive receptor is of a low sensitivity to change and/or of a low intrinsic value. The impact would be of local importance. The impact would be of a long to short-term nature, and/or unlikely to occur.

Visual Amenity

43. The significance of visual impacts has been assessed in relation to:

- The number and sensitivity of receptors affected;

- The duration of the changes;
• The extent of visibility and distance from the Scheme;

• The type of view – proportion of development visible, focus on Scheme due to proximity and whether it is fixed, transient, or sequential;

• The changes to the view from the identified view points as shown by the photomontages; and

• The scope for mitigation / enhancement measures to screen the development.

44. Based on the above criteria an assessment of the significance of the visual impact on each of the agreed viewpoints was made in terms of whether it is considered to be of:

• **Major significance** - *substantial changes in the view*. Where the extent of the impact on the view would be large in magnitude and affect a large number of receptors or is of particular importance to the viewers affected. May be an advertised viewpoint and/or a view with high amenity and scenic qualities and few intrusive elements in the view;

• **Moderate significance** – *moderate change to the view*. Where the extent of the impact on the view would be moderate in magnitude or extent and affect a moderate number of receptors or is of some importance to the viewers affected. May be a viewpoint from which there is a view with some visual amenity / intrinsic value (this may include views across, or within, a regionally or locally designated landscape) and potentially some intrusive elements to the view;

• **Minor significance** – *smaller changes to the view*. Where the extent of the impact on the view would be small in magnitude or extent, and affect relatively few receptors, or a larger number of receptors with passing interest in their visual environment. The view would have a low visual amenity / intrinsic value or with intrusive man-made elements within the view; or be

• **Not significant** - *little or no obvious changes to the view*. Where the extent of the impact on the visual amenity would be of limited importance in scale or magnitude, or affect persons of low sensitivity to change, and / or be a view of low intrinsic value. Alternatively, the impact would affect very few people, be transient and only affect a small part of the Scheme or panorama.

45. **Table 5** identifies impact significance in a tabular format. It should be noted that there is a gradual transition between categories; although the relationship between magnitude and sensitivity is defined in **Table 5**, significance comes down to a professional judgement. Impact significance is recorded as one of the four categories (not significant, minor, moderate, or major).
Table 5: Identification of Impact Significance

<table>
<thead>
<tr>
<th>Sensitivity of Receptor</th>
<th>Magnitude of change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imperceptible</td>
</tr>
<tr>
<td>Low</td>
<td>Not significant</td>
</tr>
<tr>
<td>Medium</td>
<td>Not significant</td>
</tr>
<tr>
<td>High</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

EXISTING CONDITIONS

Landscape

46. As mentioned, the Scheme Site lies within a densely built area in Sliema on the Tigne peninsula. The area has become dominated by high, largely residential buildings. The existing development at Tigne and Fort Cambridge is high-end and the massing is extensive. The extent of development in this area makes it visible from a number of long distance viewpoints and is most notable from across the harbour. The vibrant hubbub of the heart of Sliema that includes shops, restaurants and coffee shops, is not far from the Scheme Site, which is also located in the immediate vicinity of the Tigne Point shopping centre.

47. Closer to the coast the promenade runs by the sea both in the direction of Gzira as well as in the opposite direction, towards St Julians. The promenade is popular in this area and is frequented by locals and tourists alike on a regular basis throughout the year. The promenade ensures open views to the sea, providing a break from the otherwise densely laid out urban conurbation. The rocky coast beneath the promenade is also a feature of the landscape at Qui-Si-Sana although it is less interrupted and provides a more dominant feature in the landscape further down Tower Road, towards St Julians. A number of lidos have been developed along the rocky coast in the Qui-Si-Sana area; the concession at Tigne beach (formerly used by NSTS) includes dilapidated structures that provide a shabby feel to the rocky coast in this area. A public garden and play area dominate the promenade at Qui-Si-Sana. Further inland, the peninsula is characterised by a continuous dense urban environment including Sliema, sandwiched between Gzira and St Julians.

48. Although the Scheme Site lies within an area that includes cultural heritage features of importance, these features are not dominant within the landscape and are not particularly noticeable from either long or short distance views due to the newer development that has mushroomed in the vicinity and the low-lying level of these features in the landscape.

49. The site is located on the Tigne peninsula, the edge of which forms part of the inner harbours fortifications area; the fortifications have afforded designation of this area as an Area of High Landscape Value.
Landscape characterisation

50. The landscape types and character areas that provide the landscape context to the Scheme Site are described below. The distinction between the types and areas is defined in the assessment as:

- **Landscape Character Types** - describe distinct and homogeneous generic landscape units that share common combinations of elements (listed and described in Table 6); and

- **Landscape Character Areas** - single unique areas that represent the discrete geographical areas of a particular type. Each Landscape Character Area may be divided into Local Landscape Tracts (LLT) that describe potential problems and pressures affecting the landscape character (illustrated in Figure 5 and described in Table 6).

### Table 6: Landscape Character Types and Landscape Character Areas

<table>
<thead>
<tr>
<th>Defined area / attribute</th>
<th>Summary description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landscape Type</strong></td>
<td></td>
</tr>
<tr>
<td>Urban environment</td>
<td>Includes settlements located around the coast.</td>
</tr>
<tr>
<td>Fortifications</td>
<td>The fortifications around Floriana and Valletta.</td>
</tr>
<tr>
<td>Coastal belt</td>
<td>The coastal belt in this area is highly anthropogenic with some remaining areas of natural, rocky coast. Most of the coast is characterised by anthropogenic structures and related uses, including food and beverage outlets, lidos, parks and the promenade.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Character area: Urban conurbation character area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predominantly urban environment, including the areas of Gżira, Sliema and St Julians, characterised by dense development hitting the skyline at various levels. The development on Tigne peninsula is dominated by dense massing and high buildings.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Local Landscape Tract 1: Gżira and Sliema</th>
<th>Adjacent to LLT1:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Dense development dominates the skyline looking inland.</td>
</tr>
<tr>
<td></td>
<td>• Promenade.</td>
</tr>
</tbody>
</table>

**Detracting features**

- • Non uniform, continuous development interrupts the skyline. |
- • Traffic and in particular parking problems are frequent. |

**Landscape Sensitivity**

- • Low to moderate |
<table>
<thead>
<tr>
<th>Defined area / attribute</th>
<th>Summary description</th>
</tr>
</thead>
</table>
| Local Landscape Tract 2: Tignè high-rise developments | Located at Tignè Point, Sliema:  
  o The tall apartment blocks at Fort Cambridge and MIDI, and the Fortina Hotel dominate the landscape.  

Detracting features  
  o Large construction sites, including their associated tower cranes and other machinery impinge on the landscape.  
  o Dense development coming on line and adding to the already dense urban conurbation dominating the landscape in this area.  
  o Fort Tignè has been engulfed by the surrounding development and is no longer a dominant feature in the landscape.  

Landscape Sensitivity  
  o Low  

| Character area: Rocky coast | The rocky coast provides a break to the dense urban conurbation on the hinterland. A number of lidos and other facilities occur at Qui-Si-Sana, limiting public access to the coast. Some such structures have been present on site for some decades, in particular at Tigne beach. Some of these structures have not been maintained and are in a dilapidated state. Further along the coast, towards Ghar id-Dud, the natural coast is more prominent, and takes up a larger expanse, although there are still a number of structures such as restaurants and kiosks that encroach onto the rocky coast in places.  

Landscape Sensitivity  
  High  

| Character area: Fortified city of Valletta | As identified in MEPA’s Landscape Assessment, Valletta is laid out on a grid iron street pattern. Dominant features of Valletta’s skyline include the dome of the Carmelite Parish Church and the spire of the Anglican Cathedral. The Phoenicia Hotel and the more recent Grand Hotel Excelsior are also dominant features in this landscape. Overall, the fortifications provide a unique cultural experience and the residential area contained therein also includes numerous cultural features, including the auberges and palaces of Valletta. Public gardens in Valletta are well-maintained. Many points along the fortifications are accessible providing excellent views of the harbour and surrounding settlements. The proximity to the coast enhances the drama of the fortifications.  

Landscape Sensitivity  
  High  

| Character area: Manoel Island |
Fort Manoel contributes to the historic context of Marsamxett Harbour, and this contribution has been enhanced as a result of the recent restoration of the Fort. The planting on the glacis introduces some greenery into the view. Lazaretto Hospital, on the southern coast of the Island, is also a dominant feature and it contributes to the historical context. MEPA’s Landscape Assessment notes that the presence of the yacht repair yard degrades long distance views closer inland. Other areas on the Island, in particular the approach from Gżira, have not been well-maintained.

**Landscape Sensitivity**

**High**

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**Visual Amenity: Zone of Theoretical Visibility**

51. **Figure 4** illustrates the computer generated ZTV. Whilst the ZTV appears extensive, in the field it was ascertained that, as a result of buildings, vegetation, and distance, the Application Site was not visible from all areas within the ZTV. The field survey was carried out to select the best viewpoints and to identify the long, medium, and short distance views from public places. The selected viewpoints were agreed with MEPA and are shown in **Figure 4**.

**Application Site Visibility**

52. In assessing views, there is often likely to be a continuum in the degree of visibility of the development from full view to no view. **Table 7** summarises the situation in respect of the Scheme and with regard to the following:

- **Extent of site visibility** – full view, partial view, glimpse or no view into the site at all demonstrates the exposure of the site and the processes thereon to public view.
  - The viewpoints selected provide a view to the general area of the site. Although, in all views it is covered by other development such that the site itself is not visible. However, the Scheme would be visible from all of the selected viewpoints except Viewpoint 5 and Viewpoint 9, due to the fact that it constitutes a tall building that rises above all other development in the area.

- **Proportion of development visible** – expresses the proportion of the development (the Scheme) that would be visible from the viewpoints: full, most, some, small amount, or none.
  - The Scheme is partially visible from all viewpoints. The Scheme cannot be seen from Viewpoints 5 and 9.

- **Focus on Scheme due to proximity** – is an indicator of the distance from the Application Site and whether the viewpoint would focus on the development due to its proximity (i.e., it is the only thing to look at), or whether the Scheme is part of a panorama.
  - Viewpoints 1, 2, 3, 4, 6, 7, and 10 are panoramic views. Viewpoints 8, and 11 are proximity views.
• **Transient or sequential view** – the principal receptors will have sequential views of the Application Site. Transient views are those that pass quickly (like looking through a doorway as one walks past), and sequential views expose the receptor to different yet sequential views of the site. The latter allows the site to be viewed for a longer period and from different and changing perspectives.
  
  o The extent of building height generally ensures sequential views.
Table 7: Summary of Application Site visibility from viewpoints

<table>
<thead>
<tr>
<th>Viewpoints</th>
<th>VP1</th>
<th>VP2</th>
<th>VP3</th>
<th>VP4</th>
<th>VP6</th>
<th>VP7</th>
<th>VP8</th>
<th>VP10</th>
<th>VP11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance of viewpoint from Scheme (m)</td>
<td>9,805</td>
<td>583</td>
<td>684</td>
<td>2,426</td>
<td>1,164</td>
<td>924</td>
<td>212</td>
<td>2,879</td>
<td>188</td>
</tr>
<tr>
<td>Extent of Scheme visibility</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
</tr>
<tr>
<td>Proportion of Scheme visible</td>
<td>50%</td>
<td>50%</td>
<td>60%</td>
<td>50%</td>
<td>60%</td>
<td>60%</td>
<td>10%</td>
<td>50%</td>
<td>20%</td>
</tr>
<tr>
<td>Focus on Scheme due to proximity</td>
<td>Panorama</td>
<td>Panorama</td>
<td>Panorama</td>
<td>Panorama</td>
<td>Panorama</td>
<td>Panorama</td>
<td>Proximity</td>
<td>Panorama</td>
<td>Proximity</td>
</tr>
<tr>
<td>Transient or sequential view</td>
<td>Transient</td>
<td>Sequential</td>
<td>Sequential</td>
<td>Transient</td>
<td>Sequential</td>
<td>Sequential</td>
<td>Sequential</td>
<td>Sequential</td>
<td>Transient</td>
</tr>
</tbody>
</table>
CHANGES IN THE LANDSCAPE AND VISUAL AMENITY

53. Changes to the landscape and visual amenity of the ZTV are anticipated as a result of the Scheme. This section focuses on the likely impacts of the Scheme on landscape and visual amenity, and points to possible mitigation measures, where relevant.

Changes in the landscape and their significance

54. The changes to the landscape during the construction and operation of the Scheme are considered together. In terms of landscape character, the impacts likely to occur as a result of the operation of the Scheme were assessed.

55. Table 8 details the landscape assessment.

Table 8: Changes in landscape character and the significance of the impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Changes</th>
<th>Effects &amp; significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Conurbation Character Area: LLT1 Gżira and Sliema</td>
<td>The Scheme is unlike anything present in the existing landscape such that its inclusion will result in large changes to the skyline.</td>
<td>High change to a landscape of low to moderate sensitivity. Impact: Major significance</td>
</tr>
<tr>
<td>Urban Conurbation Character Area: LLT2 Tignè high-rise development</td>
<td>Despite the presence of other large buildings in this LLT, the Scheme is significantly higher than anything present in the existing landscape such that its inclusion will result in large changes to the skyline.</td>
<td>High change to a landscape of low sensitivity. Impact: Moderate significance</td>
</tr>
<tr>
<td>Rocky Coast Character Area</td>
<td>No changes.</td>
<td>No changes. Impact: Not significant</td>
</tr>
<tr>
<td>Fortified cities of Floriana and Valletta Character Area</td>
<td>The height on this building will make it the most dominant landscape element in its Landscape Character Area and it will also affect the setting of the fortifications because it dominates the skyline of the Fortifications Character Area from other viewpoints also, thus affecting the cultural and urban skyline of this Character Area.</td>
<td>High change to a landscape of high sensitivity. Impact: Major significance.</td>
</tr>
<tr>
<td>Manoel Island Character Area</td>
<td>No changes.</td>
<td>No changes. Impact: Not significant</td>
</tr>
</tbody>
</table>

Changes in Visual Amenity and their Significance

1.47. Changes to the visual amenity were assessed from suitable viewpoints as described above and presented below.
<table>
<thead>
<tr>
<th>Viewpoint 1</th>
<th>Pjazza tas-Sur</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>L-Imdina</td>
</tr>
</tbody>
</table>
| **Key features** | Panoramic view over lowland including rural scenes as well as the urban fabric in the distance and even the sea in the far distance. The view includes part of the Mdina bastions in the foreground.  
High visual amenity, high intrinsic value. |
| **Sensitive receptors** | Visitors coming to partake of the rare viewpoint in the Maltese Islands from a site of historic value.  
High numbers of high sensitive receptors |
| **Change to Visual Amenity** | The change to the view includes the tower that can be seen in the distance, breaking the skyline in the horizon. |
| **Impact** | A small scale change in the distance affecting a view of high intrinsic value and impacting on highly sensitive receptors.  
Impact: Minor significance. |
<table>
<thead>
<tr>
<th><strong>Viewpoint 2</strong></th>
<th>Near Preluna, Tower Road</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Sliema</td>
</tr>
<tr>
<td><strong>Key features</strong></td>
<td>Typical seafront development rising to 7 or 8 storeys, presenting a largely regular skyline with high rise development in the background and towards the edge of the view, which, from this perspective do not rise significantly change the skyline. Low to moderate visual amenity, moderate intrinsic value.</td>
</tr>
<tr>
<td><strong>Sensitive receptors</strong></td>
<td>Users of the promenade for walking, sightseeing and recreation – tourists and locals, large numbers of moderate to high sensitive viewers. Road users – low sensitive receptors.</td>
</tr>
<tr>
<td><strong>Change to Visual Amenity</strong></td>
<td>The Scheme rises considerably higher than the existing skyline and the change in height is a sharp one (there is no tapering either side, as suggested in the Development Brief).</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>A large scale change affecting a view of moderate intrinsic value and impacting on a large number of moderate to highly sensitive receptors. Impact: Major significance.</td>
</tr>
<tr>
<td>Viewpoint 3</td>
<td>Promenade on Gżira side</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Location</td>
<td>Sliema</td>
</tr>
<tr>
<td>Key features</td>
<td>View towards Sliema includes Id-Daħla qa’ Taz-Sliema, the promenade and the urban environment dominating the skyline. Maritime uses including moored pleasure boats contribute to the sea view. Low to moderate visual amenity, moderate intrinsic value.</td>
</tr>
<tr>
<td>Sensitive receptors</td>
<td>Recreational users including walkers, runners, etc, making use of the promenade. Moderate to high numbers of moderate to high sensitive receptors.</td>
</tr>
<tr>
<td>Change to Visual Amenity</td>
<td>The Scheme rises to more than double the height of the existing tallest buildings on the Sliema Tigne skyline.</td>
</tr>
<tr>
<td>Impact</td>
<td>A large scale change affecting a view of moderate intrinsic value and impacting on moderate to highly sensitive receptors. Impact: Major significance.</td>
</tr>
<tr>
<td>Viewpoint 4</td>
<td>Rinella Bay</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Location</td>
<td>Kalkara</td>
</tr>
<tr>
<td>Key features</td>
<td>This is a panoramic view across the Bay towards the Grand Harbour and its bastions. Behind the bastions church cupolas are distinct, and provide a landmark on the historic skyline of Valletta. The view is framed by bastions and structures of cultural heritage interest on either side, including Villa Bighi on the left and an operational quay is prominent on the right. Newer development on the Tigne peninsula is also visible in the distance. High visual amenity, high intrinsic value.</td>
</tr>
<tr>
<td>Sensitive receptors</td>
<td>Bathers using the area for recreation – tourists and locals: moderate numbers of moderate to high sensitive viewers.</td>
</tr>
<tr>
<td>Change to Visual Amenity</td>
<td>The tower breaks the skyline and is noticeable on the otherwise mainly historic view.</td>
</tr>
<tr>
<td>Impact</td>
<td>A noticeable change affecting a view of high intrinsic value and impacting on moderate to highly sensitive receptors. Impact: Major significance.</td>
</tr>
<tr>
<td>Viewpoint 6</td>
<td>Great Siege Road</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Location</td>
<td>Valletta</td>
</tr>
<tr>
<td>Key features</td>
<td>View over the sea towards Tigne peninsula dominated by high-rise buildings. Manoel Island and Fort Manoel also feature prominently. Moderate visual amenity, moderate intrinsic value.</td>
</tr>
<tr>
<td>Sensitive receptors</td>
<td>Pedestrians and road users. Moderate to high numbers of low to moderate sensitive receptors.</td>
</tr>
<tr>
<td>Change to Visual Amenity</td>
<td>The Scheme domineers to approximately double the height of the tallest buildings on the Tigne peninsula.</td>
</tr>
<tr>
<td>Impact</td>
<td>A large scale change affecting a view of moderate intrinsic value and impacting on low to moderate sensitive receptors. Impact: Major significance.</td>
</tr>
<tr>
<td>Viewpoint 7</td>
<td>Triq il-Lancja</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Valletta</td>
</tr>
<tr>
<td><strong>Key features</strong></td>
<td>View over the sea towards Tigne Peninsula. High rise buildings as well as construction cranes dominate the view on the peninsula. Lower buildings to the left of the peninsula provide a continuation in the urban environment, there is no break in built up area from this view. Low to moderate visual amenity, low to moderate intrinsic value.</td>
</tr>
<tr>
<td><strong>Sensitive receptors</strong></td>
<td>Recreational users and users of the Sliema-Valletta ferry. High numbers of moderate to high sensitive receptors.</td>
</tr>
<tr>
<td><strong>Change to Visual Amenity</strong></td>
<td>The Scheme domineers to approximately double the height of the tallest buildings on the Tigne peninsula.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>A large scale change affecting a view of low to moderate intrinsic value and impacting on moderate to highly sensitive receptors. Impact: Major significance.</td>
</tr>
<tr>
<td>Viewpoint 8</td>
<td>Qui-Si-Sana</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Sliema</td>
</tr>
<tr>
<td><strong>Key features</strong></td>
<td>Proximity view towards Tigne peninsula. The Qui-Si-Sana public park is overshadowed by the medium to high rise buildings. Extensive new development on the peninsula frames the scene. Low to moderate visual amenity, low to moderate intrinsic value.</td>
</tr>
<tr>
<td><strong>Sensitive receptors</strong></td>
<td>Recreational users including walkers, runners, etc, making use of the promenade. Moderate to high numbers of moderate to high sensitive receptors.</td>
</tr>
<tr>
<td><strong>Change to Visual Amenity</strong></td>
<td>The Scheme can be noticed rising higher behind the first row of buildings on the promenade.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>A small to moderate scale change affecting a view of low to moderate intrinsic value and impacting on highly sensitive receptors. Impact: Minor to moderate significance.</td>
</tr>
<tr>
<td>Viewpoint</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>10</td>
<td>Swieqi</td>
</tr>
</tbody>
</table>

**Key features**
- Urban view dominated by residential development; buildings with varying heights. Portomaso Tower dominates the skyline; the Spinola Court development is also dominant, rising a few storeys higher than the rest of the general urban environment, to the right of the Portomaso Tower.
- Low visual amenity, low intrinsic value

**Sensitive receptors**
- Road users
  - Low numbers of low sensitive receptors

**Change to Visual Amenity**
- The Scheme provides the eye with another landmark reference as it breaks the skyline on the horizon at the other end of the view from the Portomaso tower.

**Impact**
- A moderate scale change affecting a view of low intrinsic value and impacting on low sensitive receptors.
  - Impact: Minor significance.
<table>
<thead>
<tr>
<th>Viewpoint 11</th>
<th>The Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Sliema</td>
</tr>
<tr>
<td>Key features</td>
<td>View towards the site from The Point. The English military structures provide a tunnel vision towards the Fort Cambridge site. The newly developed residential buildings at Fort Cambridge can be seen beyond the Point. Low to moderate visual amenity, low to moderate intrinsic value.</td>
</tr>
<tr>
<td>Sensitive receptors</td>
<td>Recreational users, workers, residents. Moderate to high numbers of moderate to high sensitive receptors.</td>
</tr>
<tr>
<td>Change to Visual Amenity</td>
<td>The Scheme can be seen rising above the existing buildings.</td>
</tr>
<tr>
<td>Impact</td>
<td>A moderate scale change affecting a view of low to moderate intrinsic value and impacting on moderate to highly sensitive receptors. Impact: Moderate significance.</td>
</tr>
<tr>
<td>Asset Impacted</td>
<td>Beneficial/ Adverse / Neutral</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Conurbation Character Area: LLT1 Gżira and Sliema</td>
<td>Adverse</td>
</tr>
<tr>
<td>Urban Conurbation Character Area: LLT2 Tigné high rise development</td>
<td>Adverse</td>
</tr>
<tr>
<td>Rocky Coast Conurbation</td>
<td>Neutral</td>
</tr>
<tr>
<td>Fortified city of Valletta Character Area</td>
<td>Adverse</td>
</tr>
<tr>
<td>Manoel Island Character Area</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

### Landscape

- **Viewpoint 1**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Minor, None, Minor
- **Viewpoint 2**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 3**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 4**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 5**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 6**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 7**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Major, None, Major
- **Viewpoint 8**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Minor to moderate, None, Minor to moderate
- **Viewpoint 9**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Minor, None, Minor
- **Viewpoint 10**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Minor, None, Minor
- **Viewpoint 11**: Adverse, All, Local, Direct, L term, Perm, Revers., Local, Likely, Minor, None, Minor
APPENDIX I:
BASE PHOTOS AND PHOTOMONTAGES
Viewpoint 2: Photomontage
Viewpoint 3: Base Photo
Viewpoint 3: Photomontage
Viewpoint 4: Base Photo
Viewpoint 4: Photomontage
Viewpoint 6: Photomontage
Viewpoint 7: Photomontage
Viewpoint 8: Photomontage
Viewpoint 11: Base Photo
Ref: TRK 162247 (EA00030/15)

Retention of the historic existing facades of the Fort Cambridge barracks - building and demolition of the existing southwest facade and internal structure. Proposed excavation and construction of a new high-rise hotel Class 3B including all ancillary facilities and amenities

Site at, Triq Tigné c/w, Triq il-Ponta Ta' Dragut,

Sliema, Malta

Environmental Planning Statement
### DOCUMENT CONTROL

**PROJECT NAME**:  
Retention of the historic existing facades of the Fort Cambridge barracks - building and demolition of the existing southwest facade and internal structure. Proposed excavation and construction of a new high-rise hotel Class 3B including all ancillary facilities and amenities 

*Site at, Triq Tigné c/w, Triq il-Ponta Ta’ Dragut, Sliema, Malta*

**DOCUMENT TITLE**:  
Environmental Planning Statement  
Geo-Environmental Study

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**Distribution**: Gap Developments

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1 INTRODUCTION

1.1 THIS REPORT

An Environmental Planning Statement (EPS) is to be prepared for the proposed project: Retention of the historic existing facades of the Fort Cambridge barracks - building and demolition of the existing southwest facade and internal structure. Proposed excavation and construction of a new high-rise hotel Class 3B including all ancillary facilities and amenities Site at, Triq Tigné c/w, Triq il-Ponta Ta’ Dragut, Sliema, Malta— (Figure 1 and Figure 2), as required by Section 2.7.1.1 of Schedule IA of the Environmental Impact Assessment Regulations, 2007 (LN 114/2007).

This report represents the geo-environmental input including mineral resource assessment to the Environmental Planning Statement.

Figure 1: Aerial Photograph showing the location of the site in Triq Tigne’, Sliema
1.2 TERMS OF REFERENCE

The terms of reference issued by MEPA were as follows:

1.2.1 GEOLOGY, GEOMORPHOLOGY, HYDROGEOLOGY AND SOILS

A comprehensive investigation of:

1. The geology and geomorphology of the site and its surroundings, including: existing lithological, stratigraphical, palaeontological, hydrogeological and physiographic features and soil types;

2. The geo-technical properties and considerations relevant to the site and its area of influence, including: land stability; mechanical, erosional and structural properties of the terrain and land mass; any relevant fissures, faults, hollows, or weak points; the vulnerability of the site to natural forces such as erosive elements, landslides and mass movements; and any other considerations affecting the implications and risks posed by the proposed development or by any of its ancillary interventions such as site clearance, earth-moving, and excavations; and

3. The quality of the material that will be excavated (including soil, rock/mineral resource, and any existing fill material) and its potential for reuse.
Sampling and testing should comply with the relevant standards (unless otherwise agreed, BS standards or other recognised equivalents should be used), and should extend to a sufficient depth below the deepest level of the proposed development (taking into consideration all proposed excavations and underground structures). Wherever the study involves the drilling of core samples, the number, depth and location thereof should also be submitted for EPD approval prior to carrying out of any in situ tests.

1.2.2 ENVIRONMENTAL IMPACT ASSESSMENT

The assessment shall address the following aspects, as applicable to the geo-environment for environmental impact, addressing the worst-case scenario wherever relevant:

1. An exhaustive identification and description of the envisaged impacts;

2. The magnitude, severity and significance of the impacts;

3. The geographical extent/range and physical distribution of the impacts, in relation to: site coverage; the features located in the site surroundings; whether the impacts are short-, medium- or long-range; and any transboundary impacts (i.e. impacts affecting other countries);

4. The timing and duration of the impacts (whether the impact is temporary or permanent; short-, medium- or long-term; and reasonable quantification of timeframes);

5. Whether the impacts are reversible or irreversible (including the degree of reversibility in practice and a clear identification of any conditions, assumptions and pre-requisites for reversibility);

6. A comprehensive coverage of direct, indirect, secondary and cumulative impacts, including: · interactions (e.g. summative, synergistic, antagonistic, and vicious-cycle effects) between impacts; · interactions or interference with natural or anthropogenic processes and dynamics; · cumulation of the project and its effects with other past, present or reasonably foreseeable developments, activities and land uses and with other relevant baseline situations; and · wider impacts and environmental implications arising from consequent demands, implications and commitments associated with the project (including: displacement of existing uses; new or increased pressures on the environment in the surroundings of the project, including pressures which may be exacerbated by the proposal but of which effects may go beyond the area of influence; and impacts of any additional interventions likely to be triggered or necessitated by situations created, induced or exacerbated by the project);

7. Whether the impacts are adverse, neutral or beneficial;

8. The sensitivity and resilience of resources, environmental features and receptors vis-à-vis the impacts;

9. Implications and conflicts vis-à-vis environmentally-relevant plans, policies and regulations;
10. The probability of the impacts occurring; and

11. The techniques, methods, calculations and assumptions used in the analyses and predictions, and the confidence level/limits and uncertainties vis-à-vis impact prediction

1.3 LOCATIONS AND DESCRIPTION OF SITE

The site is located on the peak of the Tigne Peninsula at Sliema at an altitude of 22.5m above sea level (Figure 1). It comprises an area of 2030 m² located in Triq Tigné c/w Triq il-Ponta Ta’ Dragut, Sliema, Malta (Figure 2 and Figure 3).

1.4 STANDARDS AND GUIDANCE

1.4.1 EVALUATION – CONSERVATION POLICIES

The extent of the vulnerability of the water resources shall be evaluated in the light of conservation policies and in accordance with EU Directive 80/68/EEC and 98/83/EC: On the protection of groundwater against pollution.


1.4.2 RELEVANT STRUCTURE PLAN POLICIES

1.4.3 WATER POLICIES

**PUT 8** In order to conserve potable water resources the feasibility of using seawater and second-class water systems in appropriate circumstances shall be investigated.

1.4.4 SITE INVESTIGATION

The site investigation shall be conducted in full accordance with:

- BS 5930: 1999; Code of practice for geological site investigations;
- BS-EN 1997:2004 Geotechnical design- PART 1 General rules;
- BS EN 1997 - 2: 2007 Geotechnical Design – Part 2 : Ground investigation and testing ;

Uniaxial compressive strength tests were done in accordance with BS 5930 and ISRM suggested methods.

1.5 AREA OF INFLUENCE

1.5.1 GEOLOGY, GEOMORPHOLOGY AND HYDROLOGY

The area of influence for geology shall be taken as the area up to a distance of about 500m from the site to include the entire Tigne’ peninsula (*Figure 4*).

1.5.2 QUALITY OF THE STONE MATERIAL

The area of influence for the quality of the material to be excavated shall be marked by the boundary of the site, while the area of influence for the stability of the excavation shall be taken as a line extending to about 20m from the site to include any steeply inclined discontinuity that may impact on the stability of the walls of the excavation at the site and adjacent roads and third party property.
1.5.3 HYDROLOGY

Considering that the proposed excavation shall be an open pit, therefore forming a closed system, the area of influence for hydrogeology shall be represented by the boundary of the proposed site extending down to the water table of the mean sea level aquifer below the site. The Area of Influence for hydrology shall be the run-off catchment downstream of the site (Figure 5). The site lies at the top of a low hill and run-off could in part flow north and partly flow south. The actual path taken by run-off will be determined during the field survey.
1.6 BASELINE SURVEY METHODOLOGY

1.6.1 LITERATURE SEARCH

Based on literature searches and the specialist sub-contracted consultants’ knowledge of the area, a summary of previous survey work undertaken within the study area will be provided as context to the results of the current survey work. It is noted that the writer has undertaken a number of subsurface geological site investigations close to the site associated with the Tigne’ Point development and other developments.

1.6.2 FIELD GEOLOGICAL AND HYDROLOGICAL SURVEY

The rock units present at the site under study belong to the Lower Globigerina Limestone Member. A field geological survey will be undertaken to map the rocks present in the environs of the sites and extending to about 500m from the site to map the rock units down to Member unit. Based on the findings of the surveys the geology of the site will be illustrated by means of a geological map on scale of 1:2500 and cross-sections across the study area.

1.6.3 SUBSURFACE INVESTIGATION

A subsurface investigation was undertaken in 2015 and comprised the drilling of 5 holes each 45m deep.

It is recalled that a number of geotechnical investigation have been undertaken for the construction of apartment blocks and shopping centres very close to the site. The subsurface investigation will aid in the assessing the quality of the stone material to be excavated as well as the extent of jointing of the rock.
1.6.4 STABILITY OF THE EXCAVATION AND QUALITY OF THE STONE MATERIAL

This shall be determined by visual inspection aided by the subsurface geological investigation and laboratory test results. For this purpose 5 holes have been drilled by continuous core sampling extending to 45m below ground level.

1.7 OUTPUT

Following the field work the following data will be produced:

- Geological map of the site and its environs
- Hydrology of the site and its surroundings including the catchment of the site
- Quality of the stone material to be excavated and its potential reuse. This shall be determined by visual inspection and by laboratory testing for:
  - Water absorption
  - Unconfined compressive strength
  - Wet and dry density

A monitoring program will be submitted if deemed necessary.

The stability of the walls of the excavation will also be determined by the field survey and by the subsurface geological investigation and more important, by direct observation during excavation. Depending on the findings recommendations to stabilise the walls of the excavation will be submitted.

1.8 IMPACT ASSESSMENT

An assessment of the geo-environmental impact will be undertaken as follows:

- During construction
- During operation

1.9 RESULTS

The geo-environmental study will describe the:

- Geomorphology (including physiology), palaeontology and geology of the area;
- The quality and quantity of the mineral resources underlying the Application Site;
- The quality and quantity of the waste stone material resulting from excavation;
• The stability of the walls of the proposed excavation through wedge or plane shear failure or through rock fractures produced on exposure of the rock to sub-aerial conditions; and determines
• The hydrology of the area including surface water drainage patterns, flows, and quality;

1.10 METHODOLOGY

1.10.1 COMPETENCE OF SURVEYOR

The Geo-environmental study was undertaken by Saviour Scerri with over 15 years experience in geo-environmental impact assessments.

1.10.2 BASELINE SURVEY METHODOLOGY

(i) LITERATURE SEARCH

There is no particular reference to the geo-environmental resources of Qui Si Sana in the literature with the exception of the occurrence of NE and NW striking faults and fractures sets.

However, the author has undertaken two geological works in the form of field mapping and subsurface geological site investigation at Tigne Point in the vicinity of the site.

(ii) FIELD GEOLOGICAL SURVEY – GEOLOGY AND PALAEONTOLOGY

Field geological survey was undertaken to map the rock units exposed at the site and its environs with particular attention to fractures that may be a risk to the stability of the rock faces during excavation at the site.

The palaeontological importance of the rock units identified was assessed during this survey.

(iii) SUBSURFACE INVESTIGATION

The field geological survey was supplemented by a subsurface investigation to assess the thickness of the strata beneath the site and assess their mineral resource potential by examination of the rock core samples recovered. This was carried out in accordance with BS: 5930: 1999 – Code of Practice for Geological Site Investigations.

For this purpose, three continuously cored holes BH1, BH2, were drilled to a depth of 15m below ground level. Four other holes were previously drilled to examine the rock strata that will support the high-rise tower being proposed.
(iv) RESOURCE QUALITY

The site is underlain by Lower Globigerina Limestone. The mineral resource potential of this rock was assessed by visual inspection of the rock exposed on site as well as by examining the rock core samples recovered for this purposes.

(v) RESOURCE QUANTITY

Based on the findings of the geological / subsurface investigations and the core sample log, the quantity of stone material to be removed was identified and mapped across the site together with the other rock units. The geological survey yielded maps as well as geological cross-sections across the site illustrating the geology and geomorphology of the site and its surroundings. The thickness of the beds was measured in order to calculate the waste stone present beneath the site.

(vi) HYDROLOGY / HYROGEOLOGY

A hydrological / hydrogeological survey was undertaken to map the drainage patterns across the site and downstream of it. This survey identified and described the following features: the mean sea level aquifer, water courses, catchment areas, surface run-off and re-charge.

The hydrological / hydrogeological survey, supplemented by the newly acquired data on the underlying geology, determined the importance of the proposed site in recharging the perched aquifer.

1.11 POLICY CONTEXT AND GUIDELINES

The principal sources of policy and legislative guidance for the Geo-environmental Study are the Structure Plan for the Maltese Islands¹, the North Harbour Local Plan², and the policies relating to development sites. Reference was also made to legislation concerning the pollution of groundwater resources.

1.11.1 GENERAL OVERVIEW

The conservation importance of the geo-environmental features was established by reference to local legislation, the Structure Plan for the Maltese Islands (1990), the North Harbour Local Plan, and the guidance of the Nature Conservancy Council (UK) on Earth Conservation.


The excavation of the Application Site and hence the exploitation and conservation of mineral resources, as well as their vulnerability were assessed in the light of Structure Plan policies as well as the Minerals Subject Plan 3.

The disposal of the excavated material is regulated by LN 337 of 2001 4, and the reuse of the soil is governed by the Fertile Soil (Preservation) Act 1973, as amended in 1980.

**Directive 2006/12/EC.** Community Law controls C&D waste by Directive 2006/12/EC on waste (which replaced Directive 75/442/EEC), better known as the Waste Framework Directive. Based on Article 3 Member States shall take appropriate measures to encourage the recovery of waste by means of recycling, re-use or reclamation or any other process with a view to extracting secondary raw materials. Article 4 asks the Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment, and in particular without risk to water, air, soil and plants and animals and without adversely affecting the countryside or places of special interest. Member States shall also take the necessary measures to prohibit the abandonment, dumping or uncontrolled disposal of waste.

### 1.11.2 RELEVANT LEGISLATION AFFECTING THE GEO-ENVIRONMENTAL RESOURCES

(i) **THE MALTA RESOURCES AUTHORITY ACT (ACT XXV OF 2000)**

This provides for the establishment of an Authority and for the regulation of water, energy and mineral resources. The Authority is charged with regulating, monitoring, and reviewing all practices, operations, and activities related to these resources and to grant the relevant licences or permits for their exploitation. Amongst other functions, the Authority regulates the conservation, augmentation, and operation of water resources and the sources of water supply, and ensures the optimum utilisation of mineral resources and regulates the quality and quantity of minerals extracted.


WATER POLICY FRAMEWORK REGULATIONS, 2004

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4 Waste Management (Permit and Control) Regulations, 2001
The Water Policy Framework establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater. They also transpose the provisions of European Directive 2000/60/EC. The Regulations aim to prevent the deterioration of the status of all bodies of surface water and groundwater, to protect, enhance, and restore all bodies of surface water and groundwater, and implement the necessary measures aimed at progressively reducing pollution, including measures to prevent or limit the input of pollutants into groundwater. In the case of bodies of water affected by human activity, the Regulations seek to achieve the highest possible ecological and chemical status for surface waters, and the least possible changes to groundwater status. The Regulations also require the designation of areas requiring special protection (for the protection of their surface waters and groundwater or for the conservation of habitats and species directly depending on the water) by the end of November 2004.


These Regulations aim to prevent pollution of groundwater from pollutants listed in the Schedules to the Regulations. The Regulations do not apply to: (i) discharges of domestic effluent from isolated dwellings not connected to the sewerage system and situated outside the groundwater protection areas, (ii) discharges containing amounts of the substances in Lists I or II of the Regulations, that are so small as to obviate any present or future danger of deterioration in groundwater quality, and (iii) discharges of radioactive substances. The direct discharge of all List I substances is prohibited by the Regulations, and activities that may lead to indirect discharges of these substances must undergo prior investigation. Prior investigation is also required for the direct discharge of List II substances or for activities that may lead to their indirect discharge. These investigations include examination of the hydrogeological conditions of the area concerned, the possible purifying powers of the soil and subsoil, and the risk of pollution and alteration of the quality of the groundwater from the discharge and are to establish whether the discharge of substances into groundwater is environmentally satisfactory.


These regulate the production, and management of wastes, and promote sound waste management practices to safeguard human health and the environment. The excavation of the Application Site will need to be undertaken in accordance to a Waste Management Permit issued by the Director of Environment Protection as required by this Legal Notice.

(v) FERITILE SOIL (PRESERVATION) ACT (ACT XXIX OF 1973)
This Act provides for the protection of fertile soil by prohibiting its transportation, burying, covering, deposition, or mixing with other materials as to render it unfertile, except with the written permission of the Director of the Agriculture Department. Further provisions under this Act are provided in the *Preservation of Fertile Soils Regulations* (*LN 104 of 1973*).

### 1.11.3 RELEVANT STRUCTURE PLAN POLICIES

In view of the urban context of the Application Site, the relevant geo-environmental Structure Plan Policies relate to Water Resources, Soil, and Mineral Resources.

#### (i) SOIL CONSERVATION POLICIES

**SP Policy AHF 4:** Builds upon existing legislation (the Fertile Soils (Preservation) Act, 1973) and maintains the mandatory conservation of soil and other soil saving measures. The policy also provides for the adoption of soil replenishment measures where suitable opportunities arise.

#### (ii) MINERAL RESOURCES POLICIES

**SP Policy MIN 1:** Safeguards mineral resources from sterilisation through development.

**SP Policy MIN 5:** Includes a presumption against surface mineral working in or near areas of acknowledged interest for ecology, archaeology, and in areas of high quality agricultural land, none of which is relevant to the Scheme.

### 1.11.4 MINERALS SUBJECT PLAN POLICIES

The Minerals Subject Plan deals with the activities of the mineral industry as a whole and provides planning guidance for the next 10 years. The Subject Plan’s policies of relevance to the geological resources are:

- HS 3, HS 4, HS 5, HS 6, HS 7 and HS 8 dealing with the safeguarding and extraction of mineral resources; and

- DC1 to DC 22 dealing with the impacts of such practice.

### 1.11.5 GUIDANCE

Conservation profiles are intended to prevent future potential damage to sites. Since no earth conservation model exists for the Maltese Islands, it has been suggested in past studies (e.g. Debono & Scerri, 1996).

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Mallia et al., 1999⁶) that until such a model is formulated, models used in other countries could be adopted for local use. The conservation model proposed is that adopted by the Earth Conservation Strategy of the Nature Conservancy Council (UK). In this model, sites of geological importance are classified into two groups: Exposure Sites and Integrity Sites. The conservation of the two groups is treated differently.

- **Exposure Sites** are those whose scientific or educational importance lies in providing exposures of a deposit that is extensive or plentiful underground but that is otherwise accessible only by remote sampling. Exposure Sites include outcrops, stream and foreshore sections, and exposures in quarries, pits, cuttings, ditches, mines and tunnels.

- **Integrity Sites** are those whose scientific or educational values lies in the fact that they contain finite and limited deposits or landforms that are irreplaceable if destroyed. These deposits or landforms are usually of limited lateral extent. Examples include caves, karst, glacial and fluvial deposits, and unique mineral, fossil, stratigraphic, structural, or other geological deposit and features (NCC, 1991⁷).

### 1.11.6 EUROPEAN UNION DIRECTIVES

The European Union does not have any directive that regulates mineral extraction *per se*. Neither does it have directives that protect the geo-environment. Of relevance to the proposed development, however, are the directives on the protection of groundwater resources against pollution events (each of which has been transposed into the legislation of Malta):

- **Directive 80/68/EEC**: *On the protection of groundwater against pollution caused by certain dangerous substances*;

- **Directive 98/83/EC**: *On the quality of water for human consumption*; and


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2 PROJECT DESCRIPTION

The proposed development consists of a city 5-star hotel designed for the business traveller. Its accommodation and leisure facilities would therefore be catering for the needs of corporate and upmarket visitors and equipped for meetings, incentives, conferences and events (MICE). The Applicant submits that the market segment which is to be targeted, together with the statement which building shall be making on the Sliema skyline, is expected to focus on the high-end services to the business sector would contribute to the attainment of the objectives of the Malta National Tourism Policy 2015-2020 (Ministry for Tourism, 2015).

The hotel has a footprint of 2506m² and Building footprint of 1770 m². It comprises of 4 storeys below ground level to cater for parking and loading and unloading facilities and 40 storeys above ground level rising to about 117m with ancillary rooftop facilities reaching a little over 120m above ground level.

The proposed plan at ground level is shown in **Figure 6**

![Figure 6: Plan showing layout at Ground level.](image-url)
3 GEOLOGY

3.1 STRATIGRAPHY

The five Late Tertiary rock formations exposed on the Maltese Islands are, from base to top (see Figure 7):

(a) Lower Coralline Limestone (oldest)
(b) Globigerina Limestone
(c) Blue Clay
(d) Greensand
(e) Upper Coralline Limestone (youngest)

In addition to these formations, Quaternary continental deposits are also known to occur sporadically on the Maltese Islands. An unconformity and an erosional surface separate this unit from the underlying marine sedimentary succession.

The only rock unit preserved in the Study Area are:

- Phosphate conglomerate bed
- Lower Globigerina Limestone Member (Figure 7)

Younger rock formations are not preserved. The Lower Coralline Limestone Formation is exposed at Dragut Point some 500m to the Northeast of the Application Site.

Figure 7: Stratigraphic column

(i) QUATERNARY RED BED DEPOSITS

Quaternary continental deposits along the coastline at Qui Si Sana consist primarily of small solution caverns filled with red conglomerate, speleothems and fissure infills.

It is interesting to note that these Quaternary deposits are always associated with faults and are common along the faults that line most of the Sliema coastline. Their colour would suggest a
different climatic regime different from the present. They may also contain fossil continental fauna
and, for this reason, they also possess palaeoclimatic significance.
Figure 8: NW-SE Geological cross-section across the site
3.2 STRUCTURAL GEOLOGY

At the Application Site, the strata are generally massive bedded and their dip is generally near horizontal, as can be seen in well-exposed rock that makes up the Qui Si Sana coastline.

3.2.1 FAULTING

The Application Site lies next to the northeast coastline which is heavily dissected by a fracture set oriented NE-SW. A conjugate fracture set oriented NW-SE is also present. The faults have throw that is of the order up to a few metres. (See X-section Figure 9). This intense fracturing appears to die out moving inland from the coastline.

Figure 9: Potential failure modes in an excavation

Evidence of faulting has been seen at the coastline and in the excavation next to the site. Fault seen are oriented NW-SE and have a throw of the order of a few m.
For the above reasons, it is imperative to ascertain the potential impacts of the cuttings related to the Application Site and the impacts of excavation on 3rd party interests on the margin of the proposed excavations within the Application Site.

The possible failure modes that may occur in a cutting due to fractures that daylight into the excavation are illustrated in [Error! Reference source not found.].

Failure of wedges that daylight into the excavation may occur in 3 modes as illustrated in the figure.

- a) Failure of a rock wedge created by the intersection of two discontinuities
- b) Failure along a dipping plane
- c) Failure of rock wedge along a dipping plane at an edge defined by two vertical walls perpendicular to each other
4 SITE INVESTIGATION – MINERAL RESOURCE ASSESSMENT

4.1 FIELD WORK

The Terms of Reference require a mineral resource assessment, which with the agreement of MEPA included the drilling of two deep continuous cores drilled to a depth ranging from 18m to 25m. It transpired that a site investigation had already been undertaken in 2015. This comprised of 5 holes BH1, BH2, BH3, BH4 and BH5 drilled to a depth of 45m. In boreholes BH1 to BH4 core sampling was started at 15m while in BH 5 sampling was started at 10m below ground level. The location of the boreholes is shown in Figure 10.

Drilling was carried out by Terracore using a T44 crawler mounted hydraulic rotary drill with water flushing and a T2 86 double tube 3m long Core Barrel, which produced a rock core sample with nominal diameter of 71mm.

The cores recovered were logged, photographed, and taken to the laboratory of Civil Engineering and Architecture of the University for testing. Photographs of the core samples recovered from BH5 are attached in Appendix 1 at the end of this report.

Drilling data is summarised in Table 1.

In addition to the core samples a visual assessment of the rock could be made on the walls of the excavation next to the site which was cut in 2007. Photos of the excavation are found in Appendix 2.
Figure 10: Site plan showing borehole locations
Field Drilling works are summarised in Table 1 below.

<table>
<thead>
<tr>
<th>Date drilled</th>
<th>18/04/2015</th>
<th>23/04/2015</th>
<th>18/04/2015</th>
<th>24/04/2014</th>
<th>27/04/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of B/R (m)</td>
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<td>0.50</td>
<td>0.70</td>
<td>0.50</td>
<td>0.30</td>
</tr>
<tr>
<td>Open Hole (m)</td>
<td>0.00-15.00</td>
<td>0.00-15.00</td>
<td>0.00-15.00</td>
<td>0.00-15.00</td>
<td>0.00-10.00</td>
</tr>
<tr>
<td>Core Recovery (m)</td>
<td>15.00-45.00</td>
<td>15.00-45.00</td>
<td>15.00-45.00</td>
<td>15.00-45.00</td>
<td>10.00-45.00</td>
</tr>
<tr>
<td>Total depth (m)</td>
<td>45.00</td>
<td>45.00</td>
<td>45.00</td>
<td>45.00</td>
<td>45.00</td>
</tr>
</tbody>
</table>

Note. All depths are from ground level

Table 1: Borehole drilling summary

4.2 RESULTS OF THE INVESTIGATION AND INTERPRETATION

4.2.1 LITHOLOGY

Samples recovered consisted of.

Lower Globigerina Limestone. Yellow to Cream, fine grained LIMESTONE, no weathering, fractures closed and slightly stained. Changes to grey, fine grained LIMESTONE between 36 to 30m.
### 4.2.2 Rock Quality Designation (RQD)

<table>
<thead>
<tr>
<th>Borehole / Run Number</th>
<th>TCR%</th>
<th>RQD%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BH1 Run 1</strong></td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td><strong>BH2 Run 1</strong></td>
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<td>90</td>
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<tr>
<td><strong>BH3 Run 1</strong></td>
<td>100</td>
<td>83</td>
</tr>
<tr>
<td><strong>BH1 Run 2</strong></td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td><strong>BH2 Run 2</strong></td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td><strong>BH3 Run 2</strong></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>BH1 Run 3</strong></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>BH2 Run 3</strong></td>
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<tr>
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<td>100</td>
</tr>
<tr>
<td><strong>BH1 Run 4</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH2 Run 4</strong></td>
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<td>87</td>
</tr>
<tr>
<td><strong>BH3 Run 4</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH1 Run 5</strong></td>
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</tr>
<tr>
<td><strong>BH3 Run 9</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH1 Run 10</strong></td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td><strong>BH2 Run 10</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH3 Run 10</strong></td>
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<td>100</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Borehole / Run Number</th>
<th>TCR%</th>
<th>RQD%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BH4 Run 1</strong></td>
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<td><strong>BH5 Run 1</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 2</strong></td>
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<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 3</strong></td>
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<td>100</td>
</tr>
<tr>
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<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 4</strong></td>
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</tr>
<tr>
<td><strong>BH5 Run 4</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 5</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH5 Run 5</strong></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 6</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH5 Run 6</strong></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 7</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH5 Run 7</strong></td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 8</strong></td>
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<td>92</td>
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<td>100</td>
</tr>
<tr>
<td><strong>BH4 Run 9</strong></td>
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<td>100</td>
</tr>
<tr>
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<td>100</td>
</tr>
<tr>
<td>BH4 Run 10</td>
<td>100</td>
<td>100</td>
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<tr>
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</tr>
</tbody>
</table>

Table 2: Listing of the core recovery, and Rock Quality (RQD)

The rock core recovered can be classified as very good to excellent.

Progress of excavation works should be monitored by an experienced geologist to identify any discontinuities anticipated to daylight in the excavation.

4.3 GROUNDWATER

Groundwater was measured from BH1 and BH4 and was found to be at 22.85m below current level. Considering the altitude at the site this means that the water table lies at sea level.

4.4 LABORATORY TESTING

20 samples were selected for uniaxial unconfined compressive strength (UCS), testing being done at the materials testing laboratory of Terracore Ltd.

Testing was undertaken to the following standards:

- Determination of Compressive Strength of Rock according to BS5930:1999 and ISRM Sugg. Method
- Determination of Water Absorption and Bulk Specific Gravity according to BS5930:1999 and ISRM Sugg. Method

The test results are listed in Table 3.

The relevant test certificates are attached to this document as Appendix 3.
<table>
<thead>
<tr>
<th>Sample No</th>
<th>BH No</th>
<th>Depth</th>
<th>Avg Bulk density</th>
<th>Avg Dry density</th>
<th>Compressive Strength</th>
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<td></td>
<td></td>
<td>(m)</td>
<td>(kg/m³)</td>
<td>(kg/m³)</td>
<td>(N/mm²)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>17.7</td>
<td>1939</td>
<td>1667</td>
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</table>
Unconfined compressive tests results of the 20 samples tested vary from 4.0MPa to 12.5MPa, with an average of 7.8Mpa. The values are slightly less than those usually obtained for Franka stone.

![UCS vs Depth](image)

**Figure 11: Diagram showing Unconfined Compressive Strength in relation to depth**

### 4.5 RESOURCE ASSESSMENT

1. A geotechnical investigation was carried out in connection with the proposed development in Fort Cambridge.

2. This comprised the drilling of 5 borehole with open hole drilling and continuous rock core recovery down to 45m

3. Samples recovered were very good to excellent with low fracture frequency.

4. Fractured were closed, <1 and stained.

5. It is recommended that excavation is done in phases and monitored by a geological engineer.

6. Unconfined compressive strength varied from 3.9 MPa to 12.5 Mpa

### 4.6 MINERAL RESOURCE ASSESSMENT

#### 4.6.1 METHOD
The quality of the stone material was assessed on the basis of:

- Visual assessment and logging of rock cores recovered from the site investigation;
- Laboratory test results
- Visual examination of equivalent rocks exposed in cuttings at Qui Si Sana and along the Sliema coastline.
- Historical experience of use of the local stone material in the Sliema Area.

4.6.2 ASSESSMENT

Rocks belonging to the Lower Globigerina Limestone Member do not yield suitable aggregate. The excavated material could be used for mass concrete, fill and screed.

*Volume of poor quality rock (Waste stone material) about 26000m³*
5 GEOMORPHOLOGY

5.1 GEOMORPHOLOGICAL UNITS PRESENT

The site lies on an elongated low ridge forming part of the Tigne promontory, the western promontory at the entrance to Marsamxett Harbour. It is bounded by the Qui si Sana coastline to the north and the Tigne coastline to the south; it is oriented NE-SW approximately parallel to the main fault trend of the island.

The coastline is slightly raised and small caverns have been formed by the hydraulic action of wave breakers on weak rock zones generated by intense jointing associated with minor faults. The best known caves are however those known as Ghar id-Dud and Ghar il-Lembi, outside the area of influence of the proposed development.

With the exception of some segments of the coastline most of the geomorphology has now been irreversibly modified by substantial removal of rock strata at each apartment building block that has been constructed recently. The area is largely built up (Figure 11). There is practically no open space left with the exception of a playground which likewise represents disturbed terrain and the littoral zone.

In areas of past developments, where no excavations have been undertaken, the geomorphology has been heavily degraded.

5.2 SOILS

Tigne peninsula is entirely developed (built up) and no organic soils are present.
Figure 12: Google map showing the intense built development of the Tigne Promontory
6 HYDROLOGY AND HYDROGEOLOGY

6.1 HYDROLOGICAL AND HYDROGEOLOGICAL FEATURES

The area is mostly developed and no surface hydrological features like watercourses, wells, channels etc., exist. The hydrogeological and hydrological features close to the Application Site are:

- The mean sea level aquifer;
- Sliema coastline;
- Catchment of the site.

6.1.1 THE MEAN SEA LEVEL AQUIFER

The geological survey indicates that the stratigraphic sequence in the vicinity of the Application Site comprises Lower Globigerina Limestone underlain by Lower Coralline Limestone (see Figure 4).

The site is underlain by Lower Globigerina Limestone which at sea level is represented by grey clayey beds which are mostly impermeable. Owing to its low permeability, Lower Globigerina Limestone is not recognised as an aquifer for this reason no aquifer is expected to be developed in the Tigne peninsula.

Figure 13: Watersheds of the site (Area of Influence for Hydrology and Hydrogeology)
6.1.2 SITE CATCHMENTS

The site lies on a ridge and most of the overland flow is led by the perimeter streets to be discharged as diffuse discharge at Qui Si Sana on the northern coastline or discharged at the Ferries along the southern coastline (Figure 13.)

As the catchment is dissected by a road network the path taken by run-off will follow the sloping roads as shown in Figure 14. (Appendix 1 Plate 1 and Plate 2)

As the site is already built up no changes in the hydrological /hydrogeological conditions are expected.

Figure 14: Map showing the path taken by run-off as it spreads out from the site
7 MINERAL RESOURCE ASSESSMENT

7.1 METHOD

The quality of the stone material was assessed on the basis of:

- Visual assessment and logging of rock cores recovered from the site investigation undertaken in 2015;
- Visual examination of equivalent rocks exposed in a cutting next to the site and at Qui Si Sana and along the Sliema coastline.
- Laboratory test results. These show that the rock is relatively weaker than the normal Franka stone.
- Historical experience of use of the local stone material in the Sliema Area. The area is not known for extraction of good quality franka stone.

VISUAL ASSESSMENT

Rock belongs to the Lower Globigerina Limestone Member “soll unit”. Owing to its clay content does not yield suitable concrete aggregate.

LABORATORY TESTING

The unconfined compressive strength listed in Table 3 show that the rock is appreciably weaker than franka stone.

7.2 QUANTITY OF STONE MATERIAL TO BE EXCAVATED

The quantity of stone material to be excavated (Waste stone material) is about 26,000 m³. It may be used as screed; mass concrete and trench fill material.
8 IMPACT ASSESSMENT

8.1 POTENTIAL IMPACTS AND RISKS DURING CONSTRUCTION

8.1.1 SITE LOCATION CONSIDERATIONS

The site lies on a peninsula, which with the exception of the littoral zone has been completely disturbed long ago. Site investigation has revealed that grey clayey Lower Globigerina Limestone extends well below sea level. This rock is impermeable and does not form an aquifer For this reason no mean sea level aquifer is developed beneath the site.

During the construction phase the site is considered to be like many other building sites scattered all over the island. Incidents involving contamination coming from a building site normally do not happen. Dust emissions could emerge during excavation works on dry windy days.

No impact on the geo-environment is envisaged. There is a potential risk of spillage of fuel and lubricants. This is avoided by storing fuels and lubricating oils in appropriate containers and proper storage. Lubricants in a construction site, during the excavation phase in particular, if spilled could easily find their way to the coastline through open fissures.

8.1.2 RE-USE OF EXCAVATED MATERIAL

The large volume of waste stone material may be difficult to reuse and has to be deposited at a designated site (Disused quarry).

8.1.3 DUST EMISSIONS

Stone material could be spilled during haulage. Run-off could carry this material to the coastline and discharged at sea. For this reason loaders should not be filled to the brim. Besides, a protective cover should be used to prevent spillage of excavation material and dust emissions, especially on dry windy days.

Once excavated the site will form a closed system and there is no risk of excavated material being transported to the coastline by run-off.
The only potential risk will arise if excavated stone material is stacked at road level before being carted away. However, in present-day excavations, the excavated material is immediately transported to waste stone material designated sites.

8.2 POTENTIAL IMPACTS AND RISKS DURING OPERATION

During operation the most common impact on the geo-environment may be due to waste such as leaking sewers which would degrade the geo-environment and could find its way to the coastal waters. Regular inspection of the sewer effluents would ensure their correct operation.

8.2.1 POTENTIAL IMPACTS

To summarise, the potential impacts arising from the construction and operation of the proposed construction project on the sensitive receptors (Mainly hydrology and hydrogeology) included:

- Removal of rock beds which is an irreversible process as geological strata take millions of years to accumulate and form a sedimentary rock deposit.
- Contamination of run-off downstream of the site (run-off). Once excavation is in progress the site shall be a closed system. Any spillages or accidents will be contained within the site boundary.
- Production of a large quantity of waste stone material which may be difficult to reuse or recycle.
- Degradation of the geomorphology. This project is practically a redevelopment. The site like the rest of the Tigne peninsula has already been disturbed years ago.

8.2.2 IMPACT SIGNIFICANCE

This section includes, for each potential impact the following information:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect; and duration of impact (temporary/permanent);
- Adverse or beneficial impact and reversible/irreversible impact;
- Sensitivity of receptor (residential dwelling, business outlets, etc.).
• Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and

• Scope for mitigation/enhancement (very good, good, none).

Based on the above criteria, a summary of the significance of the impact will be considered:

• **Insignificant** – little or no change to
  
o the hydrologic regime or geological / geomorphological regime;

• **Minor significance** - change to the geological/ hydrological/hydrogeological regimes with scope for mitigation.

The only significant impact of the project is the production of large quantities of waste stone materials.

Spilled fuel oils and other noxious substances may flow superficially and discharge along the coastline.

Any noxious substance discharged into the rock will percolate or may be washed and discharged at the coastline.

8.3 **MITIGATION**

Waste stone material can be used to produce mass concrete, screed and trenching fill.

Fuels and other noxious substances that may be needed during construction should be stored in specially designated areas.

8.3.1 **DURING CONSTRUCTION**

During construction, the construction site will be more or less similar to a normal building site with use of excavation and construction equipment.

8.3.2 **DURING OPERATION**

Discharge of wastes such as sewer due to accidental leakage could find its way to the coastline and degrade the coastal waters.
### 8.4 SIGNIFICANCE OF LIKELY IMPACTS

#### Table 4: Significance of likely impacts on Water Quality

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly beneficial</td>
<td>Developments for the treatment of run-off or groundwater</td>
</tr>
<tr>
<td>Beneficial</td>
<td>Natural Processes that are intended to purify run-off or groundwater such as reed beds</td>
</tr>
</tbody>
</table>
| Neutral             | - Developments that require the catchment of water and recirculation such as turf grass cultivation with underlying membrane to catch excess irrigation water to be recycled.  
                        | - Spillage of fresh water say from a water bowser                                                                                         |
| Adverse             | All spillages/leakages change the quality of groundwater normally by contaminating it and therefore are adverse                                 |

#### Table 4: Significance of likely impacts on Water Quality

<table>
<thead>
<tr>
<th>Significance of likely impacts on Mineral resources (Policies Min 1, MIN5 and MIN 6, subject plan Policies HS 3, HS 4, HS 5, HS 6, HS 7 and HS 8, DC1 to DC 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of significance</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Insignificant</td>
</tr>
</tbody>
</table>
### Table 5: Significance of likely impacts on Mineral resources

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly beneficial</td>
<td>Developments that will protect or enhance mineral deposits for posterity</td>
</tr>
<tr>
<td>Beneficial</td>
<td>Developments that will recycle mineral resources</td>
</tr>
<tr>
<td>Neutral</td>
<td>1a) Developments that do not involve removal of geological strata</td>
</tr>
<tr>
<td></td>
<td>b) Excavations (moderate) with possibility to fully recycle moderate</td>
</tr>
<tr>
<td></td>
<td>amounts of stone material</td>
</tr>
<tr>
<td>Adverse</td>
<td>a) Sterilisation of mineral resources</td>
</tr>
<tr>
<td></td>
<td>b) Production of excessive amounts of mineral resources</td>
</tr>
<tr>
<td></td>
<td>c) Destruction of mineral resources such as conventional</td>
</tr>
<tr>
<td></td>
<td>excavations in good franka stone</td>
</tr>
<tr>
<td></td>
<td>d) Production of waste stone material with no scope for recycling</td>
</tr>
</tbody>
</table>

A summary of the impacts and risks of the proposed development is presented in a tabulated form in the foregoing paragraphs.

### 8.5 MONITORING

#### 8.5.1 DURING OPERATION

Periodic checks of the sewage effluents and other waste disposal systems would ensure that no harmful substances are leaked to the ground. Groundwater analysis as part of the baseline study would produce a baseline water quality which would serve as a base for future monitoring of the water quality.
8.6 WASTE MANAGEMENT PLAN (WMP)

In view of the waste stone material that will be generated, a waste management plan is available for the construction phase (in particular) and operation phase of the site to cater for the wastes generated during construction and operation of the site.

8.7 RESIDUAL IMPACTS – THE CUMULATIVE EFFECT

Although a development site might be considered to have little impact on each of the components of the Geo-Environment: Geology including mineral resources, geomorphology, palaeontology, geomorphology, soils, hydrology and hydrogeology - the residual impact is always present.

The building of a house or even perhaps a larger development site, nowadays accompanied by excavation for a basement will always be accompanied by:

- Loss in reserves of mineral resources
- Increase in waste stone material
- Loss of geological strata
- Loss of geomorphology
- Loss of soil
- Increase in run-off or decrease depending on availability of storm water storage reservoir/s
- Loss of recharge
- Loss of groundwater quality - leakage of sewers pollution of run-off e.g. traffic or acid rain
- Loss of recharge to the aquifers

All these impacts, arising from a single building or larger development site, might be very small indeed and would cause no significant change to the Geo-Environment when taken on a one – by- one basis. But, collectively they would produce a town with all the accompanying cumulative negative impacts on the geo-Environment that are usually associated with towns and large villages.
9 REFERENCES


- Hoek E., 2001 Practical Rock Engineering


**Identification of Groundwater Bodies**


- Malta Environment and Planning Authority 2004, Structure Plan Review Public Consultation

- Planning Authority 1990, Structure Plan for the Maltese Islands

- 1996, Mineral resource Assessment

- Rockscience 2004, DIPS 5 Interactive analysis of orientation based geological data.


- Terracore May 2015 (Internal report): Site investigation at Fort Cambridge hotel - geological sub-surface investigation report


APPENDIX 1 - PLATES

Plate 1: View of triq Tigne running in front of the site

Plate 2: Triq Ponta ta’ Dragut running west of the site
Plate 3: Triq Sant’Antnin in Triq Tigne leading to the coastline

Plate 4: Triq Locker branching from triq Tigne’ leading to the coastline
Plate 5: View of the excavation undertaken in 2007 in Fort Cambridge

Plate 6: Fissures in the excavation for the fort Cambridge Project
Plate 7: another view of the wall of the excavation for the Fort Cambridge project

Plate 8: another view of the wall of the excavation for the Fort Cambridge project
Plate 9: Photograph showing samples from BH 5 Run No1 and Run No2

Plate 10: Photograph showing samples from BH 5 Run No3 and Run No4
Plate 11: Photograph showing samples from BH 5 Run No5 and Run No6

Plate 12: Photograph showing samples from BH 5 Run No7 and Run No8
Plate 13: Photograph showing samples from BH 5 Run No9 and Run No10

Plate 14: Photograph showing samples from BH 5 Run No11 and Run No12
### APPENDIX 3 – SUMMARY OF IMPACTS AND RISKS DURING OPERATIONS AND MITIGATIONS

<table>
<thead>
<tr>
<th>Impact</th>
<th>Extent</th>
<th>Duration</th>
<th>Adverse/ Beneficial</th>
<th>Reversible/ Irreversible</th>
<th>Sensitivity of receptor</th>
<th>Probability of impact occurring</th>
<th>Scope for mitigation</th>
<th>Significance</th>
<th>Mitigation Measures</th>
<th>Residual impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology: loss of rock strata</td>
<td>Site</td>
<td>Permanent</td>
<td>Adverse</td>
<td>Irreversible</td>
<td>Little</td>
<td>remote</td>
<td>None</td>
<td>low</td>
<td>None. Marine Sedimentary rocks such as Lower Coraline Limestone require millions of years to form</td>
<td>Loss of rock strata equal to the volume of rock excavated</td>
<td>Insignificant as the volume of rock strata removed is relatively very small. However when a number of excavations from small developments are put together the sum of the impacts may be very high</td>
</tr>
<tr>
<td>Mineral resources excavation of substantial quantities of stone material</td>
<td>Site</td>
<td>Permanent</td>
<td>Adverse</td>
<td>Irreversible</td>
<td>Sensitive</td>
<td>unlikely</td>
<td>Reuse of excavated stone material</td>
<td>low</td>
<td>Reuse as mass concrete screed and trenching fill</td>
<td>In the short term it would be difficult to reuse all the material and therefore some may have to be disposed in disused quarries</td>
<td>May be high depending on the ability to reuse the stone material</td>
</tr>
<tr>
<td>Hydrogeology: Pollution through spillage of oil fuels associated with a normal construction site.</td>
<td>Site, but likely to spread during percolation</td>
<td>temporary</td>
<td>Adverse</td>
<td>reversible</td>
<td>sensitive</td>
<td>unlikely</td>
<td>Yes: Applying good drilling practice and implementation of the waste management plan</td>
<td>moderate</td>
<td>Avoid fuelling and servicing of vehicles on site</td>
<td>Possible</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Stability of the walls of the excavation during construction</td>
<td>Site</td>
<td>Temporary</td>
<td>Adverse</td>
<td>reversible</td>
<td>Sensitive</td>
<td>uncertain</td>
<td>Yes: monitor site walls during excavation</td>
<td>moderate</td>
<td>Monitor walls during excavation</td>
<td>Rock wedge stabilisation may not be permanent</td>
<td>Moderate to Very high</td>
</tr>
<tr>
<td>Coastal: Pollution through minor spillage of sewage</td>
<td>Coastline</td>
<td>temporary</td>
<td>Adverse</td>
<td>reversible</td>
<td>Sensitive</td>
<td>remote</td>
<td>Yes: monitor sewage effluents regularly</td>
<td>Very high</td>
<td>Good maintenance of sewage effluents</td>
<td>Residual hydrocarbons absorbed in soil or rock are very difficult to remove</td>
<td>Very high</td>
</tr>
</tbody>
</table>

Table 6: Summary of Impacts and Risks during Construction and Mitigations

Table 7: Summary of Impacts and Risks during Operation and Mitigations