TN 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZJONI, ĦAS-SAPTAN, GĦAXAQ (TN160087)

ENVIRONMENTAL PLANNING STATEMENT
TECHNICAL APPENDICES

Version 1: August 2016

Report Reference:

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Technical Appendix 1

TERMS OF REFERENCE AND METHOD STATEMENTS

Supporting Documents for

Environmental Planning Statement

TERMS OF REFERENCE[1]

FOR THE PREPARATION OF AN

ENVIRONMENTAL PLANNING STATEMENT

June 2016

DISCLAIMER:

1. **The assessment shall in no way be constrained or conditioned by the content, structure, or limitations of this document, and ERA reserves the right to amend the TORs, even significantly, as necessary. Such amendments may include: additional studies or extension of studies; omission or downscaling of any studies deemed irrelevant or unimportant; changes to methodology, format or level of detail; and any other modifications as ERA deems appropriate once a clearer picture of the proposal is available. The content of this document shall in no way constitute an exemption from the ensuing requirements, nor shall ERA be responsible or liable for any issues, difficulties or claims arising from variations from this document.**

2. **EIA Terms of Reference are primarily intended to guide the EIA process, rather than as a basis for tendering, subcontracting, calls for expression of interest, or other purposes even if ancillary to the project. Any use for such purposes is at the sole risk of the user.**

Note 1: The Environment and Resources Authority (ERA) reserves the right to modify these Terms of Reference according to any relevant environmental and planning considerations that may emerge at any relevant stage of the EIA or the permit application process, as well as in the event of any changes or updates to the proposed development. ERA also reserves the right to request additional or amended studies should the findings of the EIA be insufficient to adequately inform the decision-making process or if the EIA identifies matters which should be subject to further investigation.

Note 2: Unless otherwise agreed with ERA, all requirements set out in these Terms of Reference are to be complied with. If there are any aspects that the consultants deem irrelevant to this study, or if at any stage the consultants discover any environmentally-relevant aspect (not included in these Terms of Reference) that needs to be studied, the consultants shall inform ERA immediately, justifying their reasoning.

Note 3: Difficulties, including technical difficulties and lack of information, encountered by the consultants in compiling the required information shall be made clear in the EIA. All references to published works and sources of information shall be duly acknowledged in a manner that enables tracing of the information source and verification. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the consultation period and thereafter, and for record-keeping and unhindered perusal by ERA. Any material which is based on unavailable proprietary data shall not be incorporated by reference.

Note 4: Any requirement for confidentiality of any section or detail of the EIA must be strongly justified and a formal request in this regard must be submitted to ERA. Should ERA grant confidentiality, alternative material that is still adequate for proper assessment, public consultation and decision-making must be provided.

Note 5: Agreement on method statements, and ancillary liaison with ERA, is not mandatory but is recommended. Nevertheless, ERA reserves the right to disagree with the methodology proposed, including proposed areas of influence, and with the EIA submissions in general, and to factor such disagreement in its critique of the EIA.

Note 6: During review of the EIA, ERA will submit comments for the consultants' consideration, as relevant. Following the consultants' response to ERA satisfaction, a revised second draft of the EIA, addressing the comments, will normally be required. This may take the form of a complete resubmission or of an Addendum detailing the revisions to the previous submissions, as deemed most expedient by ERA, taking into account continuity and traceability of the information, and overall user-friendliness vis-à-vis subsequent review, presentation, public consultation, record-keeping and decision-making. A complete resubmission will generally be required if changes are numerous or complex, whereas an Addendum may be preferred if changes are more limited.

Note 7: The consultants are not exonerated from obtaining any formal authorisation from ERA, and from other relevant entities, vis-à-vis any activity ancillary to the EIA (*e.g.* collection, sampling, capture, or waiver of access restrictions) wherever such authorisation is legally required.

Note 8: These Terms of Reference, and all ancillary correspondence, are issued without prejudice to the ERA position on the project and to ERA's final decision. Accordingly, their issuing (even when customised to address specific project details) should not be construed as evidence in favour or against the project or any component thereof, unless the contrary is clearly stated.

An Environmental Planning Statement (EPS) is to be prepared for *TRK 160087: Demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq*, as required by the Environmental Impact Assessment Regulations, 2007 (S.L. 549.46). The required components of the EPS are:

i. A **Coordinated Assessment Report**, in conformity with the following Sections of these Terms of Reference. This report should assess the project in its totality;
*[**Note:** The coordinated assessment should seek to analyse and integrate the main considerations emerging from the technical reports, rather than just reproducing excerpts from the reports.]*

ii. A separate **Appendix (or Appendices)** containing all original survey reports as prepared by the individual specialist consultants for specific topics;
*[**Note:** Experts contributing to the EPS should be specifically asked to consider impact interactions and cross-cutting issues, and to communicate information between each other accordingly].*

iii. A separate **Non-Technical Summary** of the EPS, in both the Maltese and English languages. This should have enough details for the public to understand the project and the related environmental considerations, and should be written in reader-friendly language (*e.g.* avoiding unnecessary technical jargon);

iv. A **declaration of conformity** with sub-regulations 28 and 29 of the EIA Regulations (refer to Appendix 1 to these Terms of Reference); and

v. An addendum detailing the **feedback received from stakeholders, from the public, and from ERA** during the relevant consultation stages of the EPS, and how they were addressed.

Wherever relevant and appropriate, all components of the EPS should include tables and figures (*e.g.* maps, plans, photographs, photomontages, charts, graphs, diagrams, cross-sections) and quantifications**.**

The complete EPS (including all the above components) should be submitted as a printable digital copy (in .pdf format, with copying fully enabled throughout) <u>and</u> as a printed copy. Likewise, once the EPS has been certified, both a printable digital copy (in .pdf format, with copying enabled throughout) and a printed copy of the certified document is to be submitted to ERA.

Wherever any other study not forming part of the EPS is also envisaged, this is to be submitted separately from the EPS. Cross-referencing between the EPS and any such study should be clear and reasonably limited, such that both of the following considerations are duly satisfied:

1. Alerting the reader to the fact that the aspect in question is also being addressed in another parallel study; and
2. Enabling the reader to easily follow both the EPS and the other studies as stand-alone documents.

More detailed specifications are identified in the following pages.

1.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT AND ITS CONTEXT

The description of the proposal is to include the aspects outlined below, and should take into account the entire proposal and any ancillary facilities and infrastructure connected with, or arising due to, the project.

1.1 Justification for the Proposal

1.1.1 Objectives

The purpose and objectives of the proposal and whether these are related to current legal obligations, policies or plans.

The assessment is to provide a detailed justification with respect to the relocation of the existing fuel storage depot at the 31st March 1979 depot at Birżebbuġa, including any relevant safety issues.

1.1.2 Demand

The current and expected requirement or demand for the proposed land uses, also explaining how the proposal will address the requirement/demand.

1.2 Description of the Physical Characteristics of the Whole Project and the Land Use Requirements during the Construction, Operational and Decommissioning Phases

The following aspects should be addressed for all phases of the project, clearly distinguishing between aspects relating to construction phase, operational phase, decommissioning phase, or more than one phase. References to construction phase and decommissioning phase also include ancillary site preparation, clearing, excavation, demolition/dismantling, and site reinstatement works, as relevant.

1.2.1 General characteristics

Description of the proposed development including size, area, height, volume, configuration/layout, general design, location and proposed elevations of buildings, hard and soft landscaping, access arrangements, boundary demarcation arrangements, land use requirements, and land take of ancillary facilities (including infrastructure, storage, servicing, security etc.). The description is to be consistent with the details submitted in the relevant permit application, throughout both the EIA process and the development permission application process.

1.2.2 Operational and production processes

The relevant operational and production processes and their main characteristics, including:

- The nature and quantity of materials used or generated;
- The source, type, quantity, composition and concentration of residues and emissions including water, air, soil pollution, noise, vibration, light, heat, radiation etc. resulting from the proposed project; and
- The expected annual and total emissions, including Greenhouse Gases (GHG), and the contribution to total national GHG emission on an annual basis.

1.2.3 Project management

An indicative framework outlining the key parameters and site management arrangements during construction, operation and decommissioning phases, including:

- Works methodology;
- Expected duration of all phases, as well as season, frequency and duration of interventions;
- Depths and volumes of excavation, and type of material to be excavated; and
- Types and quantities of raw materials and primary resources to be consumed, including water, energy, stone and other resources, and measures to reduce such consumption.

1.2.4 Access, transportation and related infrastructure

1. A forecast of the type, quantity and size of vehicles envisaged during each phase and their respective frequency of use, as well as an identification of the routes that vehicles will use to/from and within the site. The required arrangements should also be compared with the relevant existing situation (in terms of structural considerations, stability and state of roads, road width and gradient, turning circles and junctions, type of surfacing, and other physical or environmental constraints, etc). Interventions that would need to be carried out to accommodate the required vehicles (*e.g.* new or altered access roads), and sites/buildings/structures/features likely to be affected as a result, should be identified accordingly.

2. Facilities for the storage, parking, on-site servicing, loading/unloading of equipment, vehicles and other machinery.

1.2.5 Water, sewerage, runoff management, energy, telecommunications, and ancillary infrastructure

1. Estimates of water management specifications of the development and the identification of the sources of water to be used, including the following:
   - The features and processes of the proposed development and its ancillary facilities which consume water, including estimates of water consumption and runoff/effluent generation during operation;
   - The sources of water (*e.g.* second-class water, public potable water mains, on-site production) envisaged to meet the projected demand;
   - The water-saving measures, if any, that are envisaged (*e.g.* use of low-flow fittings, reuse of harvested storm water runoff and rainwater, treatment and reuse of grey water/sewage), and details as to how such water will be used/managed; and
   - The facilities and structures to be installed in connection with the above (*e.g.* water production, purification, collection, storage, distribution and saving) including estimates of the sizing of pipelines, reservoirs and equipment.

2. Estimates of the energy-related specifications, including:
   - The features and processes of the proposed development and its ancillary facilities which consume energy, including estimates of consumption during operation. The analysis should consider, as relevant, the connected load (in MW or MVA), the overall power factor, the annual MWh split in terms of end-use (lighting, climate cooling/heating/ventilation, plant etc.) which reflects the expected use of the facilities;
   - The energy sources envisaged to meet the projected demand;
   - The facilities and structures to be installed in connection with the above (*e.g.* energy production, storage, distribution and saving) including estimates of the sizing of cables, buildings and equipment; and
   - The expected energy performance of the proposal, including building orientation, natural ventilation, construction materials, integration of low/zero-carbon technologies to meet energy needs; avoidance of features which increase energy consumption; and energy efficiency measures in the finishing and operation of the development.

3. Infrastructural services and utilities related to water and power supplies, sewerage, telecommunications and runoff management, and ancillary works (*e.g.* trenches, tunnels, culverts, switching/transformer stations, pumphouses, inspection chambers).

4. The extent to which the project can realistically be self-sufficient with regard to its energy and water needs, through appropriate measures such as the efficient use of energy and water, collection of rain and storm water for reuse, reuse of treated wastewater/sewage, technologies that reduce energy consumption, and the integration of alternative energy sources. Alternatives in terms of design, fabric and orientation of the buildings should also be explored and assessed.

1.2.6 Waste management

1. A sufficiently detailed indication of the waste management implications likely to arise from the project, including wastes generated by ancillary facilities and wastes which may arise from accidental spillages and leakages and from repair works. Wastes should be subdivided according to the relevant project phases.

2. The following information is to be provided for each waste stream, as relevant to each phase:

- Identification of processes or activities that would result in waste generation;
- European Waste Catalogue Codes for each waste stream, as per relevant legislation;
- The projected quantities and rate of generation for each type of waste;
- Information on waste handling and storage, on site as well as off site; and
- The method of transportation and frequency.

This information should be presented in table format as follows, and should also include cross-references to the relevant regulations, particularly The Waste Regulations (Legal Notice 184 of 2011 as amended):

Phase	Type of waste	EWC Code	H-Code	Activity (*e.g.* sanding, scraping, power washing etc.)	Estimated quantities	Final permitted disposal location

3. The envisaged waste management arrangements using the Best Practicable Environmental Options (BPEO) available, and the envisaged efforts to minimise waste generation and to divert waste to reuse or recycling rather than disposal.

4. Layout plans (to scale) clearly showing all relevant waste management infrastructure and related facilities (*e.g.* bunded areas for storage of waste fuels, wheel-wash facilities, etc.), clearly distinguishing between temporary and permanent structures for each phase.

1.2.7 Longer-term developments

Additional future developments, land uses and other commitments that are ancillary or consequent to the project or are likely to arise in relation to the same project or its expansion, as well as longer-term needs of the proposal, including: ancillary infrastructure not accounted for in the previous sections; any consequent interventions/arrangements required to accommodate the development; any foreseeable extensions or updates to the proposal; any displacement of existing uses; and decommissioning.

2.0 ASSESSMENT OF ALTERNATIVES

An outline of the main alternatives studied and an indication of the main reasons for this choice, taking into account the relevant environmental effects and their prevention (or optimisation) at source. The following alternatives need to be duly considered, as relevant to the development itself (or to one or more phases thereof) and its requirements and constraints:

2.1 Alternative sites

2.2 Alternative technologies

2.3 Alternative layouts (including building heights, where relevant)

2.4 Downscaling of the project, or elimination of project components

2.5 Zero option (do-nothing scenario) - *i.e.* an assessment of the way the site would develop in the absence of the proposed project.

*[**Note:** The zero option should be considered in sufficient detail as a plausible scenario in the EPS, wherever relevant, and not discarded upfront without proper discussion of its implications.]*

2.6 Hybrids/combinations of the above

The findings of the assessment of alternatives should be summarised in a table format for ease of comparison.

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).

Note: *It is recommended that these details are discussed in advance with the ERA prior to commencement of the relevant parts of the studies, in order to pre-empt (as much as possible) later-stage issues.*

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by ***Section 4*** below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (*e.g.* European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (*e.g.* Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (*e.g.* local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

Note: *In addition to already in-force legislation, policies and plans, the discussion should also cover any foreseeable future updates (or new legislation, policies and plans) likely to be fulfilled, affected or compromised by the proposed project. Furthermore, it should be noted that some cross-cutting legal/policy instruments (e.g. Water Framework Directive) may need to be factored into more than one aspect of the discussion.*

3.1 Land cover and Land Uses

A description of the land cover and land uses, within the area of influence of the project, including roads, footpaths, public access routes and any agricultural tracts of land. Details including nature, magnitude, proximity to site, etc. should be included. Any trees, including protected trees, are to be mapped and identified accordingly.

3.2 Terrestrial Ecology

The assessment should include:

1. An investigation of the ecology of the site and its surroundings (including, flora and fauna), ensuring adequate coverage of all relevant species and ecosystem components;
2. A reporting of the conservation status and ecological condition of the area and the state of health of its habitats, species and ecological features, as relevant;
3. A reporting of all protected, endangered, rare, unique, endemic, high-quality, keystone, invasive/deleterious, or otherwise important species, habitats, ecological assemblages, and ecological conditions found in the area under study; and
4. A prediction of the potential impacts of the proposed project on the ecology of the site and its surroundings, including loss, damage or alteration of habitats and species including alteration in the habitats and species' condition/state of health as measured through indicators used/specified for assessment of status in relevant EU policy.

In particular, the study should identify all relevant species and assemblages (*e.g.* protected species or habitats, key species relevant to habitat characterisation, and monitoring indicators), and assess their abundance and distribution patterns as well as the species' ecological niches. The findings should be supported by adequate maps and photographs. Classification of habitat types and species should be conducted in accordance with recognised classification systems (*e.g.* EUNIS and Palaearctic), to ERA's satisfaction.

3.3 Agricultural land

The study should identify any agricultural land within the area of influence of the development, and should provide a clear and reasonably detailed indication of:

1. The physical quality and productivity of the land, justifying the indicators used in this regard. Soil depths, textures, and properties should also be described in the relevant level of detail;
2. Whether the land is dry land, irrigated land, recently reclaimed land, long-abandoned land with an established trend toward regeneration of natural vegetation, or otherwise;
3. The main crops and trees cultivated in the surrounding area, as a meaningful indicator of longer-term quality and potential of the cultivable fields. In this regard, emphasis is to be laid on appropriate and representative indicator crops, avoiding overly precise but superficial field-by-field snapshots of all crops that happen to be under cultivation at a given point in time. For similar reasons, superficial indicators based on transitory factors (*e.g.* fallow land, currently abandoned land; or underutilised land) are insufficient and potentially distortive, and for a more representative baseline the investigation needs to look more deeply into how the land was used over the past years;
4. Any agro-ecosystems and related interactions including the living and non-living components (*e.g.* dry-stone rubble walls, associated natural and man-made habitats etc) that are currently coexisting with established agricultural activity or are being maintained in connection with such activity;
5. All relevant ancillary aspects (*e.g.* irrigation water sources, access routes, land drainage patterns, exposure and microclimate, holding sizes and configurations) that may be lost, displaced or otherwise affected by the proposed development; and,
6. Any baseline environmental pressures and exceedances (*e.g.* pollution) resulting from agricultural activity, that may be directly or indirectly relevant to the proposed development, particularly any aspects that will be displaced, abated or compounded as a result of the development.

3.4 Landscape Character and Visual Amenity

3.4.1 Landscape Character

The study should describe the landscape-related area of influence and landscape setting of the proposed site, identifying the component character areas and local landscape tracts, and the landscape elements, characteristics and degree of sensitivity thereof, so as to enable the prediction and assessment of:

- The changes to the landscape attributable (in full or in part) to the proposed development;
- The implications of such changes on the quality and perception of the landscape and its elements, in each of the identified landscape character areas and local landscape tracts; and
- The effects of such changes on relevant receptors. (The receptors should also be duly identified and their degree of sensitivity should also be indicated and justified).

Reference should also be made to the Planning Authority's '*Draft Landscape Assessment Study, 2004,*' and to the *Guidelines for Landscape and Visual Impact Assessment, 2015* (*The Landscape Institute* & *IEMA*), as relevant.

3.4.2 Visual Amenity

The following need to be identified and submitted for prior ERA approval:

- The Zone of Theoretical Visibility (ZTV) of the site and the development under consideration; and
- Assessment viewpoints representative of short-, medium- and long-distance views towards the site. A baseline photograph taken from each proposed viewpoint is also required. The submission should cover all the important views of the site, whilst avoiding the inclusion of superfluous or inappropriate viewpoints (*e.g.* positions from which the site is not visible, or where the view is obstructed or dominated by physical obstacles in the foreground).

Thereafter, for each approved viewpoint, the projected situation and appearance of the site (*i.e.* as it would look with the proposed development in place) should be compared to the current baseline situation (*i.e.* without the proposed development). The following should be predicted and assessed accordingly:

- The expected changes to visual amenity as a result of the proposed development;

- The effects of such changes on the quality of the visual amenity of the site; and
- The effects of such changes on relevant receptors. (The receptors should also be duly identified and their degree of sensitivity should also be indicated and justified).

Note: *The baseline photographs and the photomontages should, unless otherwise directed by ERA, satisfy the following:*

(a) The location of each viewpoint should be shown on a map that also depicts the viewshed for the proposed site as described above. The visual angle of the photograph should also be indicated and should not be greater than 50°. Stitched photos that illustrate the field of vision towards the site from each viewpoint are acceptable as long as they are additional to the 50-degree photograph.

(b) The photographs and photomontages submitted should:
- *Be at least A3 in size. Strips which are A3 in width but not in length are not appropriate except as supplementary illustrative material;*
- *Include the date and time at which the photo was taken;*
- *Be of good quality, with faithful reproduction approximating as much as reasonably possible what would normally be visible to the naked eye. The photos should be taken in good weather, and should be taken at least 2 hours after sunrise and 2 hours before sunset. Colours should not be digitally or otherwise manipulated. As a guideline, the image should have a printing density of 200 dots per inch or better. In some instances, digital images having a resolution of 1024 x 728 or better may be required for multimedia presentation purposes;*
- *Be taken in such a manner that near-field objects do not overpower or dominate features near the image plane passing through the project area;*
- *Be taken from a height above ground level that is representative of the eye level of the viewer, and such height should be duly documented; and*
- *Ensure that all additional/replacement structures and features depicted in the photomontages have a scale which proportionately tallies with the existing nearby features.*

(c) Wherever relevant, the photomontage(s) should cover the following scenarios:
- *The development without the proposed landscaping scheme, representing the worst-case scenario;*
- *The development complete with the proposed landscaping scheme as it is expected to look when the trees reach maturity, also providing an indicative timeframe as to when such maturity is expected to be attained; and*
- *(where relevant in relation to impact of nocturnal lighting) the development and its ancillary lighting as it would appear during night-time.*

Exterior lighting

In the case of light pollution, the study needs to consider, among others, glare (e.g. the blinding light which is a danger to motorists/pedestrians and to fauna), light trespass (light straying into an area where it is not desired or required) and sky glow ('wasted' light directed upwards), together with any other relevant variables which are relevant to the determination of impact on any surrounding receptors.

3.5 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 wave action, 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 ERA approval prior to carrying out of any *in situ* tests.

3.6 Architectural, Archaeological, Historical and Cultural Heritage and related Material Assets

Refer to Appendix 2.

3.7 Air Quality

This study should clearly establish the current background levels of pollution namely VOCs, benzene and odours and 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 ERA's evaluation prior to commencement of the studies.

The sampling points for the air-quality study, one of which should be at the most sensitive receptor in the prevailing wind direction, should also be submitted to ERA prior to the commencement of studies.

The study should provide a sufficiently detailed baseline to enable:

- An adequate determination of how the current air quality will be affected by the project (including its emissions to air during all relevant phases);
- A detailed breakdown, as relevant, by source, type, quantity, composition, concentration and distribution of each pollutant; and
- An adequate estimation of indirect impacts on air quality.

3.8 Infrastructure and Utilities

The assessment should investigate the currently available infrastructural services (including water supply, energy supply, sewerage, telecommunications infrastructure, access roads, parking, *etc.*), including details about their carrying capacity, physical condition and other relevant practical considerations. It should also compare this information to the infrastructural demands of the project as identified in ***Section 1*** above, so as to clearly indicate:

1. whether the current utilities are adequate to meet the demand arising from the proposed development;
2. whether any significant loading, congestion or damaging of the infrastructural or transport network is envisaged; and
3. whether any new or upgraded services/arrangements will be rendered necessary, both in the short-term and in the longer-term. If any requirement for new infrastructure (or upgrading, alteration or extension of the existing infrastructure) is envisaged, the relevant details including associated works and their environmental implications should also be indicated.

The assessment should also identify any existing or projected infrastructural services located within the area of influence of the development (even if not related to the demands of the development) that might be affected by the development or which may need to be displaced or diverted as a consequence of the development or its ancillary operations and interventions.

3.9 Public Access

The assessment should identify the current public access arrangements, including existing footpaths and other public access routes, and should clearly indicate whether these would be affected and how.

Wherever any new or altered arrangements are proposed, these should be clearly identified and their environmental implications should also be indicated.

3.10 Other relevant environmental aspects and features

Other relevant environmental features or considerations not identified in the preceding sections should also be identified and described, as relevant.

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.

4.2 Impacts related to Climate Change and Climate Change Adaptation

The assessment should address the following aspects, as relevant:

1. The contribution of the project to greenhouse gas (GHG) emissions and climate change, including:
    (i) The direct, indirect and off-site GHG emissions and related impacts during all relevant phases of the project, including those arising as a result of the electrical power demand of the project;
    (ii) Any massive GHG emissions that may occur as a consequence of accidents or malfunctions;
    (iii) The impacts of the proposal on carbon sinks (*e.g.* wooded/afforested areas, agricultural soils, landfills, wetlands, and marine environments);
    (iv) The components of the project that are expected to contribute to renewable energy generation on site, including a quantification and critique of their reliability and actual net contribution to climate change mitigation as well as an identification of the impacts of such components on other aspects of the environment (*e.g.* landscape, land take, avifauna); and
    (v) The implications of the project and its operations and ancillary demands on National GHG emission targets.

2. The implications of climate change on the proposal, including:
    (i) The aspects/elements of the project that are likely to be affected by changes or variability in climate-related parameters (*e.g.* temperature, humidity, weather patterns, sea level, etc.);
    (ii) The potential impacts that such changes may have on the proposal, including any possible impacts resulting from changes to multiple parameters; and
    (iii) The adaptability of the project and its components and operations vis-à-vis the relevant climate change parameters and trends.

4.3 Environmental Risk

The assessment should also address, in sufficient detail, any relevant environmental risk (including major-accident scenarios such as contamination, emissions, explosions, blast, flooding, major spillages, etc.) likely to result in environmental damage or deterioration. The range of accident scenarios considered should exhaustively cover, as relevant:

1. one-time risks (*e.g.* during construction or decommissioning works);
2. recurrent risks during project operation; and
3. risks associated with extreme events (*e.g.* effect of earthquakes or natural disasters on the project).

The assessment should include, as relevant: a quantification of the risk magnitude and probability; and risk analysis vis-à-vis any hazardous materials stored, handled, or generated on site or transported to/from the site.

4.4 Effects on Human Populations resulting from impacts on the environment

This assessment should also identify any impacts of the development on the surrounding and visiting population (*e.g.* effects on public health or on socio-economic considerations), that may result from impacts on the environment. In the case of health-related effects, reference should be made to published epidemiological and other studies, as relevant, and the views of the Environmental Health Directorate should be sought.

4.5 Other Environmental Effects

Any other environmental effects deemed relevant to the project but not fitting within any of the above sections should also be identified and assessed.

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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see ***Section 5.4*** below], 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 ERA'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 be not 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 Decommissioning Plan

A decommissioning plan (DP) should also be proposed to address the following circumstances, as relevant:

1. Removal of any temporary or defined-lifetime development (or of any structures, infrastructure or land use required temporarily in connection with it) upon the expiry of their permitted duration; and
2. Removal of the development (or of any secondary developments, infrastructure or land use ancillary to it) in the event of redundancy, cessation of operations, serious default from critical mitigation measures, or other overriding situations that may emerge in future.

The DP should also include, as relevant, a phasing-out plan, proposals for site remediation or decontamination, and methodological guidance on site reinstatement or appropriate after-use.

5.5 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);
*[**Note:** Official written consent from the competent authorities may also be required for such interventions.]*

(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 ERA (*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.

5.6 Identification of required authorisations

The assessment should also identify all environmentally-relevant permits, licences, clearances and authorisations (other than the development permit to which this EPS is ancillary) which must be obtained by the applicant in order to effectively implement the project if development permission is granted. Any uncertainty, as to whether any of these pre-requisites is applicable to the project, should be clearly stated.

Note on Sections 5.1 to 5.6 above:

The expected effects, the proposed measures, the residual impacts, the proposed monitoring etc. should also be summarised in a user-friendly itemised table that enables the reader to easily relate the various aspects to each other. An indicative specimen table is attached in ***Appendix 3.***

APPENDIX 1 REQUIRED DECLARATIONS [EIA REGULATIONS, 2007 - REGULATIONS 28 & 29]

Regulation 28: Identification of consultants and contributors

Extract:

28. (1) The environmental impact statement shall list the registration number and the names of the consultants and contributors responsible for the preparation of the environmental impact statement, environmental survey reports, appendices, non-technical summary and other components of the statement.

(2) The consultants who are responsible for a particular analysis, including analysis in the environmental survey reports, shall be identified.

(3) All consultants and contributors employed in the environmental impact assessment shall sign a declaration stating that the particular study (or part thereof) was solely carried out by them and that they take responsibility for any statement and conclusion contained therein. This signed declaration shall be included with each environmental survey report included with the environmental impact statement.

Signed declaration in accordance with sub-regulation 28(3):

This declaration is to be submitted with each environmental survey report forming part of the EIA.

Attn: Director of Environment (ERA).

I ____, who carried out the study (or part thereof) on ____ for the EIA for the proposed ____, hereby declare that such study was solely carried out by me and take responsibility for any statement and conclusion contained therein.

____________________________ ____

Date Signature

Regulation 29: Conflict of interest

Extract:

29. (1) In the interest of fairness, objectivity and the avoidance of bias, all consultants shall required to sign and abide by a declaration that they have no personal or financial interest in the proposed development.

(2) The Director of Environment Protection shall not approve consultants, groups of consultants or consultancy firms that are in any way associated with any company, association or grouping that has any direct or indirect personal, association or grouping that has any direct or indirect personal, professional or financial interest in the proposed development.

(3) The Director of Environment Protection shall not approve any environmental impact statement or environmental planning statement produced by a consultant or group of consultants, one or more of whom does not comply with the provisions of sub-regulations (1) or (2) of this regulation.

Signed declaration in accordance with Sub-regulation 29(1):

This declaration is to be submitted when proposing the list of EIA Consultants for approval.

Attn: Director of Environment (ERA)

I ____, herby declare that I have no personal or financial interest in the proposed development, namely ____. Moreover, I declare that I am not in any way associated with any individual, company, association or grouping that has any direct or indirect, personal, professional or financial interest in the abovementioned proposed development.

____________________________ ____

Date Signature

____________________________ ____

____________________________ ____

Appendix 2: Terms of Reference for a Cultural Heritage Assessment (As provided by the Superintendence of Cultural Heritage, as revised in October 2013)

1.0 Preamble

The proposed project would involve development over an extensive area and may lead to intensification of activity over a larger area. Potential impacts may occur within the footprint of the project, in the immediate environs, and along access routes to the site. Potential impacts may include direct and immediate material impacts, as well as subsequent impacts that might arise from the modification of the existing situation.

2.0 Scope and Definitions of the EIA

For the purposes of this document, cultural heritage is defined by Article 2 of the Cultural Heritage Act (2002). This includes movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance.

2.1 The study area shall include the total footprint of the proposed development.

2.2 In the context of this particular application, cultural heritage considerations may include:
- Features of archaeological value and potential;
- Military or civil architecture from the Knights period to British period;
- Vernacular structures; and
- Field systems and agricultural features such as irrigation systems.

The above cultural heritage definitions and considerations are not to be considered as exhaustive. The EIA must consider all other forms of cultural heritage, both known and unknown.

2.3 The Environmental Impact assessment will:
- Describe the Cultural Heritage assets within the study area;
- Analyse the cultural heritage features within the context of the cultural landscape;
- Assess the physical, spatial and visual impacts of the proposed development on the cultural heritage assets; and
- Propose corrective measures for the protection of the cultural resources.

3.0 Methodology

In quantifying the cultural heritage assets within the study area, and assessing the impacts of the proposed development, the EIA will undertake:
- Description and assessment of the property;
- Desktop and archival research limited to the study area;
- Fieldwork and research, including “field walking”, topographic survey and remote sensing as may be necessary within the site. All fieldwork has to be authorised by the Superintendence of Cultural Heritage as defined below under point 4;
- Consultations with any relevant bodies, including the Superintendence of Cultural Heritage, Heritage Malta, the University of Malta, NGOs and Local Councils;
- Compilation of an inventory of the cultural heritage assets identified within the study area. The features of cultural heritage are to be described and plotted with grid references, on Data Capture Sheets, the design of which should be approved in advance by the Superintendence of Cultural Heritage. The Data Capture Sheets will be presented as an appendix to the EPS. The analysis of the features will be included in the main report; and
- A cultural heritage Risk Assessment Map examining the various impacts of the proposed project is to be included in the EIA.

4.0 Authorisation by the Superintendence of Cultural Heritage

As per Cultural Heritage Act 2002, any form of investigation or prospection required for the identification of cultural heritage (including excavation, field walking, topographic survey and remote sensing) may only be undertaken by the Superintendence of Cultural Heritage or with its written approval.

ERA PTOTECTIVE INVENTORY OF THE MALTESE CULTURAL HERITAGE HERITAGE DATA CAPTURE SHEET			**Ref. No.**
Location	**Category**	**Type**	**Site Location (Address)**
Eastings	**Northings**	**Feature**	**Period - Year**
S.S. No. 1 **S.S. No. 3**	**S.S. No. 2** **S.S. No. 4**	**Description**	
Date			
Negative No.	**Film No.**		
Present Utilization			
Existing Legal Protection		**GN. Number**	**GN. Date**
Comments			

Buffer Zone	**A**	**B**	**C**	**D**	**E**	**Others**
Eastings						
Northings						

Site Map
Scale 1 : 2500

Archaeological Characteristics – Sketch/Scaled drawings:	
Condition:	**Degree of Protection (Structure Plan policies UCO7 or ARC 2)**:
State of Security:	**Proposed Utilization:**
Basic Bibliography:	
Compiled by: **Checked by:** **Date:**	**Revised by:** **Checked by:** **Date:**

APPENDIX 3: SPECIMEN IMPACT TABLE

Impact type and source			Impact receptor		Effect & scale							Probability of impact occurring (Inevitable, Likely, Unlikely, Remote, Uncertain)	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements (monitoring, authorisations, etc)
Impact type	**Specific intervention leading to impact**	**Project phase** (construction/ operation/ decommissioning)	**Receptor type**	**Sensitivity & resilience toward impact**	**Direct/ Indirect/ Cumulative**	**Beneficial/ Adverse**	**Severity**	**Physical / geographic extent of impact**	**Short-/medium-/ long-term**	**Temporary** (indicate duration)**/ Permanent**	**Reversible** (indicate ease of reversibility) **/ Irreversible**					

[Insert definition of relevant criteria used to describe the impacts]

ASSOCIATES

TRK 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZONI, ĦAS-SAPTAN, GĦAXAQ

GEO-ENVIRONMENT METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the Geo-Environment Study for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

TERMS OF REFERENCE

3. The draft Terms of Reference provided by the Terms of Reference provided by the Environment and Resources Authority (ERA) are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;

- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.5 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 wave action, 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 ERA approval prior to carrying out of any in situ tests.

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section

5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

AREA OF INFLUENCE

4. Having regard to the nature of the Scheme, and the extent of the excavation works in particular, the Area of Influence (A of I) for the geo-environment study comprises the Scheme Site.

5. The AoI for the study is illustrated in **Figure 1**. The extent of the A of I takes account of both the construction of the Scheme and the Scheme in operation.

ASSESSMENT METHODOLOGY

Literature Search

6. A literature search in relation to previous geo-environment survey work relevant to the A of I will be undertaken. This, together with the Consultant's own knowledge of the area, will provide a context for the baseline surveys.

Methodology

7. The study will establish the existing geology, geomorphology and hydrogeological baseline. This will involve:

- Identification and description of the geology, geomorphology and hydrogeology of the site and the A of I (see **Figure 1**);
- Identification of features that are protected by legislation, or which warrant such protection and their appropriate level of protection, as necessary.

8. The following will be produced as part of the geo-environment baseline survey:

- Geological Map; and
- Report of the quality of the stone material to be excavated and its potential reuse. This will be determined by visual inspection and by laboratory testing for water absorption, unconfined compressive strength, and wet and dry density.

Standards and guidance

9. The conservation importance of geologic, geomorphologic and hydrogeologic features will be determined by reference to the *South Malta Local Plan, Minerals Subject Plan* and the *Earth Conservation Strategy* (The British Nature Conservancy Council, 1991).

IDENTIFICATION OF IMPACTS

10. In terms of geology geomorphology, hydrogeology, and soils, the geo-environmental impacts of the Scheme are likely to arise from the excavation and construction of the Scheme.

11. The impact of changes resulting from the Scheme on geology and geomorphology will make reference to the nature of the beds and the degree of protection afforded to them through policy and / or legislation.

IMPACT SIGNIFICANCE

12. The significance of the impact(s) will include:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect;
- Duration of impact (temporary / permanent);
- Adverse or beneficial impact;
- Reversible / irreversible impact;
- Sensitivity of geo-environmental resources to impacts;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation / enhancement (very good, good, none).

13. Based on the above, a summary of the significance of the impact will be judged in terms of whether the impact is considered to be:

- **Not significant**:
  - Little or no change to the geological, geomorphological and hydrogeological regime.
- **Minor significance**:
  - Changes to the geological, geomorphological and hydrogeological regime that may affect neighbouring properties but which may be offset by mitigation measures.
- **Major significance**:
  - Changes to the geological, geomorphological and hydrogeological regime that may affect neighbouring properties and which may not be offset by

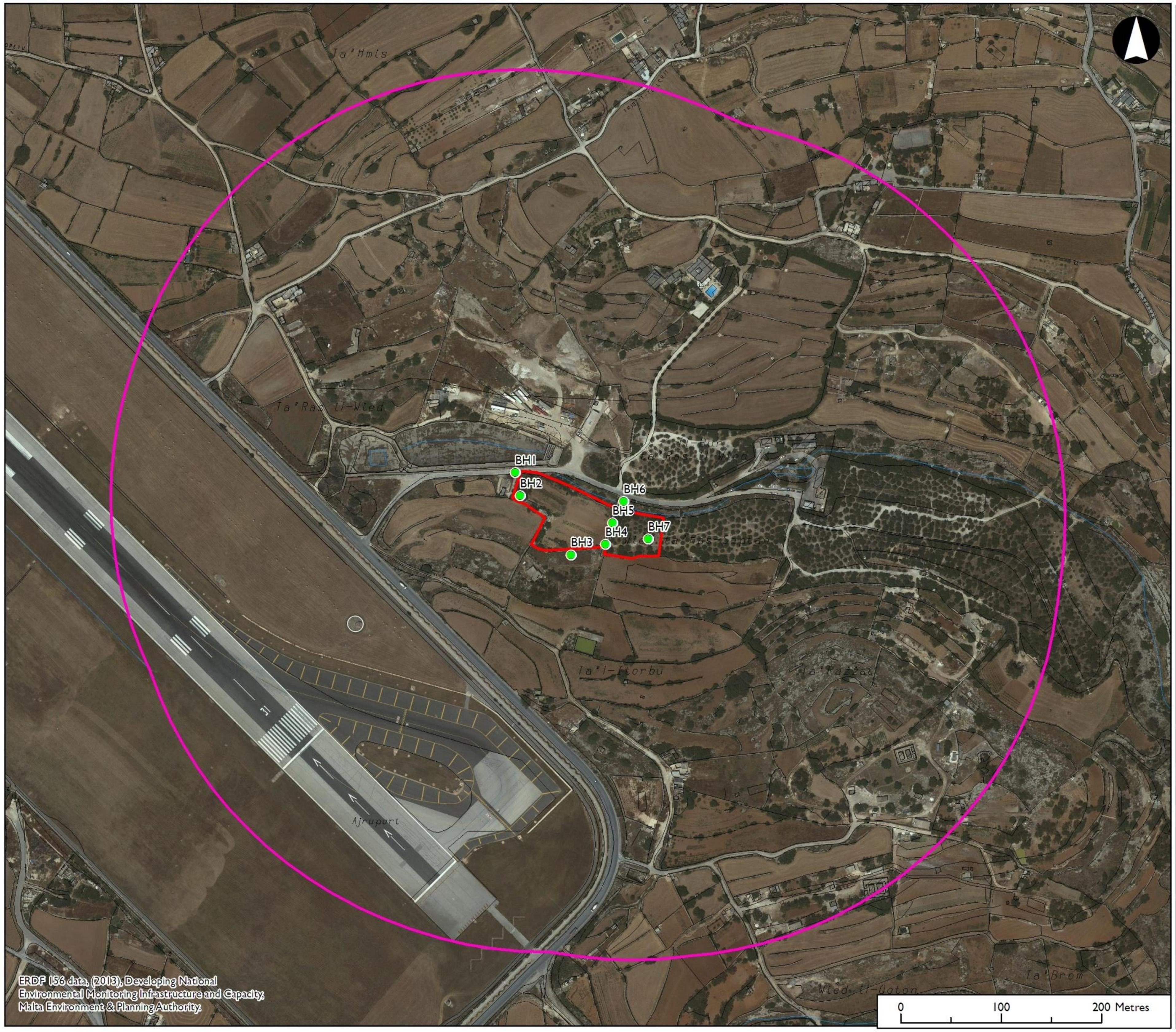
mitigation measures (if negative) or may be enhanced by mitigation measures (if positive).

IMPACT MITIGATION AND MONITORING

14. The scope for mitigation will be identified, and the need for monitoring of geological, geomorphological and hydrogeological aspects within the A of I will be addressed in the Environmental Planning Statement (EPS).

Adi Associates Environmental Consultants Ltd
June 2016

Figure 1: Area of Study



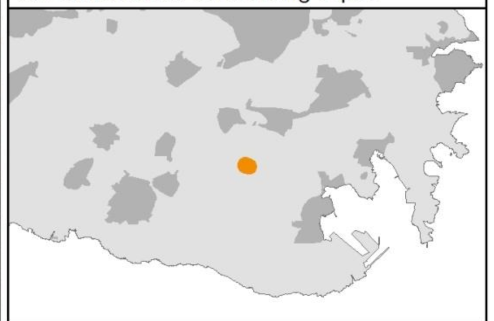
Adi
ASSOCIATES

Geo-environment - Area of study

Legend

- Site boundary
- Area of study
- Boreholes

TN 160087 - Demolition of existing structures and construction of fuel filling depot



Map by: Adi Associates Environmental Consultants Ltd

Client: Enemed Co. Ltd	Ref: EMD005
File ref: EPS\Has Saptan installation\Maps\	Date: 06/2016

INDICATIVE ONLY - Not to be used for direct interpretation

TRK 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZONI, ĦAS-SAPTAN, GĦAXAQ

AGRICULTURE METHOD STATEMENT

INTRODUCTION

1. This method statement provides information on the agriculture input into Environmental Planning Statement (EPS) for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

Terms of Reference

3. The draft Terms of Reference provided by the Environment and Resources Authority (ERA) are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.3 Agricultural Land

The study should identify any agricultural land within the area of influence of the development, and should provide a clear and reasonably detailed indication of:

1. The physical quality and productivity of the land, justifying the indicators used in this regard. Soil depths, textures, and properties should also be described in the relevant level of detail;
2. Whether the land is dry land, irrigated land, recently reclaimed land, long-abandoned land with an established trend toward regeneration of natural vegetation, or otherwise;
3. The main crops and trees cultivated in the surrounding area, as a meaningful indicator of longer-term quality and potential of the cultivable fields. In this regard, emphasis is to be laid on appropriate and representative indicator crops, avoiding overly precise but superficial field-by-field snapshots of all crops that happen to be under cultivation at a given point in time. For similar reasons, superficial indicators based on transitory factors (e.g. fallow land, currently abandoned land; or underutilised land) are insufficient and potentially distortive, and for a more representative baseline the investigation needs to look more deeply into how the land was used over the past years;
4. Any agro-ecosystems and related interactions including the living and non-living components (e.g. drystone rubble walls, associated natural and man-made habitats etc) that are currently coexisting with established agricultural activity or are being maintained in connection with such activity;
5. All relevant ancillary aspects (e.g. irrigation water sources, access routes, land drainage patterns, exposure and microclimate, holding sizes and configurations) that may be lost, displaced or otherwise affected by the proposed development; and,
6. Any baseline environmental pressures and exceedances (e.g. pollution) resulting from agricultural activity, that may be directly or indirectly relevant to the proposed development, particularly any aspects that will be displaced, abated or compounded as a result of the development.

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

AREA OF INFLUENCE

4. The Area of Influence (A of I) for the agriculture study has been defined having regard to the consideration of the fact that the main impact on agriculture is likely to be from dust emissions produced as a result of the construction of the Scheme. The A of I is illustrated on **Figure 1**.

PROPOSED METHODOLOGY

Methodology

5. The agriculture study will comprise:

- A field-by-field survey of the A of I to establish the seasonal and standing crops in the area; and
- Determination of the current agricultural value of the land within the A of I, in terms of productivity, and an assessment of the quality of the land in relation to its agricultural use. This assessment will be based on the survey data collected.

Literature search

6. A literature search in relation to previous survey work relevant to the A of I will be undertaken. This, together with the Consultant's own knowledge of the area, will provide a context for the baseline survey and assessment of agricultural quality.

Baseline survey

7. The survey will take account of:

- The physical quality and productivity of the land, justifying the indicators used in this regard. Soil depths, textures, and properties will be described in the relevant level of detail;
- Whether the land is dry land, irrigated land, recently reclaimed land, long-abandoned land with an established trend toward regeneration of natural vegetation, or otherwise;

- The main crops and trees cultivated in the area, as a meaningful indicator of longer-term quality and potential of the cultivable fields. In this regard, emphasis will be placed on appropriate and representative indicator crops, avoiding overly precise but superficial field-by-field snapshots of all crops that happen to be under cultivation at a given point in time. For similar reasons, superficial indicators based on transitory factors (for example, fallow land, currently abandoned land; or underutilised land) are insufficient and potentially distortive, and for a more representative baseline the investigation will consider how the land was used over the past years;

- Any agri-ecosystems and related interactions, including the living and non-living components (for example, dry-stone rubble walls, associated natural and man-made habitats, etc.) that are currently co-existing with established agricultural activity, or are being maintained in connection with such activity;

- All relevant ancillary aspects that may be lost, displaced or otherwise affected by the Scheme;

- Any baseline environmental pressures and exceedances (for example, pollution) resulting from agricultural activity, that may be directly or indirectly relevant to the Scheme, particularly any aspects that will be displaced, abated or compounded as a result of the development; and

- The aspects of the *Rural Development Programme 2014 – 2020*, and other plans and programmes, which are relevant to the Scheme Site and / or the Area of Influence.

8. The baseline survey will also assist in the identification of agricultural areas that are considered sensitive and of agricultural conservation value.

9. All the survey data will be recorded on GIS, to facilitate reference and analysis.

IDENTIFICATION OF IMPACTS

10. The main impact on agriculture from the Scheme is likely to be from dust emissions produced as a result of the construction of the Scheme. This impact could result in:

- Loss of good quality agricultural land, through impacts on crop growth and quality of the produce;

- Displacement of farming activities; and

- Potential loss of employment / income for farmers.

IMPACT SIGNIFICANCE

11. The analysis of the significance of each impact identified (positive or negative) will include:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect;
- Duration of impact (temporary / permanent);
- Adverse or beneficial impact;
- Reversible / irreversible impact;
- Sensitivity of receptor;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation / enhancement (very good, good, none).

12. Based on the above, a summary of the significance of the impact will be judged in terms of whether the impact is considered to be:

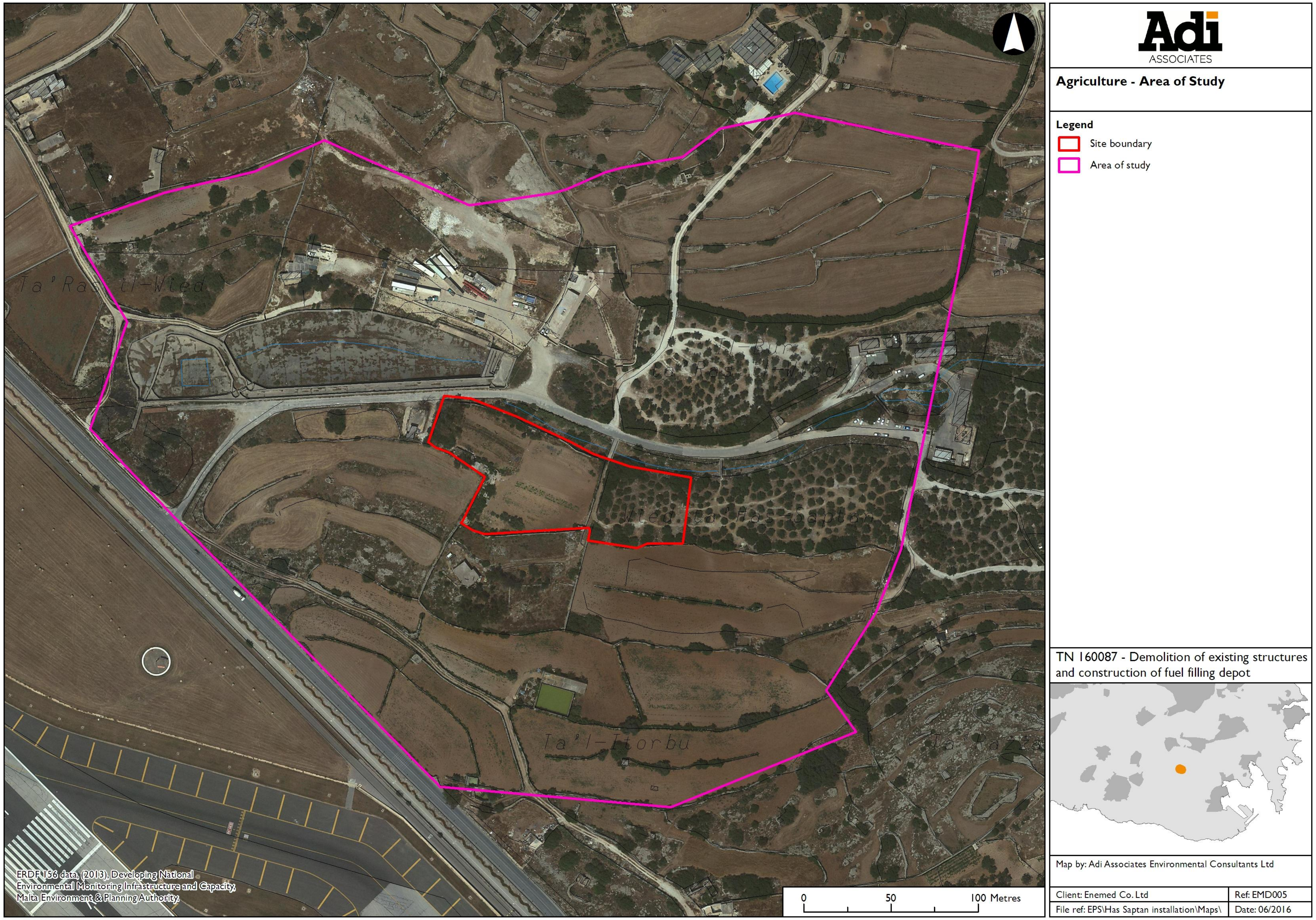
- **Not significant -** no material change in agricultural quality and / or extent;
- **Minor significance -** small-scale loss / disturbance of agricultural land that is unlikely to affect the agricultural integrity of the area; and
- **Major significance** – large / small scale loss / disturbance to agricultural land that is likely to affect the agricultural integrity of the area.

IMPACT MITIGATION AND MONITORING

13. The scope for mitigation will be identified, and the need for monitoring of agricultural areas within the A of I will be addressed in the Environmental Planning Statement.

Adi Associates Environmental Consultants Ltd
June 2016

Figure 1: Area of Influence for Agriculture Study



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TRK 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZONI, ĦAS-SAPTAN, GĦAXAQ

ECOLOGY METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the ecology input to the Environmental Planning Statement (EPS) for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

TERMS OF REFERENCE

3. The draft Terms of Reference provided by ERA are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.5 Terrestrial Ecology

3.2 Terrestrial Ecology
The assessment should include:
1. An investigation of the ecology of the site and its surroundings (including, flora and fauna), ensuring adequate coverage of all relevant species and ecosystem components;
2. A reporting of the conservation status and ecological condition of the area and the state of health of its habitats, species and ecological features, as relevant;
3. A reporting of all protected, endangered, rare, unique, endemic, high-quality, keystone, invasive/deleterious, or otherwise important species, habitats, ecological assemblages, and ecological conditions found in the area under study; and
4. A prediction of the potential impacts of the proposed project on the ecology of the site and its surroundings, including loss, damage or alteration of habitats and species including alteration in the habitats and species' condition/state of health as measured through indicators used/specified for assessment of status in relevant EU policy.

In particular, the study should identify all relevant species and assemblages (e.g. protected species or habitats, key species relevant to habitat characterisation, and monitoring indicators), and assess their abundance and distribution patterns as well as the species' ecological niches. The findings should be supported by adequate maps and photographs. Classification of habitat types and species should be conducted in accordance with recognised classification systems (e.g. EUNIS and Palaearctic), to ERA's satisfaction.

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

ASSESSMENT METHODOLOGY

Scope of work

4. Part of the site is located in a proposed Area of Ecological Importance (AEI) and Site of Scientific Importance (SSI) as identified in the South Malta Local Plan through policy **SMCO 03**. The site also lies within a Valley Protection Zone.

5. An ecology survey will be carried out in the area as identified in **Figure 1**.

Baseline methodology

6. The ecology baseline study will comprise:

   - A walk over survey including a description of the biotic assemblages and communities, which will be characterised based on indicator species, mainly vegetation. Classification of terrestrial community types will follow the scheme outlined in Schembri, 1991 and modified by Schembri *et al.*, 1999.; and

   - The identification, description and analysis of the relevant international / Maltese legislation and protocols, agreements, etc., and Government / PA / ERA policies, and a summary of the threats and opportunities posed by the scheme in respect of the findings will be identified.

IDENTIFICATION OF POTENTIAL IMPACTS

7. Potential impacts relate mainly to loss of any species of conservation interest that may be currently growing on site.

IMPACT SIGNIFICANCE

8. The significance of the impact(s) will include:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect;
- Duration of impact (temporary / permanent);
- Adverse or beneficial impact;

- Reversible / irreversible impact;
- Sensitivity of geo-environmental resources to impacts;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation / enhancement (very good, good, none).

9. Based on the above, a summary of the significance of the impact will be judged in terms of whether the impact is considered to be:

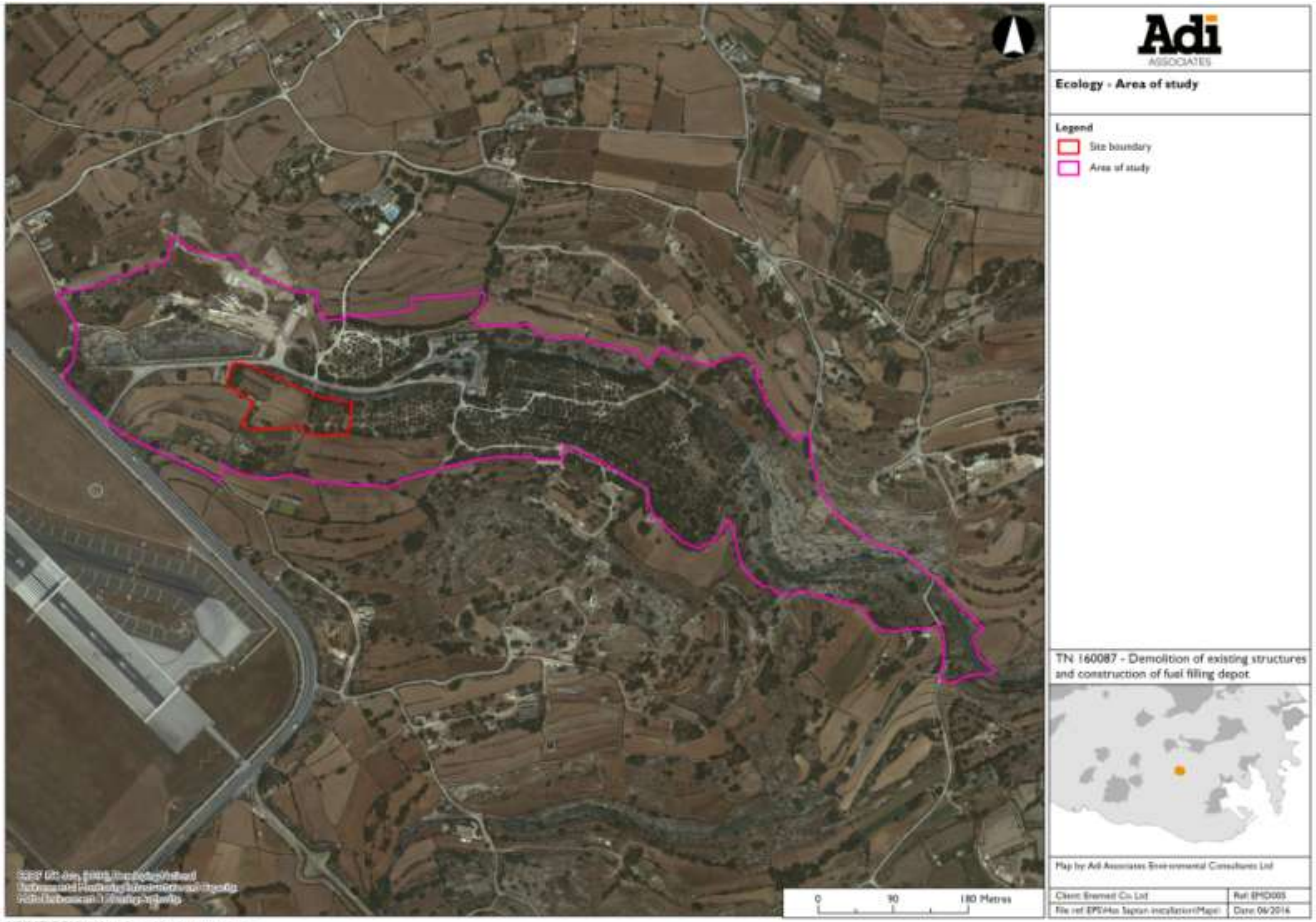
- **Not significant**:
  - No material change in species of conservation interest;
- **Minor significance**:
  - Small-scale loss / disturbance in species of conservation interest;
- **Major significance**:
  - Large-scale loss / disturbance in species of conservation interest.

IMPACT MITIGATION AND MONITORING

10. The ecology 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

Figure 1: Ecology Area of Study



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CULTURAL HERITAGE METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the Cultural Heritage Study for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

TERMS OF REFERENCE

3. The draft Terms of Reference provided by the Terms of Reference provided by the Environment and Resources Authority (ERA) are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;

- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.6 Architectural, Archaeological, Historical and Cultural Heritage and related Material Assets Refer to Appendix 2

5.0 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.

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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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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 2: Terms of Reference for a Cultural Heritage Assessment (As provided by the Superintendence of Cultural Heritage, as revised in October 2013)

1.0 Preamble

The proposed project would involve development over an extensive area and may lead to intensification of activity over a larger area. Potential impacts may occur within the footprint of the project, in the immediate environs, and along access routes to the site. Potential impacts may include direct and immediate material impacts, as well as subsequent impacts that might arise from the modification of the existing situation.

2.0 Scope and Definitions of the EIA

For the purposes of this document, cultural heritage is defined by Article 2 of the Cultural Heritage Act (2002). This includes movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance.

2.1 The study area shall include the total footprint of the proposed development.

2.2 In the context of this particular application, cultural heritage considerations may include:
- Features of archaeological value and potential;
- Military or civil architecture from the Knights period to British period;
- Vernacular structures; and
- Field systems and agricultural features such as irrigation systems.

The above cultural heritage definitions and considerations are not to be considered as exhaustive. The EIA must consider all other forms of cultural heritage, both known and unknown.

2.3 The Environmental Impact assessment will:
- Describe the Cultural Heritage assets within the study area;
- Analyse the cultural heritage features within the context of the cultural landscape;
- Assess the physical, spatial and visual impacts of the proposed development on the cultural heritage assets; and
- Propose corrective measures for the protection of the cultural resources.

3.0 Methodology

In quantifying the cultural heritage assets within the study area, and assessing the impacts of the proposed development, the EIA will undertake:
- Description and assessment of the property;
- Desktop and archival research limited to the study area;
- Fieldwork and research, including "field walking", topographic survey and remote sensing as may be necessary within the site. All fieldwork has to be authorised by the Superintendence of Cultural Heritage as defined below under point 4;
- Consultations with any relevant bodies, including the Superintendence of Cultural Heritage, Heritage Malta, the University of Malta, NGOs and Local Councils;
- Compilation of an inventory of the cultural heritage assets identified within the study area. The features of cultural heritage are to be described and plotted with grid references, on Data Capture Sheets, the design of which should be approved in advance by the Superintendence of Cultural Heritage. The Data Capture Sheets will be presented as an appendix to the EPS. The analysis of the features will be included in the main report; and
- A cultural heritage Risk Assessment Map examining the various impacts of the proposed project is to be included in the EIA.

4.0 Authorisation by the Superintendence of Cultural Heritage

As per Cultural Heritage Act 2002, any form of investigation or prospection required for the identification of cultural heritage (including excavation, field walking, topographic survey and remote sensing) may only be undertaken by the Superintendence of Cultural Heritage or with its written approval.

ERA PTOTECTIVE INVENTORY OF THE MALTESE CULTURAL HERITAGE HERITAGE DATA CAPTURE SHEET			Ref. No.
Location	Category	Type	Site Location (Address)
Eastings	Northings	Feature	Period - Year
S.S. No. 1 S.S. No. 3	S.S. No. 2 S.S. No. 4	Description	
Date			
Negative No.	Film No.		
Present Utilization			
Existing Legal Protection		GN. Number	GN. Date
Comments			

Buffer Zone	A	B	C	D	E	Others
Eastings						
Northings						

Site Map
Scale 1 : 2500

Archaeological Characteristics – Sketch/Scaled drawings:	
Condition:	Degree of Protection (Structure Plan policies UCO7 or ARC 2):
State of Security:	Proposed Utilization:
Basic Bibliography:	
Compiled by: Checked by: Date:	Revised by: Checked by: Date:

AREA OF INFLUENCE

4. The Area of Influence (A of I) for the Cultural Heritage study is illustrated in **Figure 1**.

ASSESSMENT METHODOLOGY

Methodology

5. The Cultural Heritage Study will comprise:

- A baseline survey of the cultural heritage assets (artistic, architectural, historical, archaeological, ethnographic assets) and an evaluation of their importance;
- An assessment of the impact of the construction and operation of the Scheme on the cultural heritage assets and an evaluation of the significance of these effects;
- Input to the design and operational plan for the Scheme to minimise potential adverse impacts on the cultural heritage assets; and
- A description of mitigation measures designed to minimise adverse impacts on cultural heritage.

Literature search

6. A literature search in relation to previous survey work relevant to the A of I will be undertaken; this will include review of existing literature, old manuscripts, and reports of earlier discoveries, a study of toponomy, and other material, as relevant. This information, together with the Consultants' knowledge of the area, will provide a context for the baseline surveys.

Mapping

7. A physical survey will be undertaken, to identify, inspect, record, and map all existing visible man-made features. No excavation or activities other than those described herein will be undertaken. The results of the survey will be provided in the form of data cards, as prescribed by the ToR. Each feature will be individually identified with a consecutive numbered reference.

Evaluation

8. Based on literature searches, on the Consultants' previous knowledge of the survey area, and on the findings of the physical survey, the conservation importance of each of the identified features will be established by reference to appropriate legislation, standards, and guidance. These will include the *Structure Plan for the Maltese Islands*

1992[1], the relevant environmental and planning legislation, and the *Cultural Heritage Act 2002*.

IDENTIFICATION OF POTENTIAL IMPACTS

9. The sensitive cultural heritage receptors will be identified as part of the baseline survey. An assessment of the potential impact will be made in accordance with the ToR.

10. The potential impacts of the Scheme during construction include loss of features through land take up, damage to features, and alteration or degradation of the quality of the setting of the features. The features may be further degraded during the operation of the Scheme.

PREDICTION OF IMPACTS

11. Each of the identified potential impacts will be examined. The survey information will be entered into a Geographical Information System (GIS); this system will enable the mapping of features / areas of cultural heritage importance that will be lost or affected during the construction and operation of the Scheme.

IMPACT SIGNIFICANCE

12. The significance of the impact(s) will include:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect;
- Duration of impact (temporary / permanent);
- Adverse or beneficial impact;
- Reversible / irreversible impact;
- Sensitivity of cultural heritage receptor to impact;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation / enhancement (very good, good, none).

13. The significance of impacts on cultural heritage is dependent upon the importance assigned to each of the cultural heritage features, either through legislation or by the

[1] The *Structure Plan for the Maltese Islands 1992* has been superseded by the *Strategic Plan for the Environment and Development 2015* (SPED); however, the SPED does not outline policy guidance for cultural heritage in the level of detail that it was outlined in the SPED. In the absence of specific policy guidance, and specifically in respect of the classification of cultural heritage features, reference was made to the Structure Plan.

Consultants, and the degree of disturbance or damage likely to arise from the construction and / or operation of the Scheme.

14. A summary of the significance of the impact will be judged in terms of whether the impact is considered to be **not significant**, of **minor significance**, or of **major significance**. The assessment criteria applicable in relation to determining the significance levels are described in **Table 1**.

Table 1: Impact Significance Criteria

Potential damage or destruction to features / Class or grade of cultural heritage feature	**Cultural significance**			
	Major Class / Grade A / 1	**Medium Class / Grade B / 2**	**Minor Class / Grade C / 3**	**None / not graded**
No material change to the cultural heritage feature	Not significant	Not significant	Not significant	Not significant
Small scale changes to the cultural heritage feature (i.e. alterations), which are unlikely to affect the integrity of the feature	Major	Minor	Minor	Not significant
Loss of, or disturbance to, the cultural heritage feature which is likely to affect the integrity of the feature	Major	Major	Minor	Not significant

IMPACT MITIGATION AND MONITORING

15. The scope for mitigation will be identified, and the need for monitoring of cultural heritage features will be addressed in the Environmental Planning Statement (EPS).

Figure 1: Area of Influence for Cultural Heritage Study

INDICATIVE ONLY - Not to be used for direct interpretation

ASSOCIATES

TRK 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZONI, ĦAS-SAPTAN, GĦAXAQ

LANDSCAPE AND VISUAL AMENITY METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the visual amenity and landscape impact assessment for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

TERMS OF REFERENCE

3. The draft Terms of Reference provided by the Terms of Reference provided by the Environment and Resources Authority (ERA) are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.4 Landscape Character and Visual Amenity

3.4.1 Landscape Character

The study should describe the landscape-related area of influence and landscape setting of the proposed site, identifying the component character areas and local landscape tracts, and the landscape elements, characteristics and degree of sensitivity thereof, so as to enable the prediction and assessment of:

- The changes to the landscape attributable (in full or in part) to the proposed development;
- The implications of such changes on the quality and perception of the landscape and its elements, in each of the identified landscape character areas and local landscape tracts; and
- The effects of such changes on relevant receptors. (The receptors should also be duly identified and their degree of sensitivity should also be indicated and justified).

Reference should also be made to the Planning Authority's '*Draft Landscape Assessment Study, 2004,*' and to the *Guidelines for Landscape and Visual Impact Assessment, 2015* (*The Landscape Institute* & *IEMA*), as relevant.

3.4.2 Visual Amenity

The following need to be identified and submitted for prior ERA approval:

- The Zone of Theoretical Visibility (ZTV) of the site and the development under consideration; and
- Assessment viewpoints representative of short-, medium- and long-distance views towards the site.

A baseline photograph taken from each proposed viewpoint is also required. The submission should cover all the important views of the site, whilst avoiding the inclusion of superfluous or inappropriate viewpoints (*e.g.* positions from which the site is not visible, or where the view is obstructed or dominated by physical obstacles in the foreground).

Thereafter, for each approved viewpoint, the projected situation and appearance of the site (*i.e.* as it would look with the proposed development in place) should be compared to the current baseline situation (*i.e.* without the proposed development). The following should be predicted and assessed accordingly:

- The expected changes to visual amenity as a result of the proposed development;
- The effects of such changes on the quality of the visual amenity of the site; and
- The effects of such changes on relevant receptors. (The receptors should also be duly identified and their degree of sensitivity should also be indicated and justified).

Note: *The baseline photographs and the photomontages should, unless otherwise directed by ERA, satisfy the following:*

(a) The location of each viewpoint should be shown on a map that also depicts the viewshed for the proposed site as described above. The visual angle of the photograph should also be indicated and should not be greater than 50°.Stitched photos that illustrate the field of vision towards the site from each viewpoint are acceptable as long as they are additional to the 50-degree photograph.

(b) The photographs and photomontages submitted should:
- Be at least A3 in size. Strips which are A3 in width but not in length are not appropriate except as supplementary illustrative material;
- Include the date and time at which the photo was taken;
- Be of good quality, with faithful reproduction approximating as much as reasonably possible what would normally be visible to the naked eye. The photos should be taken in good weather, and should be taken at least 2 hours after sunrise and 2 hours before sunset. Colours should not be digitally or otherwise manipulated. As a guideline, the image should have a printing density of 200 dots per inch or better. In some instances, digital images having a resolution of 1024 x 728 or better may be required for multimedia presentation purposes;
- Be taken in such a manner that near-field objects do not overpower or dominate features near the image plane passing through the project area;
- Be taken from a height above ground level that is representative of the eye level of the viewer, and such height should be duly documented; and
- Ensure that all additional/replacement structures and features depicted in the photomontages have a scale which proportionately tallies with the existing nearby features.

(c) Wherever relevant, the photomontage(s) should cover the following scenarios:
- The development without the proposed landscaping scheme, representing the worst-case scenario;
- The development complete with the proposed landscaping scheme as it is expected to look when the trees reach maturity, also providing an indicative timeframe as to when such maturity is expected to be attained; and
- (where relevant in relation to impact of nocturnal lighting) the development and its ancillary lighting as it would appear during night-time.

Exterior lighting

In the case of light pollution, the study needs to consider, among others, glare (e.g. the blinding light which is a danger to motorists/pedestrians and to fauna), light trespass (light straying into an area where it is not desired or required) and sky glow (‘wasted’ light directed upwards), together with any other relevant variables which are relevant to the determination of impact on any surrounding receptors.

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

4. Assessment of landscape and visual amenity is a complex task, involving examination of a wide range of factors that contribute to the qualities and attributes of the existing landscape and that may contribute to the attributes 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.

5. Landscape and visual impacts are distinct, albeit strongly related. Landscape impacts result from the interaction between the proposed development and the existing landscape resource, experienced through changes to any element or combination of landscape elements. Visual impacts relate to the effect that the Scheme would have on the amenity of sensitive receptors, relating to the actual or perceived visible changes to the character and quality of the landscape.

6. The landscape and visual amenity study will comprise the following:

- Baseline survey and characterisation of the landscape and visual amenity at and around the Scheme site using desktop and field survey techniques;
- Evaluation of the landscape character of the Scheme site and its setting;
- Establishment of the key factors that have led to the formation of the current landscape;
- Establishment of the Zone of Theoretical Visibility (ZTV) for the Scheme and identification of key viewpoints and receptors;
- Input of potentially beneficial design measures to the Scheme;
- Prediction of the impacts of the Scheme on the visual amenity of the Area of Influence;
- Assessment of the significance of the impacts on the landscape and visual amenity of the Area of Influence; and

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

ASSESSMENT METHODOLOGY

Standards and guidance

7. The landscape and visual assessment will be carried out in line with the UK best practice methodologies as appropriate, notably:

- *Preparation of Environmental Statements for Planning Projects that require Environmental Assessment, A Good Practice Guide produced by the Department of the Environment (now DETR) (1995)*;
- *Guidelines for Landscape and Visual Impact Assessment (2013)* – Institute of Environmental Management & Assessment and the Landscape Institute (UK)
- MEPA's draft Landscape Assessment Study; and
- *Best Practice Guide – Visual Simulations* (2015) – MEPA

Area of Influence

8. The Area of Influence has been defined using a combination of desk and field-based techniques. Most notably, the ZTV of the Scheme is identified. This encompasses the roads and public places from where the Scheme Site is visible. The ZTV and viewpoints are illustrated in **Figure 1** and **Figure 2**.

Baseline data

9. The visual amenity baseline will be formulated by reference to a series of viewpoints within the ZTV that will be agreed with ERA (see **Figure 2**).

10. The landscape baseline will be established through reference to mapped land use information including cultural heritage features, trees, etc., an analysis of aerial photographs, and a review of the Strategic Plan for the Environment and Development (SPED), the South Malta Local Plan, and the draft Landscape Assessment for the Maltese Islands, to identify policy background and any potentially important landscape areas within or adjacent to the Scheme.

Landscape assessment

Description and character of site

11. This will comprise the description of the landform and land cover of the Scheme Site and its surroundings and confirmation of the location of landscape features. The landscape character of the Scheme Site will also be identified. The information will be recorded through the use of checklists, map annotations, and photographic records.

Characterisation of local area

12. The characterisation of the local area will provide inputs into the design of the Scheme so that it might fit in with the local landscape and built character.

Evaluation

13. The importance of the landscape will be assessed in relation to appropriate legislation, standards, and guidelines, and in particular to any designations that apply to the Scheme Site and / or to the surrounding area.

Visual assessment

14. The mapped material will be used to identify potentially significant views and viewpoints for analysis during the field survey. A three-dimensional computer-based viewshed analysis was established for the Scheme. The extent of the viewshed (ZTV) has been verified in the field and key viewpoints identified. They include:

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

15. The viewpoints are illustrated in **Figure 1** and listed below:

Viewpoint	Location
1	Triq ta' Loretu, il-Gudja
2	Triq L-Avjazzjoni, Ħal Luqa

16. The existing views from these locations have been photographed. These views will form the basis for the preparation of photomontages that will be used to assess the impact of the Scheme. The initial photographs from the 2 viewpoints are set out in **Appendix 1**.

IDENTIFICATION OF POTENTIAL IMPACTS

17. Receptors sensitive to the change in the visual amenity will be identified.

18. Potential changes in the landscape will be identified for each of the landscape character areas.

Prediction of potential impacts

19. The visual impacts of the development will be predicted by creating photomontages for each of the identified viewpoints. This will include overlaying a computer-generated perspective of the project over photographs of the existing situation, and assessing how the visual amenity will change.

20. Changes to the landscape will be assessed using the photomontages and the information available in the baselines studies: geo-environment, cultural heritage, and land cover.

IMPACT SIGNIFICANCE

21. This section will include the following information for each potential impact:

- Description of impact;
- Policy importance of the impact (Local, National, International);
- Extent of effect on landscape / visual amenity;
- Duration of impact (temporary/permanent);
- Adverse or beneficial impact;
- Reversible/irreversible impact;
- Sensitivity of receptor;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote);
- Scope for mitigation/enhancement (very good, good, none); and
- Residual impacts.

22. The significance of visual impacts will be assessed in relation to:

- The number and sensitivity of receptors affected;
- The duration of the changes;
- The changes to the view from the identified view points as shown by the photomontages; and
- Scope for further mitigation / enhancement measures.

23. Based on the above criteria, an assessment of: (i) the significance of impacts on the landscape and (ii) the visual impact at each of the viewpoints will be made in terms of whether it is considered:

- **Not significant** – little or no perceptible changes to the view or landscape;
- Of **minor significance** – noticeable changes to the view or landscape with potential for substantial changes to be offset by mitigation; and
- Of **major significance** – substantial changes to the view or landscape with little opportunity for changes to be offset by mitigation.

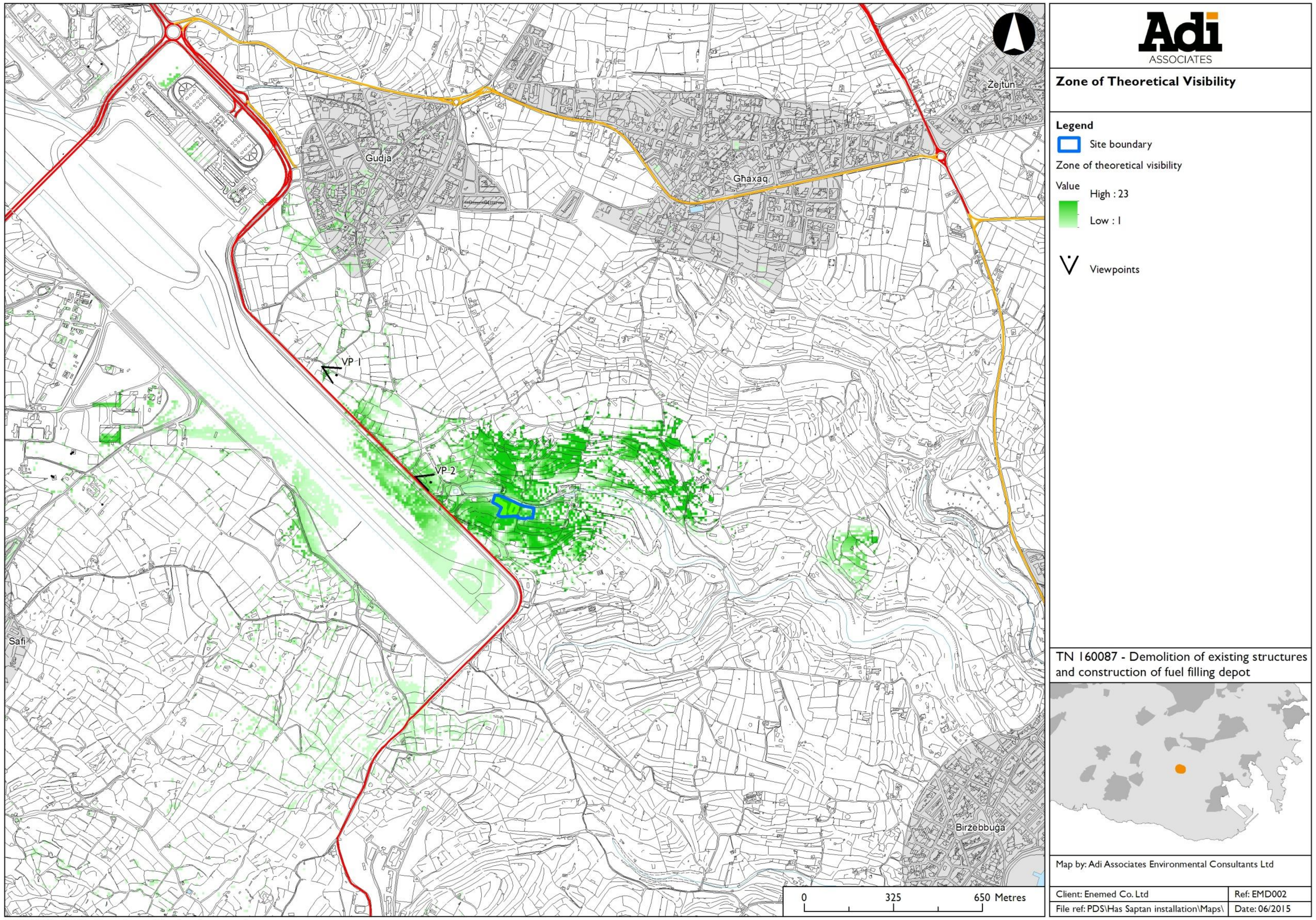
IMPACT MITIGATION & MONITORING

24. It is envisaged that the majority of the mitigation measures will be incorporated in the design of the Scheme so that it fits as closely as possible with the landscape and built

character of the area. Landscape proposals will take account of the provisions in the *'Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands'* published by the Malta Environment and Planning Authority (now the Planning Authority).

Adi Associates Environmental Consultants Ltd
June 2016

Figure 1: Zone of Theoretical Visibility



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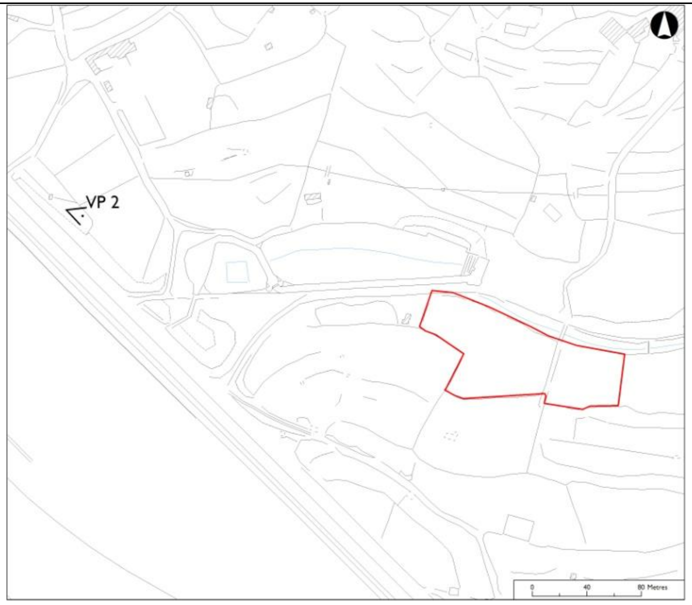
APPENDIX I

Viewpoint 1: Triq Ta' Loretu, il-Gudja

Viewpoint 2: Vjal l-Avjazzjoni, Hal Luqa



TRK 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZONI, ĦAS-SAPTAN, GĦAXAQ

AIR QUALITY METHOD STATEMENT

INTRODUCTION

1. This method statement outlines the methodology for the air quality input to the Environmental Planning Statement (EPS) for the proposed fuel dispensing station for refuelling of road tankers at Ħas-Saptan l/o Ħal Għaxaq. The development is hereinafter referred to as 'the Scheme'.

2. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

TERMS OF REFERENCE

3. The Terms of Reference provided by ERA are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.5 Air Quality

This study should clearly establish the current background levels of pollution namely VOCs, benzene and odours and 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 ERA's evaluation prior to commencement of the studies.

The sampling points for the air-quality study, one of which should be at the most sensitive receptor in the prevailing wind direction, should also be submitted to EPD prior to the commencement of studies.

The study should provide a sufficiently detailed baseline to enable:

- An adequate determination of how the current air quality will be affected by the project (including its emissions to air during all relevant phases);
- A detailed breakdown, as relevant, by source, type, quantity, composition, concentration and distribution of each pollutant; and
- An adequate estimation of indirect impacts on air quality.

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

ASSESSMENT METHODOLOGY

Scope of assessment

4. The air quality assessment will focus on the potential impacts on air quality as a result of emissions during fuel delivery to the Scheme (from the existing Ħas-Saptan fuel tanks) and emissions during road tanker refuelling.

5. The need for assessment of air quality arising from the construction of the Scheme and from increase in operational traffic were scoped out during an EIA screening exercise carried out in April 2016;[1] it is noted that the applicable trigger levels are not reached by the Scheme.

VOC & Benzene

6. In fuel dispensing stations where there is no abatement, emissions of Volatile Organic Compounds (VOC) arise mainly from the following activities related to the handling of petrol:

- Tank emissions: vapour displacement when an incoming delivery of petrol is received into day tanks; and
- Emissions during road tanker loading: occur when gasoline is transferred from day tanks to the road tanker. They are a combination of vapour from the day tank's contents and the vapour evolved in the road tanker's containers as a result of splashing and turbulence during filling.

7. The Ambient Air Quality Regulations, S.L. 549.59, do not set a target or limit value for Volatile Organic Compounds (VOCs). However, they set a limit value for benzene of 5 $\mu g/m^3$ (annual average).

8. Benzene is a VOC, and it may be found in petrol in concentrations of up to 1% v/v in accordance with Directive 98/70/EC.

9. Since the Regulations only set a limit value for benzene, and there are no limit values or local guidelines for total VOC in ambient air, benzene has been selected as the

[1] MEPA (2016) *Environmental Impact Assessment Screening Report* (revised April 2016), 18 pp.

VOC to be used in the air quality assessment.

Odour

10. Because there is no instrument that can be used to objectively measure odours, and since the human nose is more sensitive to certain odours associated with particular gases than any instrument, it is proposed that odour assessment will be based on the "sniff test", as recommended by Defra (2010).[2]

Competence of surveyors

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

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

Baseline data

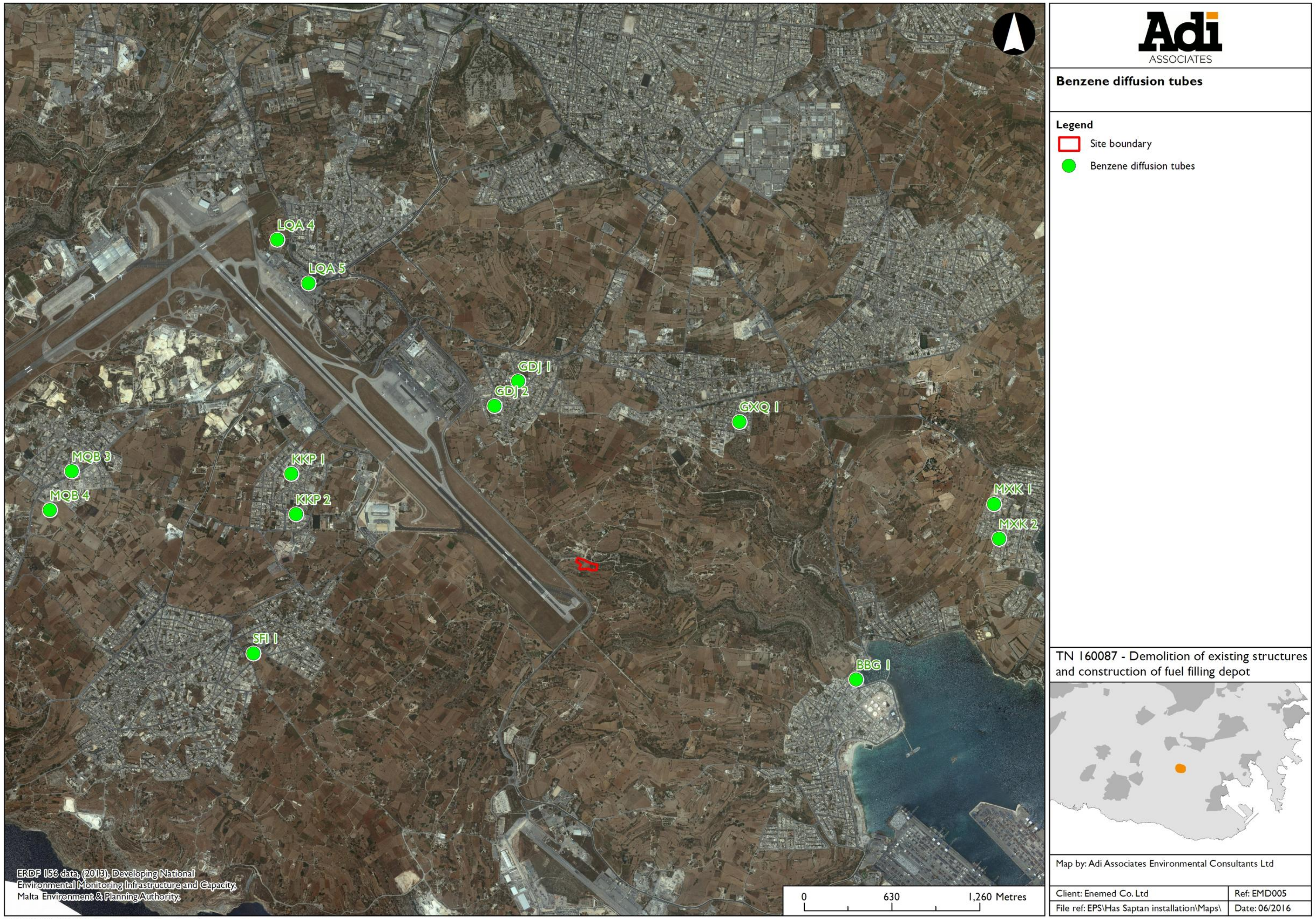
Benzene

13. It is proposed that ERA's long-term diffusion tube data will be used to obtain a baseline indicating current levels of benzene. An average of the data available from ERA's diffusion tube monitoring stations for the years 2014 – 2016 will be used, as shown in **Figure 1**. It will therefore be assumed that this baseline (without the Scheme) currently applies at the identified sensitive receptors.

[2] Defra (2010) *Odour Guidance for Local Authorities* www.gov.uk/government/uploads/system/uploads/attachment_data/file/69305/pb13554-local-auth-guidance-100326.pdf

Adi
ASSOCIATES

Figure 1: Diffusion tube locations for baseline data



INDICATIVE ONLY - Not to be used for direct interpretation

14. As a precaution, it will be assumed that current benzene concentrations will remain constant in the future. This is a conservative assumption since the increasing uptake of vapour recovery systems in petrol stations and lower hydrocarbon emissions from newer vehicles[3] are expected to lead to a reduction in ambient benzene levels.

Odour

15. Baseline odour levels in the vicinity of the Scheme site will be established through a sniff test carried out by two Adi Associates staff members at the nearest odour sensitive receptor over five minutes, and recording any odour experienced at the receptor during this time. Records will be made of any existing odours, including frequency, intensity, duration and offensiveness, as well as the prevailing wind direction.

16. A scale published by the Institute of Air Quality Management (2014)[4] will be used to record odour intensity, as shown in **Table 1**.

Table 1: Odour intensity categories

Odour strength	Intensity level	Description
No odour / not perceptible	0	No odour
Slight / very weak	1	There is probably some doubt as to whether the odour is actually present
Slight / weak	2	The odour is present but cannot be described using precise word or terms
Distinct	3	The odour character is barely recognisable
Strong	4	The odour character is easily recognisable
Very strong	5	The odour is offensive. Exposure to this level would be considered undesirable
Extremely strong	6	The odour is offensive. An instinctive reaction would be to mitigate against further exposure

17. The survey will ideally be undertaken when the wind is blowing towards the sensitive receptor, however, if this is not possible, another location which during the survey is downwind from the Site will also be surveyed.

18. Guidance published by the Institute of Air Quality Management (2014) will be used for classification of receptors as follows:

- High sensitivity receptors: Land where users can reasonably expect enjoyment of

[3] Regulation (EC) N° 715/2007 on the type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 & Euro 6) and on access to vehicle repair and maintenance information. *Official Journal of the European Union,* 171, 1-16

[4] Institute of Air Quality Management (2014) *Guidance on the Assessment of Odour for Planning* http://www.iaqm.co.uk/text/guidance/odour-guidance-2014.pdf.

a high level of amenity and be expected to be present continuously or regularly (e.g. residences, schools);

- Medium sensitivity receptors: Land where users would expect to enjoy a reasonable level of amenity (but not at the same level as in their home), or wouldn't expect to be present here continuously or regularly (e.g. workplaces, commercial / retail premises, playing fields); and

- Low sensitivity receptors: Land where enjoyment of amenity would not reasonably be expected, or where there is transient exposure (e.g. industrial, farms, footpaths and roads).

Modelling of benzene emissions

19. AERMOD will be used to model the annual average increment of benzene from the Scheme. AERMOD[5] is an internationally accepted US EPA regulatory dispersion model that has been extensively validated by the US EPA.

20. Estimates of the annual average emissions of benzene (in tonnes per year) from the Scheme will be provided by the Applicant and used in the dispersion model.

21. Meteorological data for the most recent five years (2011 to 2015) will be obtained from the Malta International Airport.

22. Annual average concentrations of benzene will be modelled at the principal air sensitive receptors within a 3 km radius around the Scheme; these will be selected taking into account the applicability of air quality objectives, as per UK guidance. [6,7] Receptors will include the schools, residential units and homes for the elderly.

23. Predictions will be made for each of five years of meteorological data.

24. The output of the model will be presented in a contour plot and in tabular format. This will enable the increment in benzene concentrations with the Scheme at the sensitive receptors to be identified.

25. Since AERMOD only predicts impacts on air quality occurring due to emissions from the Scheme, the model output will be added to the measured baseline to predict the overall benzene concentrations with the Scheme at the sensitive receptors.

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[5] US EPA (2016) *Preferred/Recommended Models* https://www3.epa.gov/scram001/dispersion_prefrec.htm.

[6] Defra (2009) *Local Air Quality Management Technical Guidance LAQM.TG(09)* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69334/pb13081-tech-guidance-laqm-tg-09-090218.pdf (Box 1.4).

[7] Environmental Protection UK (2010) *Development Control: Planning For Air Quality (2010 Update)* www.iaqm.co.uk/text/guidance/epuk/aq_guidance.pdf (Table 1).

Odour assessment

26. To establish whether the Scheme has the potential to cause odour impacts, a sniff test will be undertaken in the vicinity of the existing the 31st March 1979 fuel installation at Birżebbuġa. This installation has been selected since it is already equipped with a vapour recovery unit (VRU), which, however, is only used during transfers from barges to the fuel tanks. On the other hand, the VRU system at the Scheme will be connected both to each gasoline day tank as well as to the road tanker filling facilities. The new road tankers that will be used at the Scheme will be bottom loaders that will not be able to operate unless they are connected to the VRU.

27. The sniff test will therefore be undertaken during a period when a transfer of petrol to the tanks is being carried out, but there are no road tanker filling operations underway.

28. It is noted that the scale of operations at Birżebbuġa is much larger than at the Scheme site, since the former includes a fuel storage capacity of around 46,000 m^3, whereas fuel storage at the Scheme will be limited to a total of 1,300 m^3 in the day tanks. Therefore this assessment would represent a worst-case scenario in terms of odour emissions.

29. The sniff test will be repeated at several distances and directions from the installation, and records will be made of the frequency, intensity, duration, offensiveness and location of any odours, as well as the prevailing wind direction. Odour intensity will be recorded using the scale presented in **Table 1**.

IMPACT SIGNIFICANCE

Benzene

30. The significance criteria in **Table 2** will be used to assess the significance of impacts arising from the Scheme on air quality. These have been calculated as proportions of the limit value, as is common practice when other pollutants are assessed in EIAs.

Table 2: Criteria of significance: Benzene annual levels

Baseline annual levels of benzene	Change in annual benzene levels due to Scheme		
	≥0.05 to <0.25 µg/m^3	**≥0.25 to <0.5 µg/m^3**	**≥5 µg/m^3**
>5 µg/m^3	Slightly adverse	Moderate adverse	Substantial adverse
≥4.5 to <5 µg/m^3	Slightly adverse	Moderate adverse	Moderate adverse
≥3.75 to <4.5 µg/m^3	Negligible	Slightly adverse	Slightly adverse
<3.75 µg/m^3	Negligible	Negligible	Negligible

Odours

31. The significance of the impact will be assessed using an odour exposure matrix for neutral and unpleasant odours (**Table 3**), followed by a matrix that classifies the odour effect at individual receptors according to the receptor sensitivity (**Table 4**).

Table 3: Odour exposure matrix[8]

Mean odour intensity	Percentage odour time				
	≤10%	**11 to 20%**	**21 to 30%**	**31 to 40%**	**≥41%**
6	Large	Very large	Very large	Very large	Very large
5	Medium	Large	Large	Very large	Very large
4	Small	Medium	Medium	Large	Large
3	Small	Medium	Medium	Medium	Medium
2	Small	Small	Medium	Medium	Medium
1	Small	Small	Small	NA	NA

Table 4: Matrix to assess the odour effect at receptors[9]

Overall odour exposure	Receptor sensitivity		
	Low	**Medium**	**High**
Very large	Substantial adverse	Substantial adverse	Substantial adverse
Large	Moderate adverse	Moderate adverse	Substantial adverse
Medium	Slight adverse	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse

IMPACT MITIGATION AND MONITORING

32. 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
July 2016

[8] Based on IAQM (2014). The odour exposure matrix only applies to neutral and unpleasant odours that can at least be classified as “barely recognisable” (level 3 on the intensity scale for at least part of the sampling period).
[9] IAQM (2014). It is noted that this matrix is not prescriptive.

ASSOCIATES

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

Technical Appendix 2

GEO-ENVIRONMENT BASELINE REPORTS

Prepared by:

SolidBase Ltd

Perit Philip B Grech

Dr Adrian Mifsud

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (ERA)

I, Adrian Mifsud, who carried out geo-technical reports (or part thereof) for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such studies (or parts thereof) were solely carried out by me.

1st August 2016

Date

Signature

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, Philip B Grech, who carried out the Stormwater Runoff Report and the Groundwater Risk Assessment Report for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such studies were solely carried out by me.

1st August 2016

Date

Signature

Proposed fuel depot, Enemed Co. Ltd.

Has-Saptan, Malta.

Job number: J1161 Report number: GIR 1/5

Ground Investigation Report (GIR) To EN1997

solidbase LABORATORY LTD.

Solidbase Laboratory Ltd., Handaq Ind.l Estate, Handaq l/o Qormi Malta QRM 4000 T. 21492807 F. 21492810

April 2015

Document:	**Ground Investigation Report**
Project:	**Enemed Co. Ltd. fuel depot relocation at Has-Saptan**
Reference No.:	**J1161**
Date:	**April 2015**
Prepared For:	**EM Architects**
Engineers:	**Adrian Mifsud B.E.&A.(Hons.), M.Sc., DIC, A&CE**
	Christian Schembri B.E.&A.(Hons.), M.Sc., DIC, A&CE

REPORT STATUS:

		Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
		Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
1	Final	Init AM Sign Comments Date 25/04/2015	Init AM Sign Comments Date 07/09/2015	Init Sign Comments Date	Init Sign Comments Date
0	Preliminary	Init CS Sign Comments Date 16/04/2015	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
Revision	Comments	Prepared By	Approved By	Issued By	Audited By

This sheet to be kept on Report file.

Auditors to insert their comments on the table, to annotate the report itself or provide comments on a separate sheet. (Please state which)

For final reports a hard copy of the signed off form will be kept on the appropriate QA file.

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LIST OF FIGURES

LIST OF TABLES

1 Terms of reference and introduction

Solidbase Laboratory Ltd. has been commissioned by Perit Luke Psaila on behalf of EM Architects to carry out a ground investigation within the proposed site for Enemed's fuel depot at Has-Saptan, Malta. The main objective of this investigation was to determine the geological profile of the site and to characterize the ground materials.

This site investigation has been carried out in accordance with BS 5930 "Code of practice for site investigations". Likewise in-situ and laboratory testing complies with B.S.1377, "Methods of Tests for Soils for Civil Engineering Purposes" and the relevant ISRM suggested methods unless stated otherwise in the text.

The investigative methods, borehole locations, drilling depths and the lab testing methods were specified by Perit Luke Psaila of EM Architects. The results and recommendations of this investigation are therefore limited by the information that can be achieved using these methods. The ground investigation included the following:

1. The drilling of 7 boreholes with full core recovery to depths varying between 6 and 8 metres from the existing ground level.
2. 4 unconfined compressive tests on intact rock specimens from the retrieved borehole core, to ISRM suggested methods at depths specified by Perit Luke Psaila.

2 Site Location

The site location is indicated on the aerial photo shown in Figure 1 (sourced from Google Earth, 2015). The site is very close to the main runway of Malta International Airport and to the main road running parallel to it.

Figure 1 – Approximate site extents are shown by the red polyline (source: Google Earth, 2015)

The topographical map of the site shown in Figure 2 indicates that the site is located within the upper reaches of Wied Has-Saptan, and very close to the valley axis and the presumed watercourse. According to the 1:2500 survey sheet, reproduced in Figure 2, the site is likely to be approximately 55m above mean sea level.

Figure 2 - Site plan of the area showing topography with the approximate location of the site indicated by the red circle

3 Site levels

The information presented in this report is organised in relation to the surveyed levels as issued by EM Architects on the drawing dated 2015-01-07.

4 Regional Geological Setting

The Geological map of the Maltese Islands, shown in Figure 3 below, indicates that the site is underlain by the Il-Mara member of the Lower Coralline Limestone formation. It may in part be underlain by the Lower member of the Globigerina Limestone formation however the contact between these two members is indicated by a dashed line which means that the exact demarcation line between the two rock formations is not known with sufficient accuracy. The Lower member of the Globigerina Limestone formation may or may not therefore be present at the site within the first few metres below the existing natural surface.

Given that the site is located along the main path of Wied Has-Saptan the rock is expected to be altered by fluvial processes. Such processes could possibly result in the deposition of sediment, left behind by the water flow, and in the development of karst geomorphology, where the water dissolves the rock to create cavities.

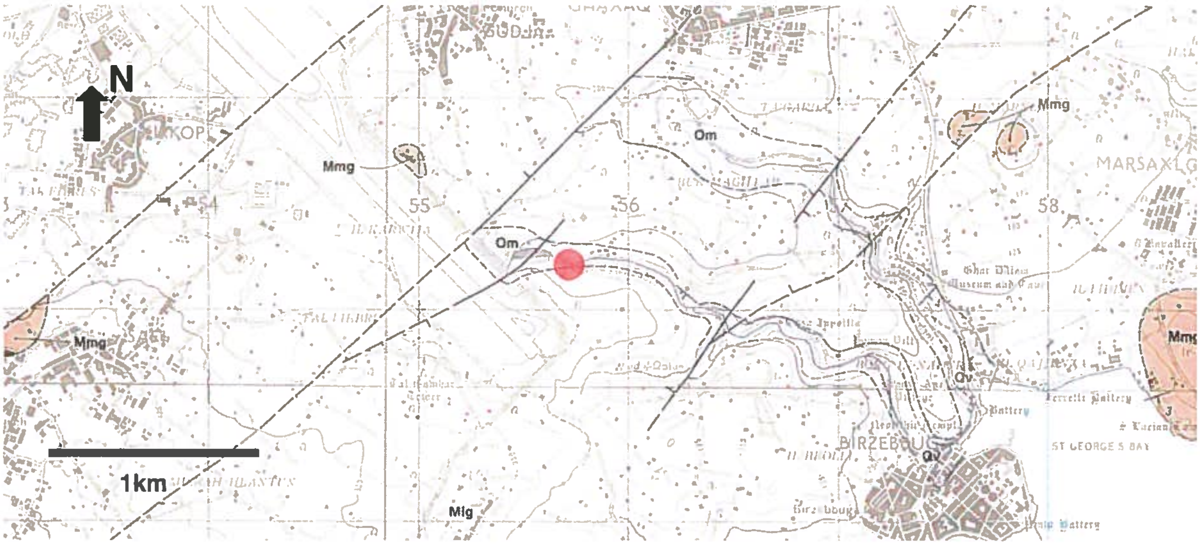


Figure 3 – Extract from the Geological Map of Malta (1993) with the location of the site indicated by the red circle

Mlg	**Lower Globigerina Limestone Member:** Pale cream to yellow planktonic foraminiferal packstones rapidly becoming wackestones above the base. Glauconite is common in western outcrops south of Fomm ir-Rih. Pectinid bivalves and *Shizaster* echinoids are frequent. The top of the member is marked by a ubiquitous hardground. This is phosphatised in western areas and carries a conglomerate (**Mcl**, Lower Phosphorite Conglomerate Bed). Common fossils include fish teeth, molluscs, solitary corals and echinoids. **Thickness 0-80m.** (**Mlg** MIOCENE, AQUITANIAN

OLIGOCENE

LOWER CORALLINE LIMESTONE FORMATION

Om	**Il - Mara Member:** Tabular beds of pale-cream to pale-grey carbonate mudstones, wackestones and packstones in 1 to 2m thick units. Thickest developments are in eastern Malta between Il - Mara and Marsascala. These pass laterally northwards and west into the Xlendi Member. The top of the member is transitional with the Lower Globigerina Limestone Member with a *Scutella* echinoid bed at the junction (**Ms** '*Scutella* Bed'). Bryozoan fragments are common and banks of '*Lepidocyclina*' foraminifers occur locally. *Terebratula* is common in the Marsascala and Wied Has - Sabtan sections. **Thickness 0-20m.** (**Om** OLIGOCENE, CHATTIAN).

Figure 4 – Extract from the legend of the Geological Map of Malta (1993)

5 Site Work

Site works included the drilling with full core recovery of 7 investigative boreholes to depths varying between 6 and 8 metres. The positions of these boreholes are shown in Figure 5.

5.1 Borehole drilling

The borehole logs and the photos of the retrieved core are shown in Appendix A. In the photographs, each set represents the core recovered from one complete borehole. Retrieved borehole core has been placed in order of depth, with the core sections retrieved from the shallower depths on the left and those retrieved from deeper sections on the right, when looking at the photo.

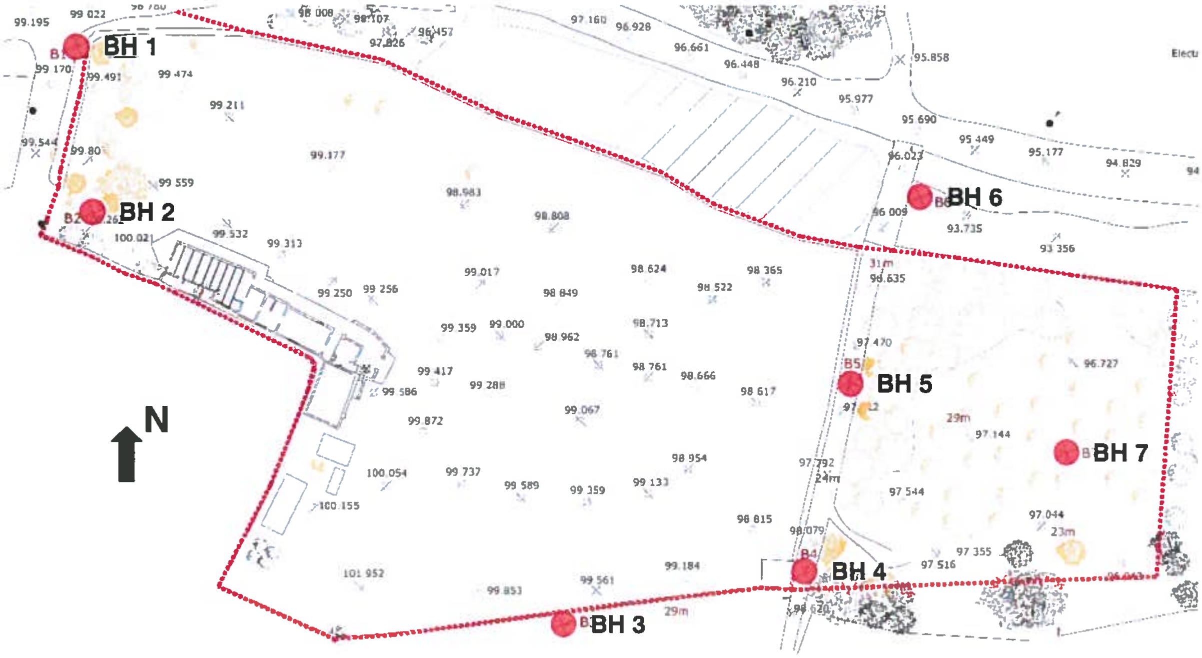


Figure 5 – Ppositions of the investigative boreholes carried out indicated by red circles on a surveyed plan of the existing.

Descriptions of strength of the retrieved core (e.g. "stiff", "moderately weak") are based on simple hand tests according to BS 5930-1999 "Code of practice for site investigations". These therefore provide a simple classification of the rock core and the soil core as observed in the laboratory as shown in Error! Not a valid bookmark self-reference. **and**

Table 2 respectively.

Table 1 – Simple hand descriptions used to describe expected rock strength

Term describing strength	**Simple hand definition**	**Expected UCS (MPa)**
Very weak	Gravel size lumps can be crushed between finger and thumb	<1.25
Weak	Gravel size lumps can be broken in half by heavy hand pressure	1.25 – 5
Moderately weak	Only thin slabs, corners or edges can be broken off with heavy hand pressure	5 – 12.5
Moderately strong	When held in the hand, rock can be broken by hammer blows	12.5 – 50
Strong	When resting on a solid surface, rock can be broken by hammer blows	50 – 100
Very strong	Rock chipped by hammer blows	100 – 200
Extremely strong	Rock rings on hammer blows, only broken by sledgehammer	>200

Table 2 – Simple hand descriptions used to describe expected soil strength (undrained strength)

Term describing strength	**Simple hand definition**	**Expected s_u (kPa)**
Very soft	Fingers easily pushed in up to 25mm	0 – 20
Soft	Fingers pushed in up to 10mm	20 – 40
Firm	Thumbs makes impression easily	40 – 75
Stiff	Can be indented by thumb	75 – 150
Very stiff	Can be indented by thumbnail	150 – 300
Hard (very weak mudstone)	Can be scratched by thumbnail	>300

The site is immediately underlain by a layer of topsoil and limestone fill which reaches a maximum depth of 2 metres in some of the boreholes, namely in boreholes 1, 2 and 6. In the other boreholes the depth of this layer ranges between 0.2 and 1.6 metres.

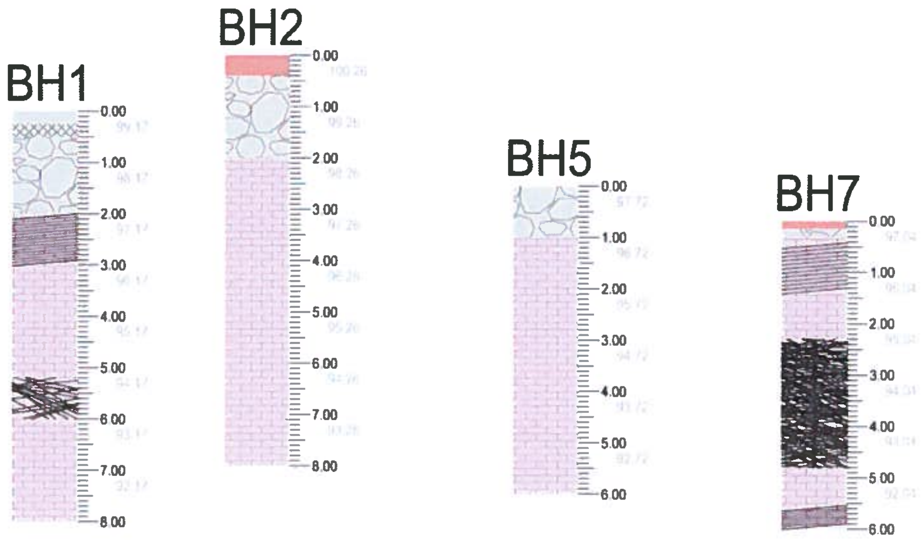


Figure 6 - Fence diagram from the borehole logs, in an approximate west-east direction

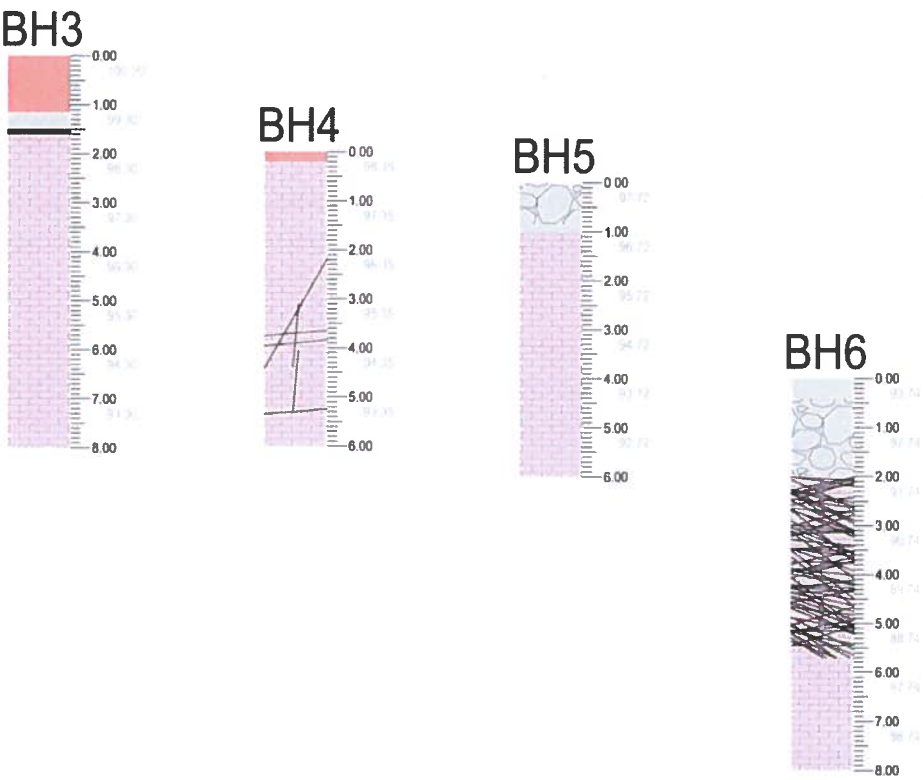


Figure 7 - Fence diagram from the borehole logs, in an approximate south-north direction

Below the top surface strata, consisting mostly of loose deposits, the Il-Mara member of the Lower Coralline Limestone formation was recovered. From visual observations it is noted that this member has a variable grain size distribution varying from fine (a similar grain size to the lower member of the Globigerina Limestone) to coarse. Stratification was carried out on this basis, but it was also noted that within a particular rock core the grain size varies from fine to coarse or from medium to coarse even within the same stratum. While highlighting that a detailed geologic profile determining the extent of the various facies across the site is beyond the scope of this investigation, the observation of a finer grained stratum occuring between the approximate levels of 93.3m and 91.4m in boreholes 3, 5 and 7 can be highlighted.

In these boreholes this stratum is overlain by a coarser grained stratum and in borehole 5, within this stratum, a karstified cavity was intersected which is extensively calcified at some locations. It has been noted from previous experience with investigations in similar strata that karstification may form along preferential paths where a change in grain size occurs. Water flows more easily through coarser-grained strata than finer-grained strata and thus the coarser-grained strata are more subject to water-dissolution. From the observations made on the retrieved borehole core the Il-Mara member of the Lower Coralline Limestone is subject to such kartification processes.

It has also been observed that within some lengths of the recovered core, the Total Core Recovery (TCR)[1] values were less than 100%, specifically within the bottom 3 metres of boreholes 1, 2, 6 and 7, where this value varied between 50% and 78%. This may mean that the rock material is very friable or that that karstified cavities have been encountered at this horizon.

The diagrams shown in the borehole logs do show discontinuities where these could be clearly observed to exist when inspecting the retrieved core. In other locations, the core was too fractured to allow direct description of the individual discontinuities, and so these are not shown. The presence of fracturing is however inferred by the lower values of the solid core recovery (SCR)[2] values and the rock quality designation (RQD)[3] values, that are shown alongside these diagrams.

The lower values of Rock Quality Designation (RQD) values measured on the retreived core are presented in Table 3. The sections of rock core having RQD in excess of 50% are not included in this list, sicne these represent the more intact strata. Similarly, solid core recovery (SCR) and RQD are not computed in the topsoil and fill layers as these parameters pertain only to rock core. RQD values lower than 25% are noted to occur in the lower elevations of boreholes 1,3 and 6 and in the top part of the rock core of borehole 7.

Table 3 – Table showing the data for the rock core having an RQD less than 50%. The orange highlighted cells indicate those sections of borehole core having RQD values less than 25%.

BH ref	Bottom level (m)	Top level (m)	SCR (%)	RQD (%)
1	94.67	97.67	60	33
1	91.17	94.17	15	13
2	92.262	95.262	41	38
3	92.30	95.30	20	13
4	92.35	95.15	50	43
5	91.722	94.722	48	41
6	88.735	91.735	30	27
6	85.735	88.735	28	22
7	94.044	96.744	26	20
7	91.044	94.044	42	33

[1] TCR (%) - ratio of core recovered (solid and non-intact) to length of core run

[2] SCR (%) - ratio of solid core recovered to length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is commonly measured along the core axis. By this definition, core is solid unless intersected by more than one joint set with different strike directions.

[3] RQD (%) – ratio of solid core pieces longer than 100mm to length of core run

From observations of the rock core and from previous experience it may well be expected that the strength of the rock core is variable within some sections due to the passage of water.

6 Laboratory Tests

Laboratory tests were carried out to assess the strength and pore structure characteristics of bedrock underlying the site. This was achieved by carrying out unconfined compressive strength measurements in accordance with the recommended methods of the International Society for Rock Mechanics (ISRM). The ultrasonic pulse velocity and the bulk density were measured for each test specimen, immediately before crushing the specimen in the compression machine. The moisture content was then determined from intact pieces of the crushed specimen by placing some of these in an oven for 24 hours.

The particle density of the rock specimens was assumed at 2.70 Mg/m^3 on the basis of tests on similar materials carried out by Solidbase Laboratory. This value depends on the mineralogical characteristics of the limestone (its purity as calcium carbonate) and generally varies between 2.60 and 2.74Mg/m^3. Assuming this value, the porosity, void ratio, degree of saturation and saturated densities can all be determined, in addition to the unconfined compression strength, the bulk density and the moisture content, which are measured directly from the test specimens.

The test specimens were all prepared from retrieved borehole core. To enable better interpretation of the results, the point representing the result of a particular test (in the following figures) is colour coded according to the borehole from which the specimen was prepared. The colour scheme used for this purpose is shown in Figure 8 below.

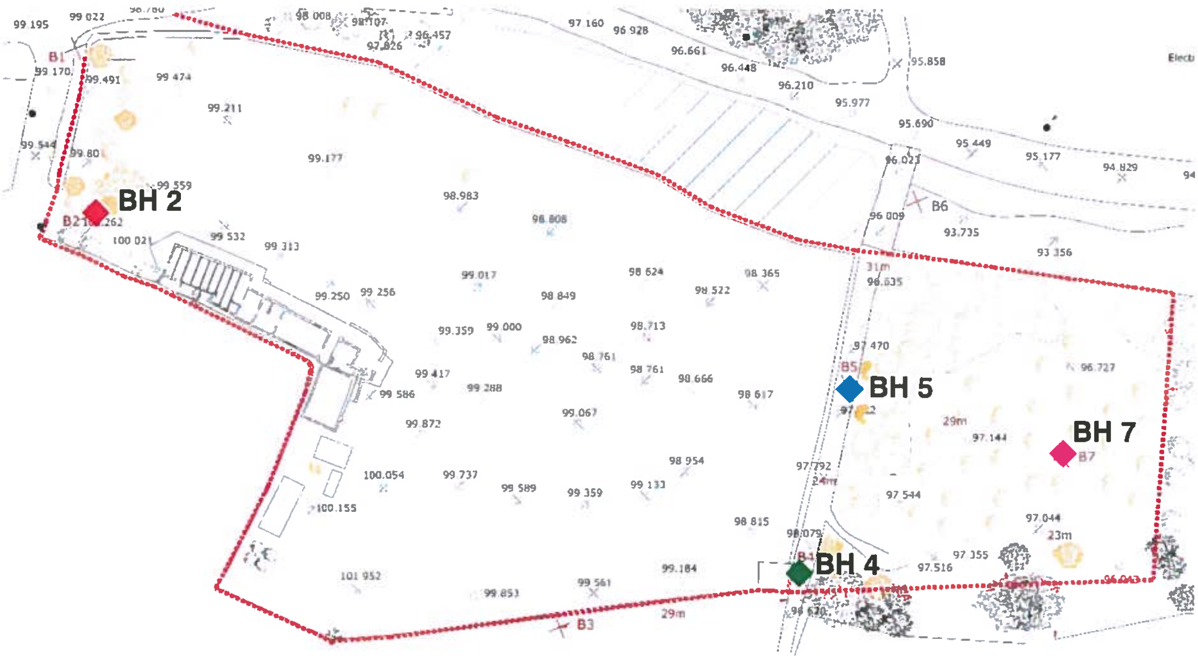


Figure 8 – Colour coding for presentation of test results on the graphs further down.

The following test results have been developed because it was possible to prepare suitable test specimens for the unconfined compressive strength tests. These tests require solid retrieved core pieces of at least 300mm length, having relatively few defects and which are sufficiently strong to withstand the forces created during machining. This machining is required to achieve the dimensional tolerances and surface flatness required by the ISRM suggested method for the unconfined compressive strength test.

The ISRM requirements imply that sections of core having discontinuities at spacing less than 300mm or that are very weak cannot be used for preparing test specimens. Some sections of the retrieved core were extensively fractured, as seen in the borehole logs and in the associated photographs, meaning that these sections had to be excluded for specimen preparation. This means that the cores as tested are biased towards the stronger strata, and the properties of the weaker rocks may not feature.

6.1 Tests in unconfined compression

The results of the tests in unconfined compression, as well as other derived parameters from the same specimens are shown in the graphs below, where the results are plotted in relation to site elevation as calculated from the level of the top of each borehole. The red line represents a linear regression fit through the data, the pink line represents the characteristic value calculated on the basis of EN 1991 and the light blue line represents the local low values. The characteristic value is considered to be a cautious estimate of the mean value.

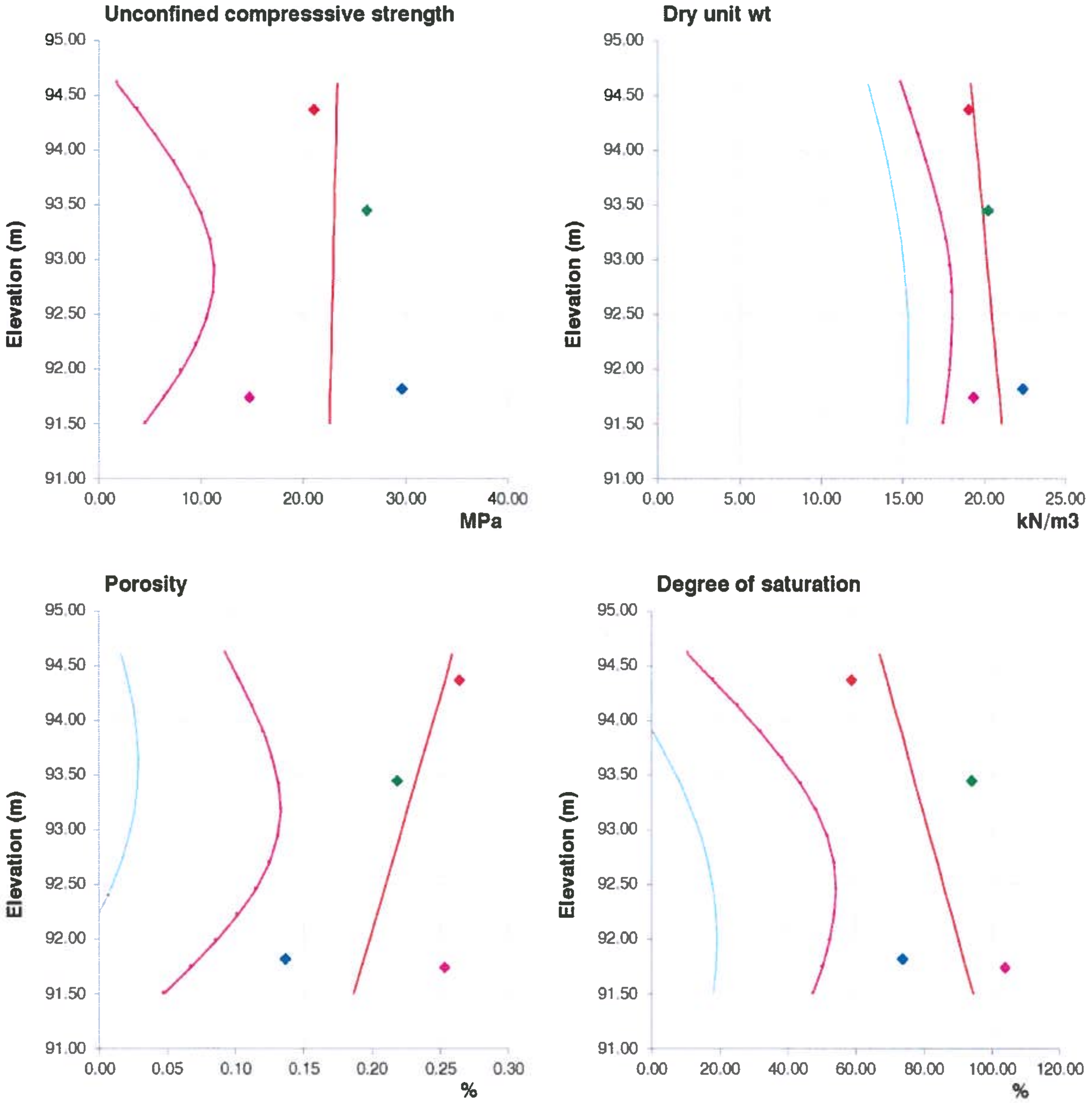


Figure 9 - Results of unconfined compression strength tests to ISRM suggested methods

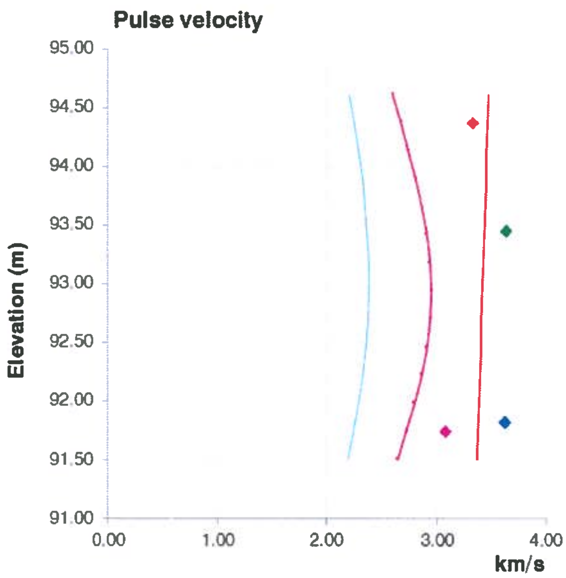
Table 4 - Summary of results from UCS tests and specimen preparation

	Gs (assumed)	Bulk unit wt	Dry unit wt	Voids ratio	Porosity	Degree of saturation	Saturated unit wt	Unconfined comp. strength	Moisture Content	Pulse velocity
	Mg/m³	kN/m³	kN/m³			%	kN/m³	MPa	%	km/s
Minimum	2.7	20.57	19.05	0.18	0.16	55.28	21.80	14.77	4.40	3.08
Maximum	2.7	23.35	22.36	0.39	0.28	97.51	23.89	29.61	13.36	3.63
Average	***2.70***	***22.02***	***20.24***	***0.31***	***0.24***	***76.12***	***22.55***	***22.90***	***8.93***	***3.42***

The tests in unconfined compression and the derived parameters indicate that il-Mara member of the Lower Coralline Limestone can exhibit moderately strong characteristics and relatively dense dry unit weight. This is confirmed by the relatively low porosity measured on the chosen test specimens. The degree of saturation approaches is less than 100% - is to be noted that saturated specimens of this type of rock tend to exhibit unconfined compressive strength values that are smaller than the equivalent strengths of the partially saturated specimens.

The scatter of results for unconfined compression is wide, with strength values varying between 14.77 and 29.61MPa with an average of around 22.90 MPa. This refers to the stronger rock strata, and excludes the weaker layers, where the estimated strength is likely to be much less. The population of test specimens is considered to be too small to make generalisations, and therefore these results should be treated with caution.

Shown in Figure 10 below are the ultrasonic pulse velocity measurements on the test cores prior to crushing. These represent the compression wave velocity through the specimen (V_p in km/s). It is seen that there is a relationship between strength and stiffness for the intact material.



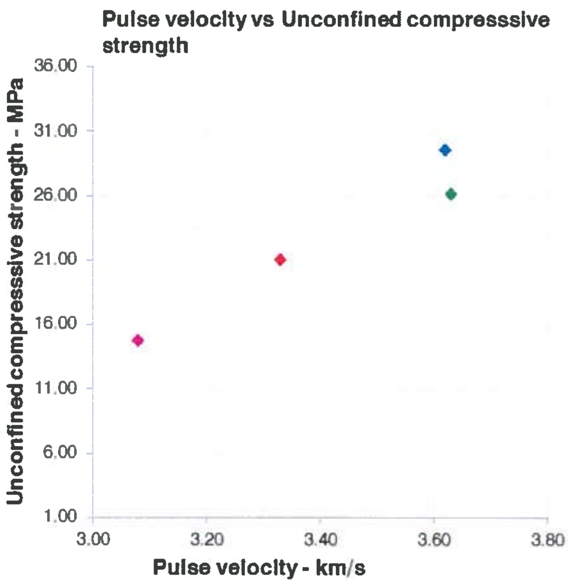


Figure 10 – Results of ultrasonic pulse velocity measurements and their correlation with unconfined compressive strength.

It is to be noted that the strength of the ground in resisting the project loads will not be dependant only on the results of these laboratory tests. The engineering behaviour of a rock mass depends on the strength of the intact rock (presented in the results of the laboratory tests) and on the degree of fracturing or discontinuity, which is indicated on the borehole logs. Both of these should be considered when assessing the interaction between the proposed structures and the ground. The rock mass is considered to be fractured in this particular site.

The choice of sections of borehole core for test specimen preparation, although carried out by Solidbase Laboratory, was carried out within the parameters specified by EM Architects. In view of the observed characteristics of borehole core, these test specimens may not be representative of indicative of the expected behaviour of the ground in relation to the proposed loading and its configurations.

The results presented should therefore NOT be considered representative of the expected geotechnical characteristics of this site, but as being representative of the specific location from which they have been taken. Geotechnical behaviour may be influenced by the overall characteristics, and not by those at the specific locations from which the test specimens have been taken.

7 Summary and Conclusion

7.1 Geomorphology and stratigraphy

1) The site is located in a valley, very close to the presumed watercourse. It is to be noted that the flow of water could have been much higher in distant geological time.
2) The site is underlain by porous and coarse grained Lower coralline Limestone, specifically of the 'il-Mara' member. There are strong indications that this type of rock is subject to dissolution by running water and therefore prone to karstification.

7.2 Ground properties

1) The strength of the rock was measured through a very limited number of unconfined compression tests, whose results may not be fully representative of the expected geotechnical behaviour of the various strata observed in the retrieved borehole core.
2) Weaker layers were identified in the retrieved core, and some strata are extensively fractured. There does not appear to be a distinct pattern in the vertical distribution of such fractured zones.

7.3 Geotechnical behaviour

1) Geotechnical behaviour will depend on the magnitude and type of the applied loads and their relative stress distribution. Small foundations will influence the top layers, and therefore the performance of such foundations will depend on the layer that they are founded on. Wider foundations will influence deeper layers and therefore the mechanical behaviour of such layers needs to be taken into account. The possibility of bearing capacity failure will exist if heavy loads are concentrated over very fractured strata.
2) Settlement considerations may be of relevance if structures that are sensitive to settlement are founded over strata that consist of weak soil and fill (as in the upper layers) or on rock strata containing discontinuities that are filled with weaker materials.
3) There is evidence to indicate that dissolution voids can exist in the rock from which the core was retrieved. Such voids can be problematic under concentrated loads, especially if these loads are substantial. The presence of such voids should therefore be checked before building foundations, using probing or geophysical techniques, since this is likely to be more critical than the actual capacity of the solid rock as a bearing stratum.
4) It is the opinion of the undersigned that a much more realistic assessment of the ground as a bearing stratum can be made once excavation levels are decided upon and the site is

excavated. This would allow the actual rock strata in contact with the foundations to be inspected, sampled and assessed.

8 Disclaimer

Any opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between exploratory positions, these are only for guidance and no liability can be accepted for their accuracy.

This analysis is relevant only to the results obtained through this investigation and cannot be extrapolated to other areas. The analysis presented in this report in no way guarantees the stability or otherwise of the existing structures, within and in the vicinity of the site investigated, or their foundations, existing and proposed. Ground conditions are relevant only to the positions of the boreholes, and there is no guarantee that similar conditions are replicated in adjacent areas, however close these may be to the borehole locations.

Report Compiled by:

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Engineering Geologist

Appendix A: Borehole logs and photos

solidbase LABORATORY LTD	Borehole Drilling Record	page 1 of 2	BH1

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	99.17	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Very Dark Greyish Brown (2.5Y 3/2), loose, medium grained, gravelly sand, mixed with topsoil, LIMESTONE FILL	0.00 (99.17)	1 (0: 0)	100					Advance casing. Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), moderately strong, medium grained (man made) concrete and LIMESTONE FILL									
Yellowish Brown (10YR 5/6), stiff, medium grained, gravel mixed with topsoil, LIMESTONE FILL	1.00 (98.17)								
Pale Brown (2.5Y 7/3), moderately strong, medium grained limestone, LIMESTONE FILL		2 (0: 0)	100	60	33.3			Coring using double core sampler	Full, Yellow
Pale Brown (2.5Y 7/3), moderately strong, medium to coarse grained, calcified and weathered limestone, LOWER CORALLINE, Il-Mara member. Discontinuity, sub-horizontal, at 60 mm spacing, rough calcified sides, terrarossa traces, aperture unclear	2.00 (97.17)								
Pale Brown (2.5Y 7/3), moderately weak to moderately strong, variably calcified, medium grained limestone, LOWER CORALLINE, Il-Mara member	3.00 (96.17)								
	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD

Borehole Drilling Record

BH1

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	99.17	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 7/3), moderately weak to moderately strong, variably calcified, medium grained limestone, LOWER CORALLINE, Il-Mara member	4.00								
		3 (0: 0)	100	90	80			Coring using double core sampler	Full, Yellowish White
Brownish Yellow (10YR 6/6), moderately strong, coarse grained, contains terrarossa traces, calcified limestone, LOWER CORALLINE, Il-Mara member	5.00	4 (0: 0)	66.7	15	13.3			Coring using double core sampler	Lost.
Discontinuity, randomly oriented, at 40 mm spacing, rough calcified sides, terrarossa traces, aperture unclear	6.00								
Very Pale Brown (10YR 7/3), moderately strong, coarse grained, calcified limestone, LOWER CORALLINE, Il-Mara member	7.00								
End of borehole	8.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

- Limestone fill (Recent deposits)
- Topsoil (Recent deposits)
- Lower Globigerina Limestone (MIOCENE, Aquitanian)
- Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
- Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
- Fill
- Clay
- Marl
- Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 11 - Retrieved core from borehole 1

Borehole Drilling Record

BH2

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	100.262	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Dark Yellowish Brown (10YR 3/4), loose, medium grained gravelly silt, TOPSOIL	0.00 (100.26)	1 (0:0)	100					Advance casing; Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), moderately weak to moderately strong, medium grained, limestone mixed with topsoil , LIMESTONE FILL	1.00 (99.26)								
Pale Brown (2.5Y 8/3), moderately weak to moderately strong, medium grained limestone, LIMESTONE FILL		2 (0:0)	100					Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), moderately strong, medium to coarse grained limestone, LOWER CORALLINE, Il-Mara member	2.00 (98.26)	3 (0:0)	100	57.7	50			Coring using double core sampler	Full, Whitish Yellow
	3.00 (97.26)								
Discontinuity at 15°, rough sides, terrarossa traces, aperture unclear	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

- Limestone fill (Recent deposits)
- Topsoil (Recent deposits)
- Lower Globigerina Limestone (MIOCENE, Aquitanian)
- Lower Coralline Limestone, il-Mara Member (OLIGOCENE, Chattian)
- Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
- Fill
- Clay
- Marl
- Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Borehole Drilling Record

BH2

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	100.262	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing		Drilling progress	Returns
Pale Brown (2.5Y 7/3), moderately strong, medium to coarse grained limestone, LOWER CORALLINE, Il-Mara member	4.00						4.80	MC: 7.99 % BD: 2097.29 kg/m3 UCS: 21.06 N/mm2		
Pale Brown (2.5Y 8/3), moderately weak to moderately strong, fine to coarse grained limestone, LOWER CORALLINE, Il-Mara member	5.00	4 0: 0	66.7	41.7	38.3				Coring using double core sampler	Lost,
	6.00									
	7.00									
End of borehole	8.00									

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

- Limestone fill (Recent deposits)
- Topsoil (Recent deposits)
- Lower Globigerina Limestone (MIOCENE, Aquitanian)
- Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
- Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
- Fill
- Clay
- Marl
- Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 12 - Retrieved core from borehole 2

Borehole Drilling Record

BH3

solidbase LABORATORY LTD

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	100.3	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Dark Yellowish Brown (10YR 3/4), loose to stiff, medium grained gravelly silt, TOPSOIL	0.00 (100.30)	1 (0: 0)	100					Advance casing Core retrieval with simple sampler	Lost,
Dark Yellowish Brown (10YR 3/4), stiff, medium grained gravelly silt, TOPSOIL	1.00 (99.30)								
Dark Yellowish Brown (10YR 3/4), moderately weak, medium grained, gravelly silt mixed with topsoil, LIMESTONE FILL									
Pale Brown (2.5Y 8/3), moderately weak, medium grained gravel, LIMESTONE FILL		2 (0: 0)	100	66	60			Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/3), moderately strong, fine to coarse grained limestone, LOWER CORALLINE, Il-Mara member	2.00 (98.30)	3 (0: 0)	100	88.3	88.3			Coring using double core sampler	Full, Whitish Yellow
Discontinuity at 45°, rough sides, terrarossa infill, aperture unclear	3.00 (97.30)								
	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Fill
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Clay
Lower Coralline Limestone, il-Mara Member (OLIGOCENE, Chattian)
Marl
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD	Borehole Drilling Record	page 2 of 2	BH3

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	100.3	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/3), moderately strong, fine to coarse grained limestone, LOWER CORALLINE, Il-Mara member	4.00								
	5.00	4 0: 0	100	20	13.3			Coring using double core sampler	Full, Yellow
	6.00								
Pale Brown (2.5Y 7/3), very weak (rock) to moderately strong, fine to coarse grained limestone, LOWER CORALLINE, Il-Mara member	7.00								
End of borehole	8.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 13 - Retrieved core from borehole 3

solidbase LABORATORY LTD

Borehole Drilling Record

BH4

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	98.35	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing		Drilling progress	Returns
Pale Brown (2.5Y 8/4), moderately strong, medium to coarse grained limestone, LOWER CORALLINE, Il-Mara member	4.00									
Discontinuity, sub-vertical, rough sides, terrarossa traces, aperture unclear							4.90	MC: 9.96 % BD: 2268.71 kg/m3 UCS: 26.17 N/mm2		
	5.00									
Discontinuity, sub-horizontal, rough sides, terrarossa infill, aperture unclear										
Discontinuity at 60°, rough sides, terrarossa traces, aperture unclear										
End of borehole	6.00									

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Fill
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Clay
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Marl
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD	Borehole Drilling Record	page 1 of 2	BH4

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	98.35	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Dark Yellowish Brown (10YR 3/4), loose, medium grained, gravelly silt mixed with limestone fill, TOPSOIL	0.00 (98.35)	1 0: 0	100					Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), moderately strong, fine to medium grained, variably calcited limestone, LOWER CORALLINE, Il-Mara member		2 0: 0	100	70	56.7			Coring using double core sampler	Full, Yellow
Discontinuity, sub-horizontal, rough sides, terrarossa traces, aperture unclear									
Discontinuity, sub-horizontal, rough sides, terrarossa traces, aperture unclear									
Discontinuity, sub-horizontal, rough sides, terrarossa traces, aperture unclear									
	1.00 (97.35)								
Pale Brown (2.5Y 7/3), very weak (rock) to moderately strong, fine to medium grained, containing soil-like limestone debris, variably calcited limestone, LOWER CORALLINE, Il-Mara member									
Pale Brown (2.5Y 8/4), moderately strong, medium to coarse grained limestone, LOWER CORALLINE, Il-Mara member	2.00 (96.35)								
Discontinuity, sub-horizontal, rough calcified sides, no infill, aperture unclear									
	3.00 (95.35)								
		3 0: 0	93.3	50	43.3			Coring using double core sampler	Full, Yellow
Discontinuity at 60°, rough sides, terrarossa infill, aperture unclear									
Discontinuity, sub-horizontal, rough sides, terrarossa traces, aperture unclear									
Discontinuity, sub-vertical, rough sides, terrarossa traces, aperture unclear									
Discontinuity, sub-horizontal, rough sides, terrarossa traces, aperture unclear	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 14 - Retrieved core from borehole 4

solidbase LABORATORY LTD	Borehole Drilling Record		BH5

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	97.722	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 7/3), moderately strong, medium grained limestone containing terrarossa traces, LIMESTONE FILL	0.00 (97.72)	1 (0: 0)	100	60	55			Coring using double core sampler	Full, Brownish Yellow
Pale Brown (2.5Y 7/3), very weak (rock) to moderately strong, medium grained limestone, LIMESTONE FILL									
Pale Brown (2.5Y 8/3), moderately strong, medium grained limestone, LOWER CORALLINE, Il-Mara member	1.00 (96.72)								
	2.00 (95.72)								
Discontinuity at 45°, rough sides, terrarossa infill, aperture unclear									
	3.00 (94.72)	2 (0: 0)	73.3	48.3	41.7			Coring using double core sampler	Full, Whitish Yellow
White (2.5Y 8/1 to 2.5Y 6/4), moderately strong, medium to coarse grained, limestone, LOWER CORALLINE, Il-Mara member - contains an extensively karstified cavity									
	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Fill
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Clay
Lower Coralline Limestone, il-Mara Member (OLIGOCENE, Chattian)
Marl
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD	Borehole Drilling Record	page 2 of 2	BH5

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	97.722	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing		Drilling progress	Returns
White (2.5Y 8/1 to 2.5Y 6/4), moderately strong, medium to coarse grained, limestone, LOWER CORALLINE, Il-Mara member - contains an extensively karstified cavity	4.00									
Pale Brown (2.5Y 8/3), moderately strong, fine grained limestone, LOWER CORALLINE, Il-Mara member	5.00									
							5.90	MC: 4.40 % BD: 2380.71 kg/m3 UCS: 29.61 N/mm2		
End of borehole	6.00									

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)

Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 15 - Retrieved core from borehole 5

solidbase LABORATORY LTD	Borehole Drilling Record	page 2 of 2	BH6

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	93.735	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/3), moderately strong, fine to coarse grained, extensively calcified at parts, limestone, LOWER CORALLINE, Il-Mara member. Discontinuity, randomly oriented, at 50 mm spacing, rough calcified sides, terrarossa traces, aperture unclear	4.00								
	5.00	4 0: 0	50	28.3	21.7			Coring using double core sampler	Lost,
Pale Brown (2.5Y 8/3), moderately strong, fine to medium grained limestone, LOWER CORALLINE, Il-Mara member	6.00								
Discontinuity at 70°, rough sides, terrarossa traces, aperture unclear	7.00								
End of borehole	8.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

- Limestone fill (Recent deposits)
- Topsoil (Recent deposits)
- Fill
- Lower Globigerina Limestone (MIOCENE, Aquitanian)
- Clay
- Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
- Marl
- Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
- Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD

Borehole Drilling Record

BH6

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	93.735	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
White (2.5Y 8/1), moderately weak, medium grained limestone, LIMESTONE FILL	0.00	1 (0: 0)	100					Core retrieval with simple sampler	Lost,
		1 (0: 0)						Advance casing	Lost,
White (2.5Y 8/1), moderately strong, medium grained man made concrete, LIMESTONE FILL									
Pale Brown (2.5Y 7/3), moderately weak, medium grained limestone, LIMESTONE FILL	1.00								
		2 (0: 0)	100					Coring using double core sampler	Lost,
Pale Brown (2.5Y 8/3), very weak (rock) to moderately strong, fine to medium grained, contains very friable soil-like limestone debris at base, limestone, LOWER CORALLINE, Il-Mara member Discontinuity, randomly oriented, at 50 mm spacing, rough calcified sides, terrarossa traces, aperture unclear	2.00								
Pale Brown (2.5Y 8/3), moderately strong, fine to coarse grained, extensively calcified at parts, limestone, LOWER CORALLINE, Il-Mara member Discontinuity, randomly oriented, at 50 mm spacing, rough calcified sides, terrarossa traces, aperture unclear	3.00	3 (0: 0)	100	30	27.5			Coring using double core sampler	Lost,
	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, Il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 16 - Retrieved core from borehole 6

solidbase LABORATORY LTD — Borehole Drilling Record

BH7

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	97.044	0

Description	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Very Dark Greyish Brown (2.5Y 3/2), loose, medium grained gravelly silt, TOPSOIL	0.00	1 (0: 0)	100					Advance casing Core retrieval with simple sampler	Lost,
White (2.5Y 8/1 to 2.5Y 7/3), moderately strong, medium grained limestone, LIMESTONE FILL		2 (0: 0)	100	26.7	20			Coring using double core sampler	Lost,
white (2.5Y 8/1 to 2.5Y 7/3), moderately strong, medium grained, weathered and calcified limestone, LOWER CORALLINE, Il-Mara member Discontinuity, sub-horizontal, at 80 mm spacing, rough calcified sides, terrarossa traces, aperture unclear									
Pale Brown (2.5Y 7/3), moderately strong, medium grained limestone, LOWER CORALLINE, Il-Mara member	1.00								
	2.00								
Pale Brown (2.5Y 7/3), moderately strong, coarse grained, contains large amounts of macrofossils Discontinuity, randomly oriented, at 20 mm spacing, rough sides, terrarossa traces, contains extensive karstification, aperture unclear	3.00	3 (0: 0)	78.6	42.9	33.9			Coring using double core sampler	Lost.
	4.00								

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

- Limestone fill (Recent deposits)
- Topsoil (Recent deposits)
- Fill
- Lower Globigerina Limestone (MIOCENE, Aquitanian)
- Clay
- Lower Coralline Limestone, il-Mara Member (OLIGOCENE, Chattian)
- Marl
- Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)
- Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

solidbase LABORATORY LTD	Borehole Drilling Record	page 2 of 2	BH7

Client:	Location:	Weather:	Date started:	Date completed:
EM Architects obo Enemed	Site at Has-Saptan	Sunny	06/04/2015	06/04/2015
			Northings: 0	Eastings: 0

Job No:	Drill type:	Bit type/diameter:	Orientation:	Drilling fluid:	Ground level:	Water level:
J1161	CMV -600	Double core	vertical	Fresh Water	97.044	0

Description	Log	Depth (Actual depth)	Run (Drill time)	TCR %	SCR %	RQD %	f/m /m	Sampling/testing		Drilling progress	Returns
Pale Brown (2.5Y 8/3), moderately weak to moderately strong, fine grained limestone, LOWER CORALLINE, Il-Mara member Discontinuity, randomly oriented, at 20 mm spacing, rough sides, terrarossa traces, contains extensive karstification, aperture unclear		4.00 5.00						5.30	MC: 13.36 % BD: 2234.24 kg/m3 UCS: 14.77 N/mm2		
Light Yellowish Brown (2.5Y 6/4), moderately strong, medium grained, hardened by water infiltration, LOWER CORALLINE, Il-Mara member Discontinuity, sub-horizontal, at 50 mm spacing, rough calcified sides, terrarossa traces, aperture unclear End of borehole		6.00									

Legend:

GL:	ground level
AOD:	above Ordinance Datum
BGL:	below ground level
AMSL:	above mean sea level
RQD:	Rock Quality Designation
TCR:	total core recovery
SCR:	solid core recovery
f:	fracture frequency
O/H:	open hole

Limestone fill (Recent deposits)
Topsoil (Recent deposits)
Lower Globigerina Limestone (MIOCENE, Aquitanian)
Lower Coralline Limestone, il-Mara Member (OLIGOCENE, Chattian)
Lower Coralline Limestone, Xlendi Member (OLIGOCENE, Chattian)

Fill
Clay
Marl
Limestone

Legend:

UCS:	uniaxial compressive strength
BD:	Bulk density
ABS:	Absorption
MC:	Moisture content
PP:	Pocket penetrometer
PSV:	Pocket shear vane

Soil and rock colour references are according to the Munsell notation (Munsell soil colour charts 2009)

Figure 17 - Retrieved core from borehole 7

Appendix B: Test Certificates

solidbase LABORATORY LTD

ISO 17025 ACCREDITED TESTING NAB-MALTA № 008

TEST CERTIFICATE

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Enemed Co Ltd
Client Address: 31st March 1979 Installation

Birzebbugia
Client Tel No: N.A.
Client Fax No: N.A.
Attn.:

Certificate Date: 22. Apr 2015
Certificate No: 1

Project: Enemed Co Ltd - J1164

Specimen Coring					
Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID		Manfroi Stefano	
Site Location	Has Saptan	Borehole	2	Depth (m)	4.8
Top of Borehole (m)	99.17	Remarks	J1161		

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
525	262.0	vertical	07. Apr 2015

Specimen Test			
Date of Test	14. Apr 2015	Technician ID	Amoury Mustafa

Applied Specifications
The tests have been carried out in accordance with client's instructions.
Test procedure and test parameters were based on :
QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

Test Performed
Unconfined compressive strength of intact rock core specimen

Core Ref

Flatness Top	Flatness Bottom	Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
OK	OK	NO	OK	77.22	185.6	2.4

Failure Load (N)	Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)
98610	704	21.06	7.99	2097.29

Deviation	

Bugeja Paolo
Managing Director

Tal-Handaq Industrial Estate, N/S in Handaq Road, Qormi, QRM 4000, Malta.
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F: (356) 2149 2810
E: info@solidbasemalta.com
W: www.solidbasemalta.com
Co. No.: C 33162
VAT No.: MT 1695 3537
Directors: Paolo Bugeja, Gordon Baldacchino

solidbase LABORATORY LTD.

ISO 17025 ACCREDITED TESTING NAB-MALTA № 008

TEST CERTIFICATE

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name:	Enemed Co Ltd
Client Address:	31st March 1979 Installation Birzebbugia
Client Tel No:	N.A.
Client Fax No:	N.A.
Attn.:	

Certificate Date:	22. Apr 2015
Certificate No:	2
Project:	Enemed Co Ltd - J1164

Specimen Coring					
Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID		Manfroi Stefano	
Site Location	Has Saptan	Borehole	5	Depth (m)	5.9
Top of Borehole (m)	97.722	Remarks	J1161		

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
526	216.0	vertical	07. Apr 2015

Specimen Test			
Date of Test	14. Apr 2015	Technician ID	Amoury Mustafa

Applied Specifications
The tests have been carried out in accordance with client's instructions. Test procedure and test parameters were based on : QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

Test Performed
Unconfined compressive strength of intact rock core specimen

Core Ref	

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	NO	77.27	178.7	2.31

Failure Load (N)	Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)
138850	991	29.61	4.4	2380.71

Deviation	

Bugeja Paolo
Managing Director

Tal-Handaq Industrial Estate, N/S in Handaq Road, Qormi, QRM 4000, Malta.
T: (356) 2149 2807/8
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Co. No.: C 33162
VAT No.: MT 1695 3537
Directors: Paolo Bugeja, Gordon Baldacchino

QF-144.001 Certificate

solidbase LABORATORY LTD

ISO 17025 ACCREDITED TESTING NAB-MALTA № 008

TEST CERTIFICATE

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Enemed Co Ltd
Client Address: 31st March 1979 Installation

Birzebbugia
Client Tel No: N.A.
Client Fax No: N.A.
Attn.:

Certificate Date: 22. Apr 2015
Certificate No: 3

Project: Enemed Co Ltd - J1164

Specimen Coring					
Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID		Manfroi Stefano	
Site Location	Has Saptan	Borehole	4	Depth (m)	4.9
Top of Borehole (m)	98.35	Remarks		J1161	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
527	214.0	vertical	07. Apr 2015

Specimen Test			
Date of Test	14. Apr 2015	Technician ID	Amoury Mustafa

Applied Specifications
The tests have been carried out in accordance with client's instructions.
Test procedure and test parameters were based on :
QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

Test Performed
Unconfined compressive strength of intact rock core specimen

Core Ref	

Flatness		Perpediculariry	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	NO	77.16	185.7	2.41

Failure Load (N)	Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)
122350	1019	26.17	9.96	2268.71

Deviation	

Bugeja Paolo
Managing Director

Tal-Handaq Industrial Estate, N/S in Handaq Road, Qormi, QRM 4000, Malta.
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Co. No.: C 33162
VAT No.: MT 1695 3537
Directors: Paolo Bugeja
Gordon Baldacchino

solidbase LABORATORY LTD.

ISO 17025 ACCREDITED TESTING NAB-MALTA Nº 008

TEST CERTIFICATE

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Enemed Co Ltd
Client Address: 31st March 1979 Installation

Birzebbugia
Client Tel No: N.A.
Client Fax No: N.A.
Attn.:

Certificate Date: 22. Apr 2015
Certificate No: 4

Project: Enemed Co Ltd - J1164

Specimen Coring					
Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID		Manfroi Stefano	
Site Location	Has Saptan	Borehole	7	Depth (m)	5.3
Top of Borehole (m)	97.044	Remarks	J1161		

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
528	183.0	vertical	07. Apr 2015

Specimen Test			
Date of Test	14. Apr 2015	Technician ID	Amoury Mustafa

Applied Specifications
The tests have been carried out in accordance with client's instructions.
Test procedure and test parameters were based on :
QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

Test Performed
Unconfined compressive strength of intact rock core specimen

Core Ref	

Flatness		Perpediculairty	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	NO	76.86	169.3	2.2

Failure Load (N)	Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)
68530	508	14.77	13.36	2234.24

Deviation	

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Proposed filling station, Enemed Co. Ltd.

Has-Saptan, Malta.

Job number: J479 Report number: EIA-1

Assessment of geological and geotechnical issues for the Environmental Impact Assessment

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Document: **Assessment of ground issues for the Environmental Impact Assessment**

Project: **Enemed Co. Ltd. proposed filling station at Has-Saptan**

Reference No.: **J479**

Date: **June 2016**

Prepared For: **ADI Associates**

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REPORT STATUS:

		Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
		Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
		Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date	Init Sign Comments Date
1	Geology and geotechnical issues for EIA	Init CS Sign Comments Date 27/06/2016	Init AM Sign Comments Date 02/07/2016	Init AM Sign Comments Date 02/08/2016	Init Sign Comments Date
Revision	Comments	Prepared By	Approved By	Issued By	Audited By

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Auditors to insert their comments on the table, to annotate the report itself or provide comments on a separate sheet. (Please state which)

For final reports a hard copy of the signed off form will be kept on the appropriate QA file.

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1 Terms of reference and introduction

The undersigned has been commissioned by ADI Associates, to carry out a study of the geology, geomorphology and geotechnical issues for the proposed filling station at Has-Saptan, for Enemed Co. Ltd. This study is required for the purposes of an environmental impact assessment (EIA).

This report is based upon, and is to be read in conjunction with the ground data presented in the ground investigation report by Solidbase Laboratory Ltd. dated 25th of April 2015, (reference J1161 GIR1/5)

The main objectives of this report include the following, as required by the Environment and Resources Authority.

1. A description of the geology and geomorphology of the site and its surroundings, including: existing lithological, stratigraphical, paleontological, hydrogeological and physiographic features and soil types;
2. An assessment of the geotechnical issues 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 wave action, 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.

2 Site Location

The site location is indicated on an aerial photo shown in Figure 1 (sourced from Google Earth, 2015). This aerial photo clearly illustrates the proximity of the site to a natural valley (Wied ta' Has-Saptan) which meanders further to the southeast. The expanse of the Malta International Airport (MIA) runway is also visible to the West, and a system of open reservoirs exists to the Northeast of the site. These reservoirs are in fact part of the storm water management system of the South-eastern area of MIA, having a catchment area consisting of the main runway and adjoining taxiways up to Apron 9, in front of the MIA main terminal[1]. This implies that considerable storm water runoff is generated at this point, which is partly buffered by the open reservoirs prior to finding itself within the main watercourse of Wied ta' Has-Saptan.

The entrance to the Has-Saptan underground tank complex is located to the East of the site, further down the watercourse and adjoining road. The main valley axis traverses this complex, and the watercourse is channelled through culverts existing below the access road, just in front of the entrance gate to this complex. The valley bed exhibits an abrupt change in level at this point.

The area around the valley bed is also seen to be more densely vegetated than the surrounding areas, which are mostly covered in topsoil. Inspection of aerial imagery of this area suggests that considerable man-made fill exists within area south and east of the valley bed, which fill is now covered by an olive grove. This fill is probably made up, in part or in whole, of the excavation spoil from the construction of underground tanks and tunnels.

[1] Major Ing. Martin Dalmas (2016) – Personal communication

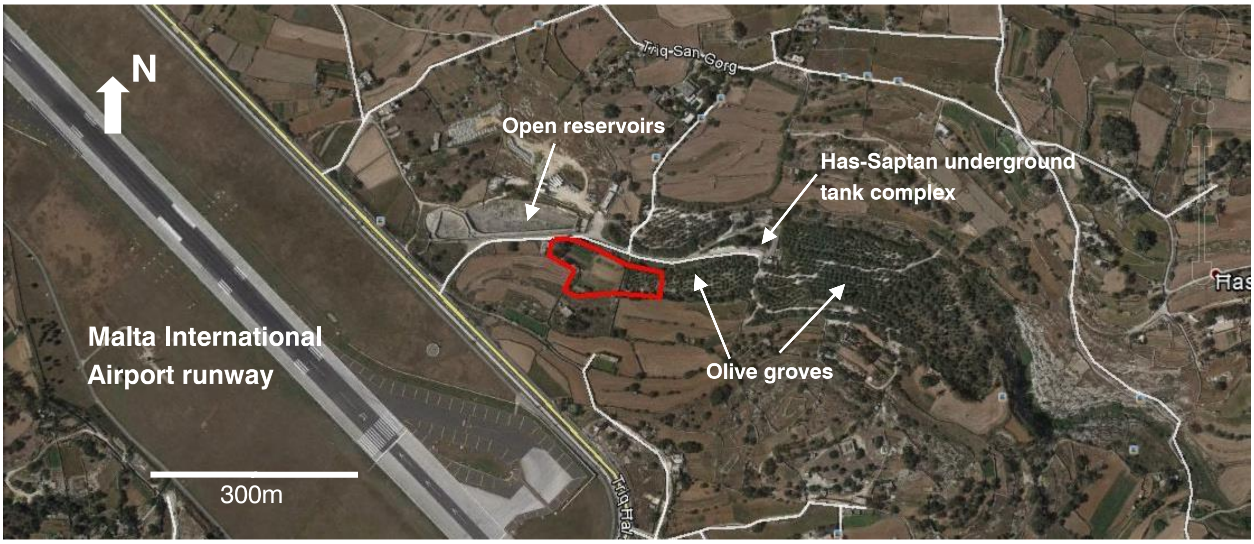

Figure 1 – Approximate site extents are shown by the red polyline (source: Google Earth, 2015)

3 Storm water runoff

There is evidence to suggest that the watercourse within Wied Has-Saptan may have been subject to substantial flows of storm water runoff. Large storm water culverts exist downstream of the main reservoirs, channelling water into the valley watercourse (Figure 3 below). At some stage, a small dam was deemed to be useful or necessary just downstream of the site within the existing watercourse (Figure 4 below) Whether large flows of water are still possible, subsequent to the construction of the open reservoir system upstream of the site, remains to be established, and falls beyond the scope of this report.

Figure 2 - Lowest part of the open reservoir complex, showing overflow culverts channelling storm water into the valley watercourse adjacent to the site

For the purposes of this report, it is assumed that considerable flow of storm water may exist adjacent to the site, of sufficient magnitude that it can influence geological and geotechnical issues related to the project. The probability of this happening is not considered to be large, but it cannot be ruled out completely [2].

Figure 3 - Part view of the open reservoirs upstream of the site, acting as buffers for large flows of storm water

Figure 4 - Dam within the watercourse, downstream of the site.

[2] Perit Philip Grech (2016) - *Ħas-Saptan Enemed Extension – Stormwater runoff report*

4 Geology and Geomorphology

4.1 Geological context

The topographical map of the site (far-field scale), shown in Figure 5, indicates that the site is located on a gentle slope within the southern flank of Wied ta' Has-Saptan. According to this 1:2500 survey sheet, the site exists at an approximate level of 55m above chart datum or mean sea level. The upper reaches of this valley have probably been filled in to enable construction of the main runway of MIA, since the contour lines forming the valley profile continue to the southwest of the same runway.

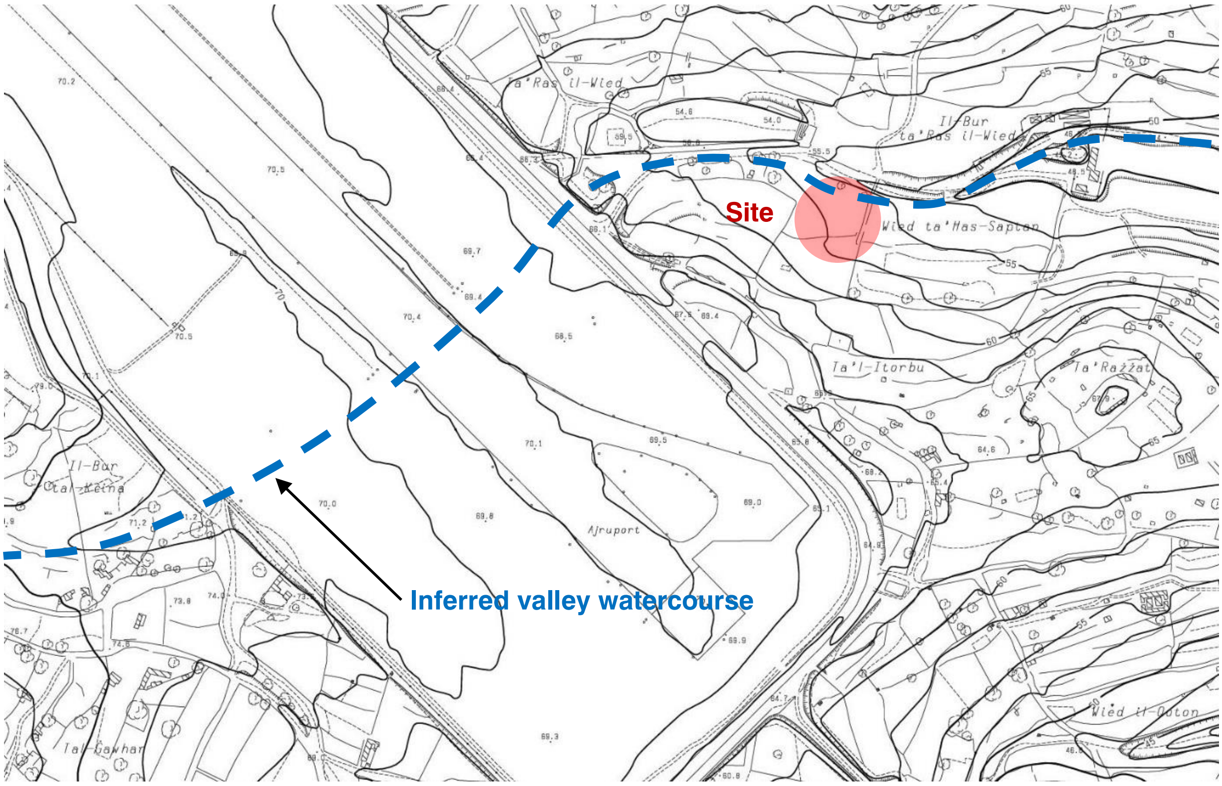

Figure 5 - Site plan of the area showing topography with the approximate location of the site indicated by the red circle

The site is underlain by Il-Mara member of the Lower Coralline Limestone formation as shown by the Geological Map and as confirmed by the ground investigation carried out by Solidbase Laboratory Ltd[3]. The base of the Il-Mara member was not intersected and therefore its total thickness across the site was not determined. The Lower member of the Globigerina Limestone formation outcrops in close proximity to the site as shown on the geological map (Figure 6 & Figure 7). The contact between the overlying Lower Globigerina Limestone and the Il-Mara member is transitional (Pedley, 1975) and is indicated by a dashed line on the geological map which means that it is not mapped with sufficient accuracy. No evidence of Globigerina Limestone was seen in the retreived borehole core.

The Lower Coralline Limestone is known to be more porous and probably more soluble than the overlying finer-grained Globigerinas. Notwithstanding, some facies within the Lower Coralline Limestone are sometimes observed to have a fine grained structure similar to that of the Globigerina Limestones,.andthe Il-Mara member is one such example. The enhanced grain-size and solubility of the Lower Coralline often lead to gentle valleys becoming deeply incised further downstream where this rock outcrops and is intersected by the flow of water. Several valleys in the South of Malta exhibit this pattern

[3] Solidbase Laboratory Ltd. (2015) - Proposed fuel depot, Enemed Co. Ltd., Has-Saptan, Malta., Ground Investigation Report (GIR) To EN1997, Report number: GIR 1/5

– Wied Dalam, Wied Moqbol, Wied Znuber, Wied Babu, Wied il-Qoton are examples in the immediate vicinity of Wied ta Has-Saptan, which also becomes deeply incised futher downstream of the site. This geomorphological feature enables better understanding of the near-field topography of the site proposed for this project.

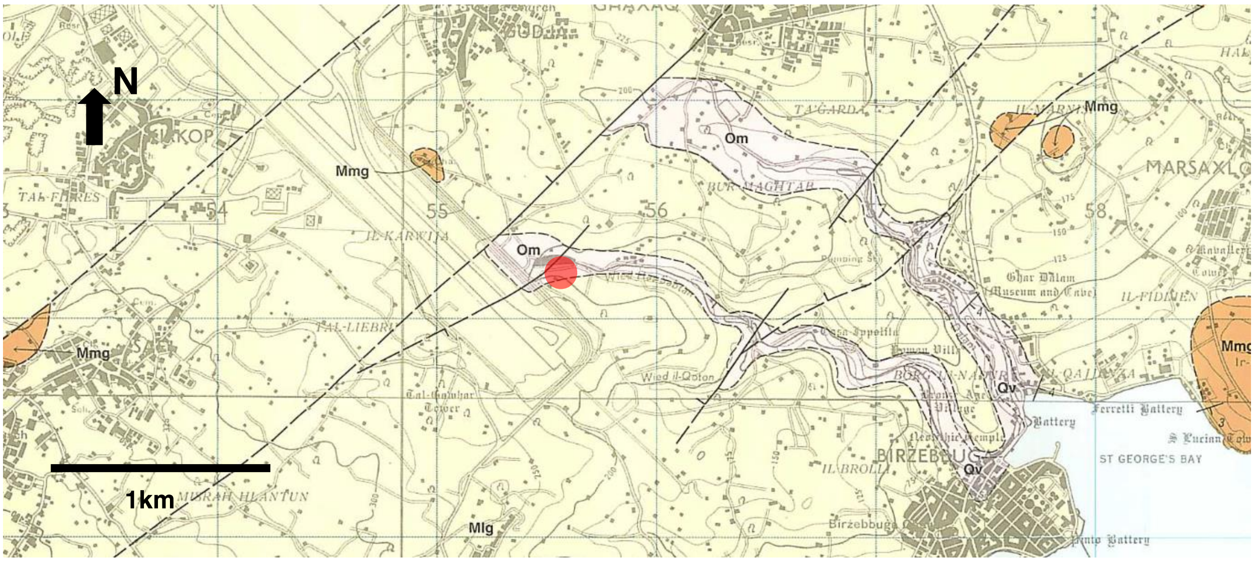

Figure 6 – Extract from the Geological Map of Malta (1993) with the location of the site indicated by the red circle

Mlg	**Lower Globigerina Limestone Member:** Pale cream to yellow planktonic foraminiferal packstones rapidly becoming wackestones above the base. Glauconite is common in western outcrops south of Fomm ir-Rih. Pectinid bivalves and *Shizaster* echinoids are frequent. The top of the member is marked by a ubiquitous hardground. This is phosphatised in western areas and carries a conglomerate (**Mcl**, Lower Phosphorite Conglomerate Bed). Common fossils include fish teeth, molluscs, solitary corals and echinoids. **Thickness 0-80m.** (**Mlg** MIOCENE, AQUITANIAN

OLIGOCENE

LOWER CORALLINE LIMESTONE FORMATION

Om	**Il - Mara Member:** Tabular beds of pale-cream to pale-grey carbonate mudstones, wackestones and packstones in 1 to 2m thick units. Thickest developments are in eastern Malta between Il - Mara and Marsascala. These pass laterally northwards and west into the Xlendi Member. The top of the member is transitional with the Lower Globigerina Limestone Member with a *Scutella* echinoid bed at the junction (**Ms** '*Scutella* Bed'). Bryozoan fragments are common and banks of '*Lepidocyclina*' foraminifers occur locally. *Terebratula* is common in the Marsascala and Wied Has - Sabtan sections. **Thickness 0-20m.** (**Om** OLIGOCENE, CHATTIAN).

Figure 7 – Extract from the legend of the Geological Map of Malta (1993)

4.2 Lithology, stratigraphy and geomorphology

The Il-Mara member is best developed in eastern Malta. Thicknesses of this member are documented along the southern coast of Malta (Pedley, 1975), where they vary between 32.5 metres (southeast of the site) and 7.5 metres (southwest of the site). The different geological strata of the island of Malta are documented to have developed along a ramp profile following an approximate east-west direction with the lowest areas to the east.

The contact of this member with overlying Lower Globigerina Limestone and underlying Xlendi member is transitional while it forms a sharp contact with the underlying Attard member as observed at locations sampled by Pedley (1975).

The Il-Mara member is composed from finer grained yellow sediments and exhibits cross-stratification, in which near-horizontal units are composed of inclined layers. The inclined strata formed during deposition and are not the result of post-depositional deformation. Cross beds form due to deposition on inclined surfaces and are indicative of a depositional environment that contained a flowing medium. An example of this would be a tide-dominated coastal environment.

The location of the boreholes drilled by Solidbase Laboratory Ltd. are presented in Figure 8, and the main lithological and stratigraphical findings are summarised in Figure 9 and Figure 10.

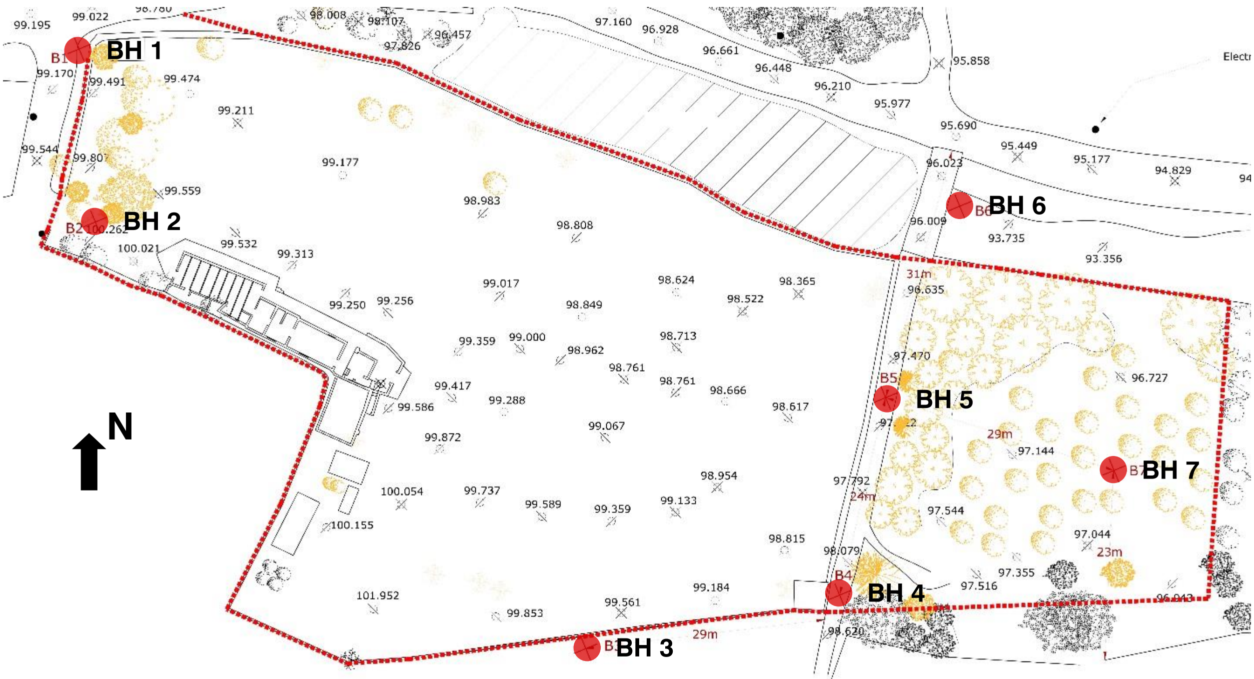

Figure 8 – Positions of the investigative boreholes carried out indicated by red circles on a surveyed plan of the existing.

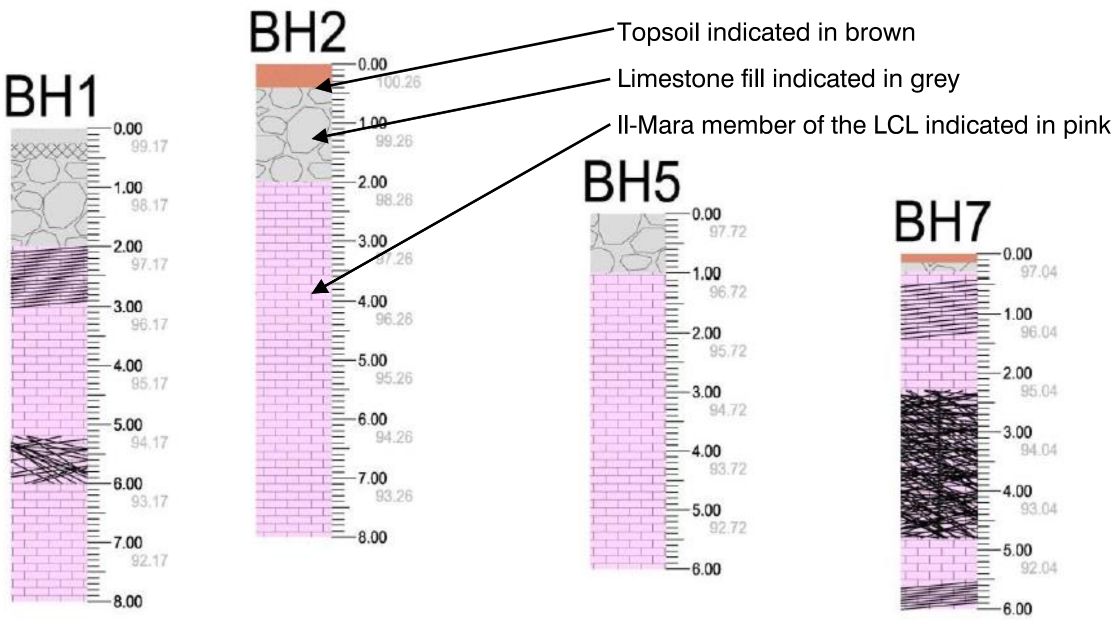

Figure 9 – Fence diagram from the borehole logs, in an approximate west-east direction

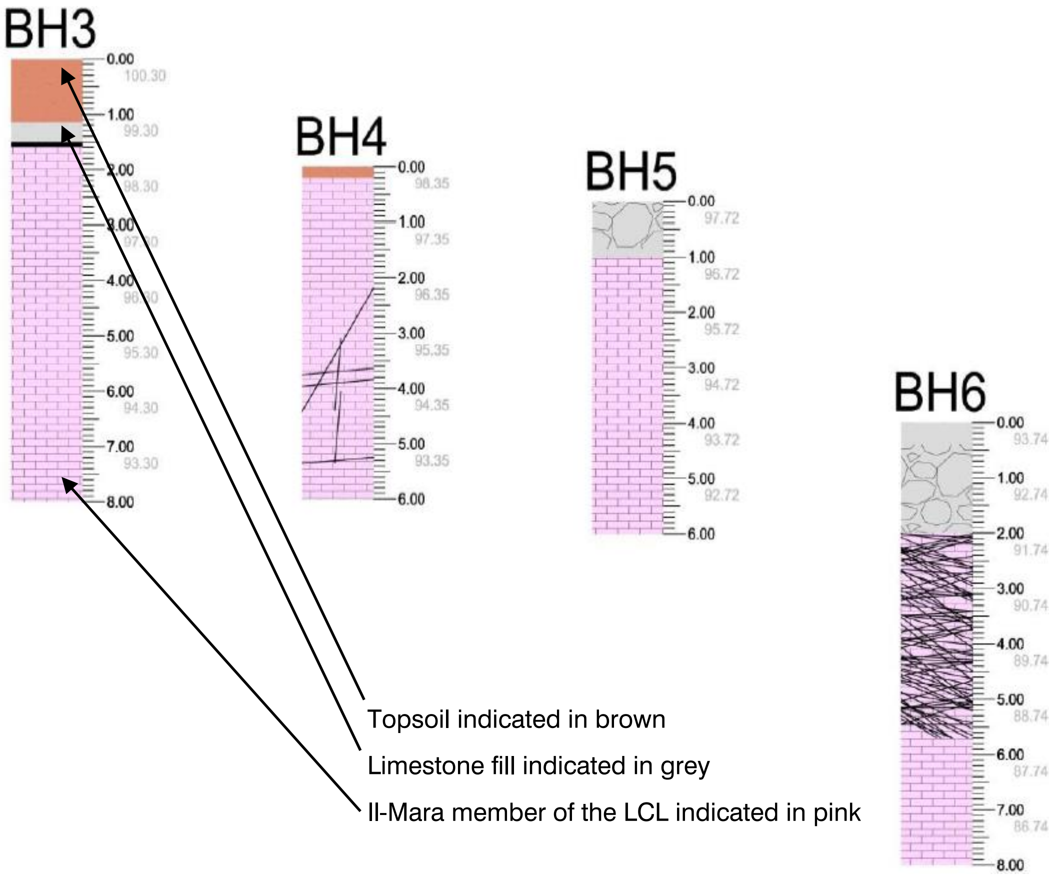

Figure 10 – Fence diagram from the borehole logs, in an approximate south-north direction

The fence diagrams through the various boreholes indicate that superficial strata, consisting of topsoil and limestone fill, range in thickness between 0.2 metres to 2 metres. The respective location of each of these thicknesses is relevant towards understanding the geomorphology. The Western part of the site exhibits the highest levels, but also has the thickest sections of fill. This thickness of fill decreases considerably to the East, and is replaced by topsoil to the South. An interesting observation can be made on the findings of borehole 6, drilled within the watercourse. At this point, 2m of fill exist below an area which is considerably lower than most of the site, indicating that this is proably alluvial material carried by storm water, now levelling off what once existed as a more deeply-incised valley bed within the Lower Coralline. The fill in borehole 5 suggests that the abrupt change in level existing between the site and the adjacent watercourse may not be entirely due to incision of the Lower Coralline limestone, but may be due to the deposition of fill by man. A visit to the site confirmed this hypothesis, because a long rubble retaining wall is clearly visible and seen creating the abrupt change in level.

Figure 11 - rubble wall containing fill, adjacent to watercourse

This rubble wall is gradually replaced by steeper rock faces towards east, downstream of the site.

The Il-Mara member of the Lower Coralline Limestone formation was observed to have a predominantly fine grain size, albeit with some variations ranging from fine to coarse. The finer facies were seen to be similar in grain size to the Lower Globigerina Limestone.

Water flow is more likely to occur through coarser-grained strata due to their higher permeabilities when compared with the finer-grained strata. The presence of coarser-grained facies within the Il-Mara member and discontinuities within the strata may provide a preferential setting for larger water flows through these zones. Water flow can cause further dissolution of both the finer and coarser grained strata, albeit at different rates. These weathering processes can form channels within bedrock to reach deeper levels within the same strata. The Il-Mara member would typically be underlain by the Attard member and the different pore structure of these two materials is likely to create preferential flow channels along their contact faces, in the horizontal direction, which will further develop karstic action. The prime example of this is perhaps Ghar Dalam, the extensive cave in the neighbouring Wied Dalam, which is known to have formed at the Il-Mara-Attard contact.

The predominant fine-grained strata occur between levels 93.3m and 91.4m, and were observed in boreholes 3, 5 and 7, located in the central and eastern parts of the site. In these boreholes, these finer-grained strata are overlain by coarser cemented sediments, and within the latter, a karstified cavity was intersected in borehole 5 which cavity is extensively calcified. It has been noted, from previous experience of investigations in similar strata, that karstification often occurs along preferential drainage paths where change in grain size occurs. Water flows more easily through coarser-grained strata than finer-grained strata and thus the former are more subject to dissolution. The retrieved borehole core indicates that the Il-Mara member of the Lower Coralline Limestone at this location is subject to these karstification processes.

Inspection of the exposed rock outcrops in the valley bed just downstream of the site provides further evidence of this phenomenon. Long horizontal cavities are present in the exposed rock outcrops in the valley bed/watercourse, suggesting preferential erosion or dissolution rates of the different facies.

Figure 12 - Differential erosion rates across inclined near-horizontal strata

The potential for karstification suggests that caves or solution caverns may be present below this site. The formation of caves/voids below this site depends on various aspects, some of which include the thickness of the Il-Mara member, the lithology of the various facies forming it and water flow rates through these same facies. Such cavities are not easy to identify when only a small number of investigative boreholes are drilled, because the chances of intercepting such cavities within the area covered by a small-diameter borehole are very small indeed.

Such cavities or voids may, however, be sought using non-destructive geophysical tests, typically the electrical resistivity method. The depth reached by these techniques is limited but would generally be suitable for the purpose of obtaining data for checking foundation stability. Such scans have not yet been carried out to date on this site. The implementation of such techniques would be strongly recommended once excavation to the final foundation level has been completed.

Figure 13 - Further evidence of different erosion rates across the inclined near-horizontal strata, some of which developed into horizontal cavities.

It has also been observed that within some lengths of the recovered core, the Total Core Recovery (TCR) was less than 100%, specifically within the bottom 3 metres of boreholes 1, 2, 6 and 7. In these boreholes, recovery varied between 50% and 78%, meaning either that the rock is friable over this interval or that karstified cavities have been encountered and therefore recovery was severely limited. The borehole logs also present information about visbile discontinuities in the retrieved core. Sections of poor core recovery often have very few descriptions of discontinuties because the rock is too fractured or incomplete to enable the fractures to be accurately described. Discontinuities were described in those intervals where signs of alteration to the rock core could be observed, such as those instances where terrarossas or calcificied sections were present. From observations on the rock core and from previous experience, the strength of the rock is expected to be variable as a result of the passage of water, with the calcified zones exhibiting higher strength and brittleness than the surrounding matrix of parent rock.

4.3 Palaeontology

Bryozoan (moss animals) fragments are commonly found in the Il-Mara member. The terebratula brachiopod is commonly found within this member in the Wied Has-Saptan area.

5 Geotechnical issues

The project as proposed involves the excavation of part of the valley side to accommodate large fuel-holding tanks below ground level, which will then be covered by a layer of fill to provide the subgrade for the tanker refilling yard. Some single storey structures will also be built to the south of the yard to accommodate offices, stores and workshops. The general layout is shown in Figure 14 below.

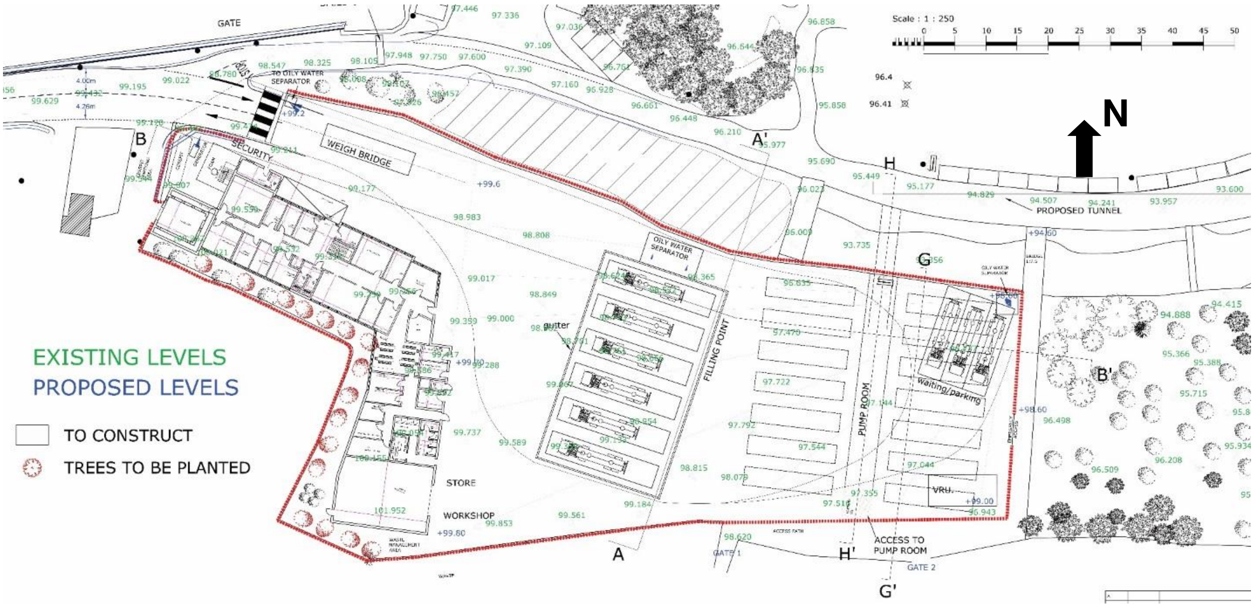

Figure 14 - Proposed plan

5.1 Foundation stability

The intact rock testing carried out during the course of the ground investigation indicate that the intact rock is moderately strong (unconfined compressive strength results range between 14.77 MPa and 29.61MPa) in accordance with the strength classification of BS 5930-1999.

If it is assumed that foundations are taken down to sound bedrock, problems of foundation instability are unlikely, especially when considering that the project proposal involves relatively small increments of load. Most of the loads are limited in magnitude and spread over a wide area, making problems of bearing capacity unlikely in the rock formations described above.

Notwithstanding, the possibility of karstic cavities needs to be given due consideration, especially in areas of high stress concentration. The eventual excavation and clearance of superficial strata would allow the possibility of visually observing the quality of bedrock, and would allow probing or geophysical testing to be implemented at that stage.

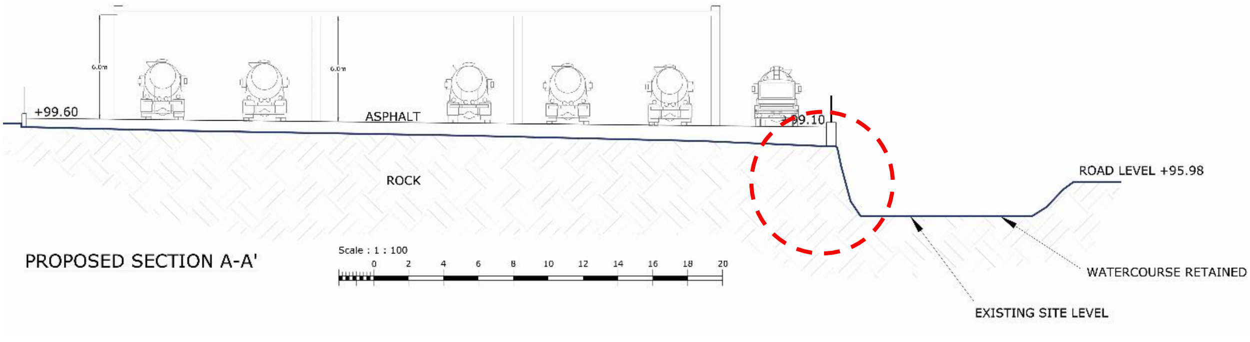

Figure 15 – Section AA through the main refilling yard.

5.2 Stability of the refilling yard pavement

Section AA, shown in Figure 15 above, shows the refilling yard supported by a ledge of rock having a sharp drop in level near the watercourse. Whilst the *shape* of the existing terrain is likely to be close to that shown on this diagram, the natural rock profile is unlikely to be of this shape, implying that a layer of fill materials would exist below the proposed pavement. Figure 16 below shows a more probable rock profile, indicating that considerable amounts of fill may exist beneath the current surface. This has been evidenced in the retrieved borehole core, and is inferred by the presence of the rubble wall running parallel to the watercourse.

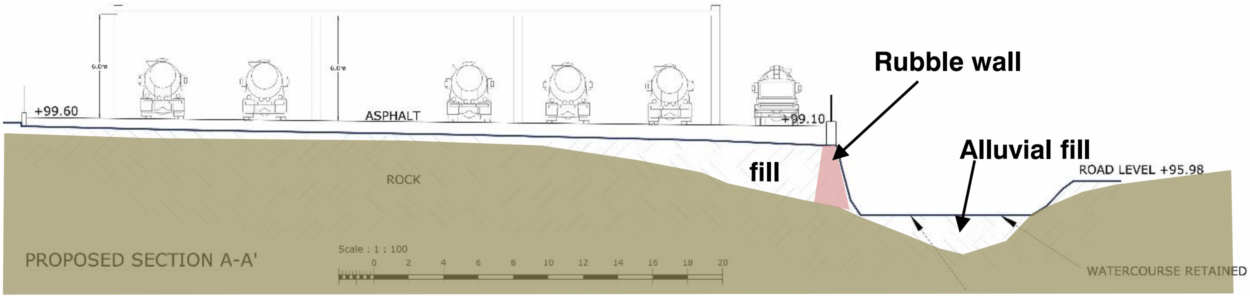

Figure 16 – More probable rock profile, on the basis of site observations

The above arrangement poses two challenges for the proposed development: the fill may not be sufficiently well compacted to sustain the superimposed load, and its stability will depend on the restraint offered by the existing rubble wall. Whilst such a structure would be sufficient for retaining soil in a field used for agricultural purposes, it is likely to be insufficient to retain soil where deformation needs to be controlled. A rubble wall is a flexible structure – it will not sustain vehicular loading without appreciable deformation (and subsequent subsidence of the adjacent ground behind it), and it does not provide a sufficiently high factor of safety against collapse. The construction of the refilling yard will therefore require the construction of a proper retaining structure in reinforced concrete, instead of, or behind the existing rubble wall.

5.3 Excavation stability

The position of the fuel tanks underground implies that a 6m to 7m deep excavation will be required within the valley side, to produce a lowered zone whose lowest level would exist below the adjacent valley bed. The tanks will then be placed within the excavation and subsequently covered with inert granular fill, or sand. The sections through the fuel tank assembly indicate 6m high walls which appear to be retaining the fill, and which create a gap between the excavated rock faces and the walls retaining the inert fill surrounding the tanks. Whilst this is a possible method of construction, there is also the possibility of supporting the lateral pressure of the inert fill by transmitting this to the exposed excavation faces, through some kind of damp-proof membrane assembly.

The above-mentioned possibilities will, in both cases, require the sides of the excavation to be stable to prevent rock fall into the newly-excavated face, and at a later stage to be able to support the lateral forces from the fill and from vehicular traffic directly above.

The possibility of encountering rock masses which are extensively layered or fractured will need to be considered in this respect. Heavily fractured rock has been identified in some of the boreholes, and alternating layers of stronger and weaker rock have been identified and also seen within the sides of the valley. This presence of weaker facies, is likely to exist over the entire site, since such strata are the product of depositional environments that once existed (millions of years ago) and that brought the rock into being.

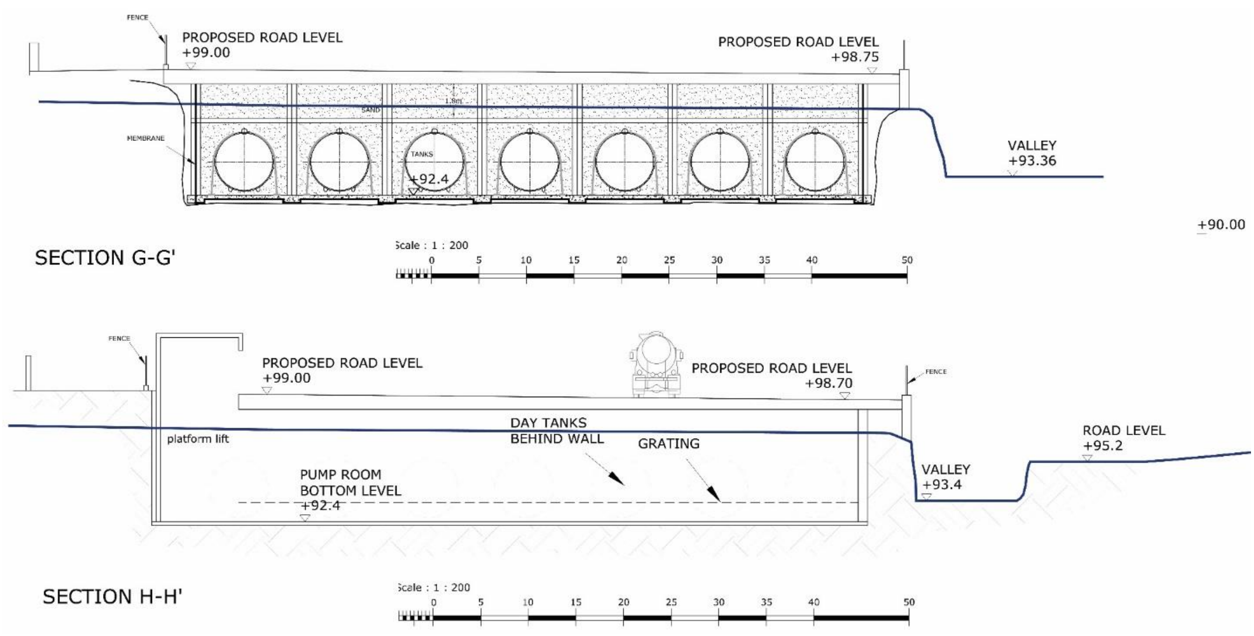

Figure 17 - Sections through the project

Such rock instability at the perimeter of excavations is usually the result of the formation of rock block sliding or toppling instability at the excavation faces, which would be generally brought about by the unfavourable intersection of different sets of discontinuities between themselves, with the weaker layers, and with the faces of the excavation. At this stage it is yet premature to assess the probability of this happening, but the site can be investigated for discontinuity characteristics when it is first cleared and after the initial phases of the excavation. In any case, rock instability problems are unlikely to be insurmountable, and can be addressed through the appropriate engineering interventions. Various mitigation measures can be implemented to prevent rock fall or side collapse (e.g. rock bolting, shotcreting, temporary buttresses in steel or reinforced concrete, etc.).

5.4 Retaining the fill

If the proposed inert fill surrounding the tanks is retained by structures which bear vertically and horizontally on the surrounding rock, then the strength of the rock mass in resisting lateral loads will need to be assessed. This is unlikely to be a problem in most cases, because the rock has been tested and is known to be moderately strong. One location, however may not provide sufficient lateral resistance if the inert fill is made to bear directly against the rock. This is the side of the excavation that will exist parallel to the valley axis and which will be defined by a narrow section of rock separating the fill from the natural side of the valley, close to the watercourse. As shown in Figure 17 above, this may be less than 10m wide, and its height as shown may consist partly of fill of unknown compaction. The section as shown will result in a mass of rock that will act as a retaining structure of height greater than width. Considering the proportions of the remaining cross-section, this is likely to be sufficient as a gravity retaining structure, if the rock is intact, but may be unstable if it is heavily fissured. This can be mitigated by careful investigation of the excavation faces, and subsequently by reinforcing the rock, if this is considered to be necessary. Further analysis is warranted for this particular situation, once the project details are further developed. A concrete retaining structure may be required in this area.

5.5 Stability of the fill

As a load-bearing element, the inert fill around the tanks needs to be carefully engineered. Loads supported by the fill may cause settlement, and may also increase the lateral forces exerted by the fill on the structures or natural rock features that are containing it.

No major permanent loads are expected to be created around the perimeter of the excavation as no structures lie immediately adjacent to the area to be excavated or close to the abrupt change in level to the north of the site. The fill at the sides of the excavation, and the fill at the northern boundary of the site will, however, be subjected to dynamic loads from the heavy vehicles using the proposed facility. The possibility of excessive settlement depends on the degree of compaction that will be applied to the fill during its placement around the tanks. The applied compaction effort will create locked-in horizontal stress on the rock surrounding the infilled area, and will also cause the fill to become less permeable, if a large percentage of fines is generated by the compaction process.

The possibility of long-term settlement in such fills should be taken in consideration during the engineering design phase. Improper or excessive compaction, coupled with the wrong post-compaction grading can influence the hydraulic conductivity of such a fill, leading to prolonged periods of saturation that will exert undue pressure on the surrounding rock faces. Inefficient drainage characteristics may also result in gross inconvenience due to ponding and settlement at the surface, issues that are best mitigated through careful design of pavement structures and storm-water runoff schemes.

6 Vulnerability to natural forces

The project may also be subject to several issues due to water flow considering its close proximity to the watercourse within Wied ta' Has-Saptan, and when considering the proposed project levels. The project sections indicate that some areas of the project will be built at a level that is below that of the current lowest level of the adjacent valley watercourse. In this respect, the possibility of storm water finding its way into these lowest areas of the project needs to be considered and mitigated for. This needs to be assessed after calculating the expected runoff volumes and flows from the surrounding areas, which may include the wide expanse that currently forms the main airport runway.

The possible scenarios related to storm water include the following:

1. Inundation of underground spaces, notably the pump rooms next to the fuel tanks, and the mechanical and electrical plant housed within.
2. Storm water may infiltrate into the rock and fill surrounding the fuel tanks. Unless properly designed for, storm water may find its way into the fill and adjacent rock masses, saturating the lowest layers. This will influence the mechanical properties of both fill and rock, and possibly induce collapse compression in the fill (depending on the nature of the fill used and the levels of compaction achieved). It may also result in uplift of the fuel tanks if these happen to be empty when water levels rise. This can be mitigated by appropriate engineering design of the fill, its retaining structures and of the interface between the project and the valley.
3. Weakening of fractured rock in close proximity to the watercourse, leading to loss of support to adjacent fill or overlying structures. This will depend on the nature of the rock mass, as exposed by excavation during the construction process. Once this is assessed, the appropriate engineering design intervention can be chosen to prevent this from happening. This could include strengthening areas of heavily fissured rock, or preventing the ingress of water by constructing impermeable linings at carefully chosen locations.
4. Lateral pressures on the proposed structures may also be created by the build-up of a head of water next to the structures.

Inundation, uplift and lateral water pressure all depend on water level and flow that can occur in the adjacent water course during the lifetime of the project. Valley flow can be modelled by considering possible catchment areas, rainfall data and ground permeability/runoff coefficients. The report by Perit Philip Grech[2] confirms that water levels in the watercourse may indeed rise during extreme events, and therefore the above considerations need to be taken into account and addressed by appropriate engineering design.

7 Risks posed by the project

The risks posed by the project on the immediate environment include oil/fuel spill from the tanks pumps and pipework (addressed in other reports), and the possibility of rock collapse at the northern boundary.

7.1 The northern boundary

The northern boundary of the site, immediately adjacent and running parallel to the valley watercourse, may create temporary obstruction in the valley bed if rock failure occurs. The considerable change in level between the proposed refilling yard and the adjacent valley bed implies that the existing difference in height will increase and the natural materials at this near-vertical interface will be subject to additional stress from the proposed vehicular activity within the project. Stability of this boundary is therefore desirable not only to avoid danger and disruption within the new filling station, but also to safeguard the existing valley bed and watercourse.

7.2 Excavation and disposal/reuse of excavation waste

The proposed excavation for the buried fuel tanks will create substantial amounts of inert fill that will need to be disposed of or reused. Excavation works inevitably create pressure on approved landfills and the associated waste-management facilities, and therefore the possibility of reinstating some of the excavation-generated rock fill as inert fill between the fuel tanks needs to be investigated. Rock generated by the excavation would need to be processed (crushed and graded) if an engineered fill is to be provided as recommended in the previous sections. The choice of excavation technique and the associated plant would therefore need to be made with this possibility in consideration, since different types of excavation plant will create rock fill having different characteristics.

The nature of the rock itself restricts its potential re-use. The Il-Mara member is not normally used for the production of aggregate of the quality required for the production of concrete. The actual natural material may be tested in order to assess its suitability for inferior quality aggregate or fill. Recommended testing in this respect would include the Los Angeles Abrasion test, the Ten Percent Fines Value test and Moisture Absorption tests.

8 Disclaimer

Any opinions expressed in this report about possible project impacts are based on drawings made available and on the ground conditions revealed by the site investigation works. The assessment carried out for the purposes of this report is of a qualitative nature only.

This assessment is relevant only to this site and project and cannot be extrapolated to other areas or other project proposals. The analysis presented in this report in no way guarantees the stability or otherwise of the existing structures, within and in the vicinity of the site investigated, or their foundations, existing and proposed.

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April 29, 2015

Re: Ħas-Saptan Enemed Extension – Groundwater risk assessment

1. The following report by the undersigned author was commissioned by Enemed Co. Ltd. in response to the request by the Malta Resources Authority (MRA) for a risk assessment of the groundwater in the vicinity of the proposed extension at the Ħas-Saptan Fuel Installation facility.

2. The concern of the MRA arose as the development is within 300m of the Ħas-Saptan borehole. In fact the proposed development is practically adjoining the borehole and is fully within a 180m radius of it. **Figure 1** refers showing the annotated layout plan. **Figure 2** shows the borehole as at present.

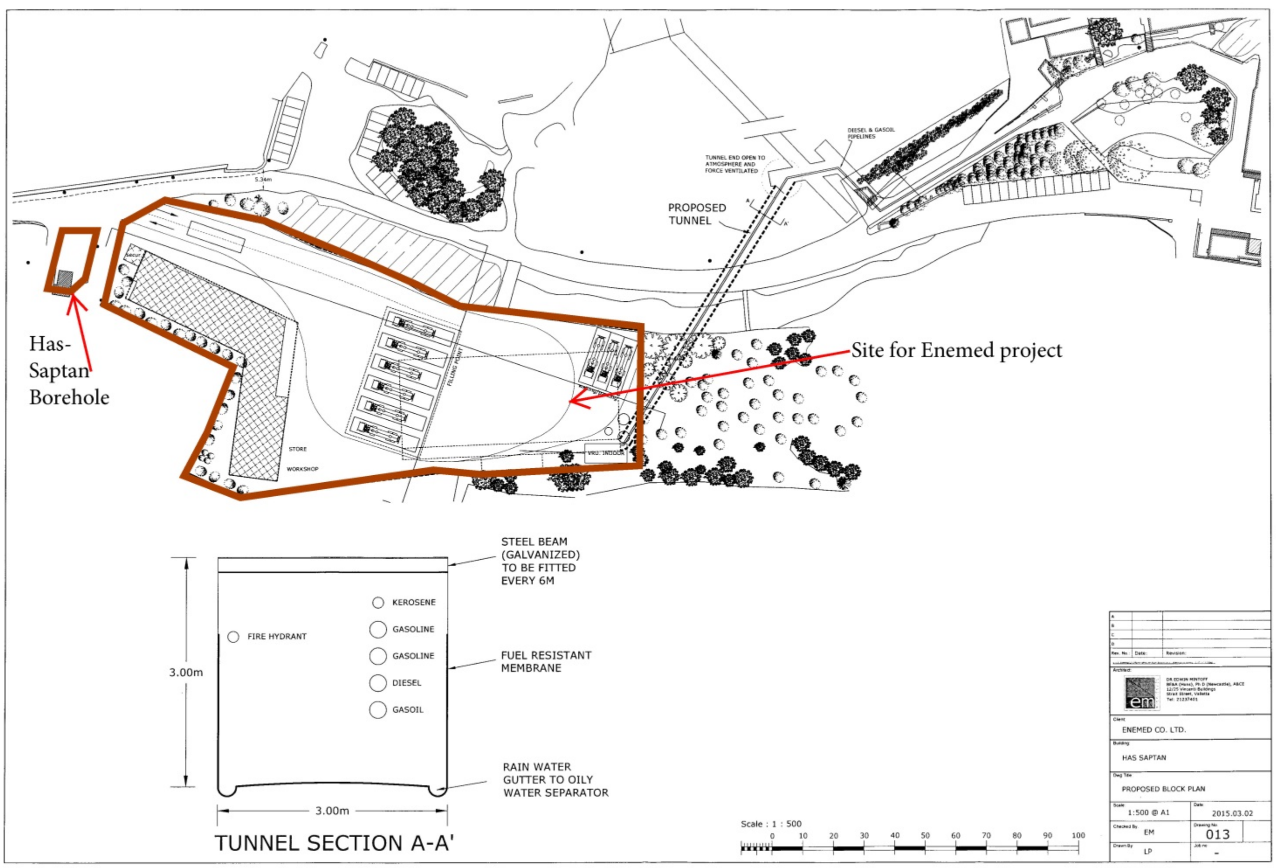

Figure 1: Annotated layout plan showing location of WSC Ħas-Saptan borehole and adjacent proposed Enemed development site. (*Source: Enemed*)

Figure 2: Ħas-Saptan WSC borehole

3. The 300m radius criteria cited by the MRA is simply an indicator of proximity to development and does not arise from a legally-defined limit to development or anthropological activity. Such limits do not exist, and are applied on a case-by-case basis, depending on the local geology. The existing Ħas-Saptan underground fuel storage facility is at least partially also within the same 300m limit. Indeed a number of boreholes with 300m radii in the vicinity in the same aquifer are shown with overlying built-up areas of Gudja and the airport runways is shown in **Figure 3**.

4. However as an indicator, the criteria is useful to raise awareness when water sources can be susceptable to pollution. The 2005 report by the MRA **Initial Characterisation of the Groundwater Bodies within the Maltese Water Catchment District under the Water Policy Framework Regulations, 2004** notes that "*One further impact facing the sea-level groundwater body is hydrocarbon pollution, partiocularly from leaks in the fuel storage installations*." It must be noted that Ħas-Saptan borehole has not reportedly exhibited any such impact throughout its service although, as stated previously, it is in the vicinity of a major underground fuel storage installation which has been operation for over 50 years. Anedotal evidence known to the author is that this concern of the MRA emanates from leaking commercial service station tanks.

Figure 3: 300m Groundwater Safeguard Zones in the immediate area: Ħas-Saptan borehole marked in red. (*Source: MEPA Mapserver*)

5. Ħas-Saptan borehole is situated in the Malta Mean Sea Level Groundwater Body. The most recent published quality parameters of this borehole are Chlorides 965mg/l, and Nitrates 37mg/l.[1] The current downstream Enemed fuel installation is at approximately 45 metres above sea level, while the elevation at the borehole is approximately 58 metres above sea level interpolating from the contours (**Figure 4**).

6. The geology of the area is in the 'Il-Mara' member of the lower coralline limestone, which is the most impermiable of the Maltese limestones (**Figure 5**). As can be seen, the borehole is very close to a fault on the geological map. This feature may well be the reason for the original siting of the borehole in this location, functioning as an adit to abstract underground water intercepted at the fault and coming from the northeast and southwest directions.

7. The project proposal consists of a tanker filling area above ground, with a series of 10 underlying fuel tanks in concrete having a connecting tunnel to the existing fuel isntallaiton facility, **Figures 1 and 6** refer. The tanks will be some 11 metres below ground level. Enemed states that the tanks will be constructed as separate units to cater for diffenential movement in the case of seismic activity, that the outside of the tanks will have a fuel resistant membrane, that the inside of the tanks will have a special

[1] **Initial Characterisation of the Groundwater Bodies within the Maltese Water Catchment District under the Water Policy Framework Regulations, 2004**. Final Draft. Malta Resources Authority 13 January 2005.

fuel resistant membrane, and that a leak detection system will be installed. Moreover a canopy will be erected over the filling area and that area will have a guter to drain off rainwater to a oil separator.[2]

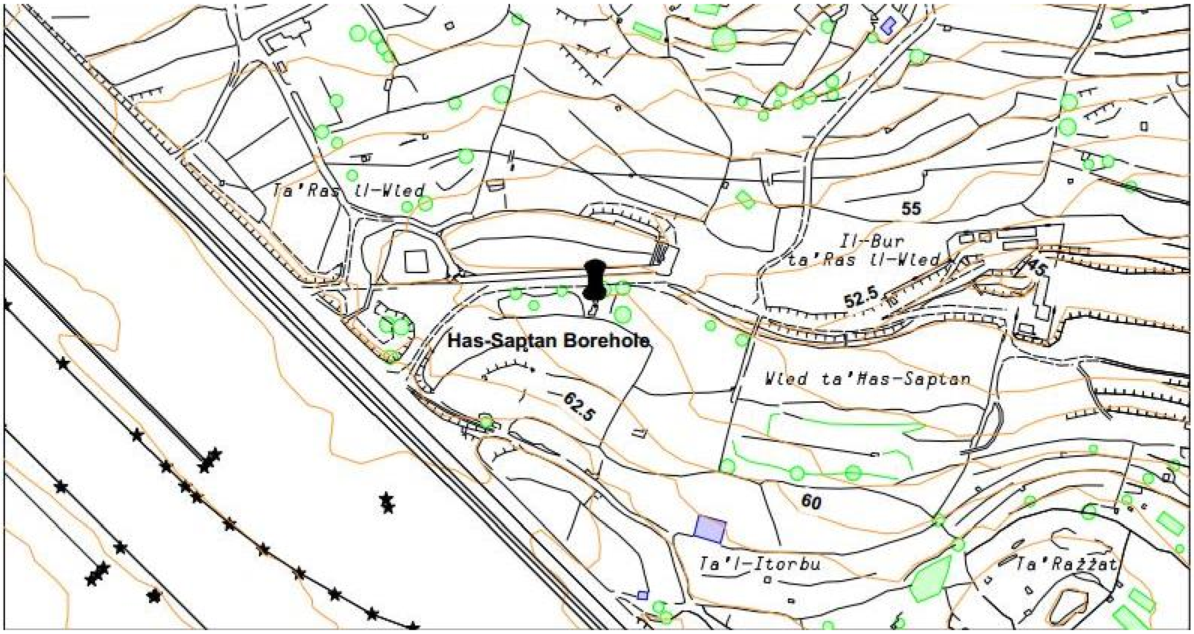

Figure 4: Location plan of Ħas-Saptan Borehole

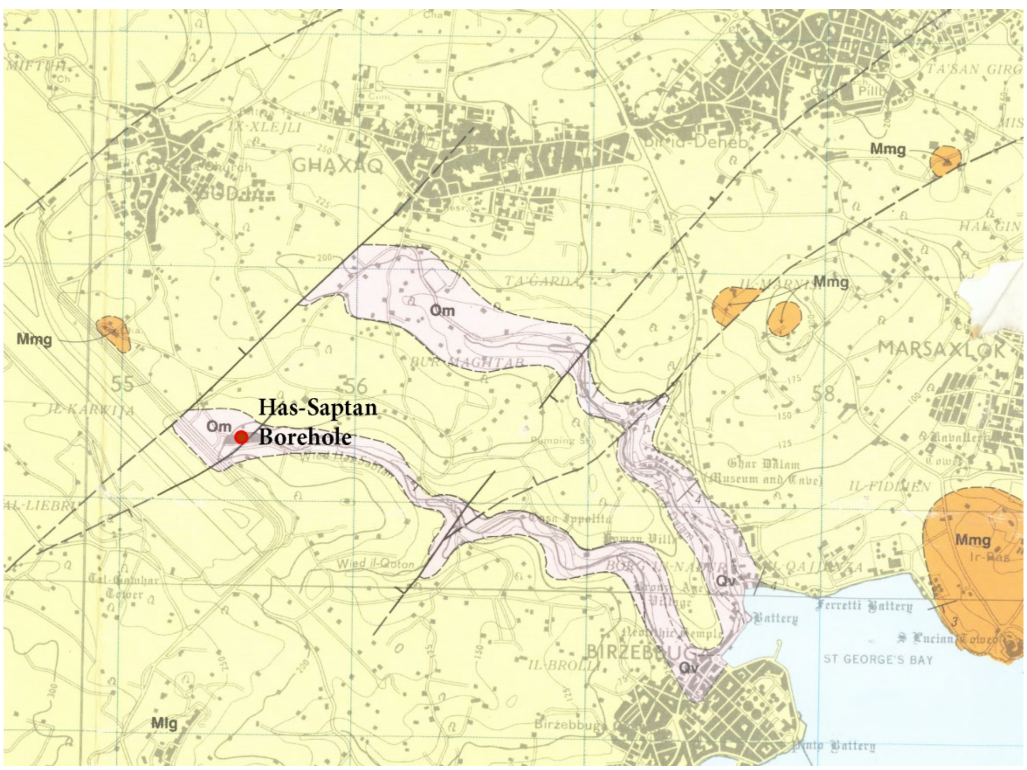

Figure 5: Geology map of Ħas-Saptan area.

Borehole highlighted in red.

(*Source: Oil Exploration Directorate, 1993*)

[2] **Conceptual description of the up-grade to the Fuel Storage Facility at Has-Saptan.** Enemed Co. Ltd. March 2015

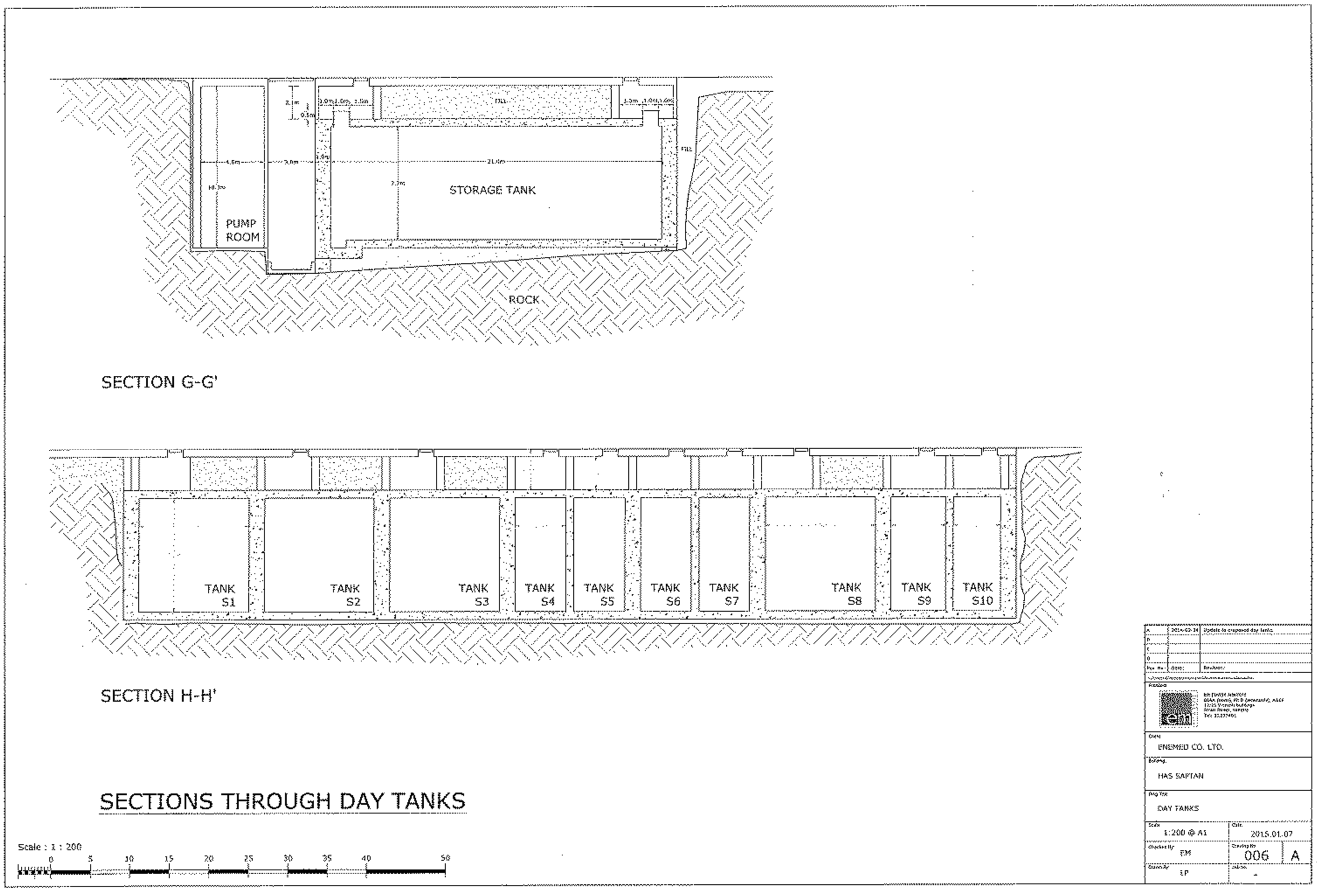

Figure 6: Proposed section through underground tanks (*Source: Enemed*)

8. The surface water collection and collection of the treated rainwater through an oil separator is entirely appropriate to this facility. The details and sizing of the separator should be in conformity with EN 858-1[3] . Of note is that the rainwater collected on the roof of the projected canopy need not be ducted to the oil/water separator, thus that area can be deducted to reduce the separators' size and improve its efficiency. Indeed, that clean rainwater should be directed as per legislation towards recharge or appropriate re-use. However any washdown within the surface area must be collected and treated through an appropriately sized separator before disposal via a holding tank to the sewers. Care must be taken to use a tighly sealed guttering system to collect such washdown, such as in an interlocking modular polymer concrete system, which will reduce the chance of leaking of contaminated water from gutter joints in the collection system itself.

9. The new underground tanks need to have an internal lining to protect the structural fabric of the holding vessel from the nature of the contined fluid. **It would not be appropriate to rely on this alone to protect the groundwater from exfiltration.** The tanks need to be double bottomed and

[3] **EN 858-1:2002/A1:2004 - EN 858-1:2002/A1:2004** - Separator systems for light liquids (e.g. oil and petrol) - Part 1: Principles of product design, performance and testing, marking and quality control

the floor of the space in between laid to falls and drained to a number of collection points. This space needs to be monitored both for fuel fumes and also liquid leak detection. The data from this monitoring system should be constantly available in real time to the MRA, and the parameters monitored agreed to by MRA. This will shorten any initial response time in case of a problem, and also provide a double check on the performance of the precautions taken at the installation. Data from hydrocarbon monitoring at the borehole in real time should also be carried out at Enemed's expense and the data similarly made constantly available to MRA.

10. It is important that this space has manual access throughout to enable repairs to be carried out after their installation and while the system is in operation, should they become necessary. The proposed sections as shown in **Figure 6** do not have this functional property and require revision. The inside lining of this double bottomed space needs to be lined with an impervious fuel resistant membrane as described. Since concrete ages and changes chemically and even carbonates in time, it is advised that steel tanks are preferably used; these could more easily be lined internally and even externally, and enable the required access for physical inspection to take place around their exterior.

11. In my considered opinion, after examining the available data and also from an site evaluation of the situation it is apparent that the risk of contamination from the proposed project of the groundwater at the borehole at Ħas-Saptan is low, if the precautions and measures indicated in preceding sections 8, 9 and 10 above are undertaken and maintained.

Philip Grech, A. & C.E.

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August 1, 2016

Re: Ħas-Saptan Enemed Extension – Stormwater runoff report

1. The following report by the undersigned author was commissioned for Enemed Co. Ltd. by Adi Associates, in response to a report by Perit Adrian Mifsud on the "Assessment of geological and geotechnical issues for the Environmental Impact Assessment", in particular the observations on the 'Vulnerability to natural forces' regarding stormwater imapct on the structures being proposed to be built on the site.[1]

2. The site is downstream of the runway of the airport and the watercourse taking the relative part of the runoff is Wied Ħas-Saptan which starts to the north west of the site and runs along its north face and continues through the current Enemed installation downstream towards Birzebbuga. The contributing catchment area from the Airport and countryside together is approximately 426,300 square metres. Diagrammatically the hydrological layout is on **Figure 1**.

3. The survey plan at **Figure 2** shows that the current site is approximately 1.5-2.0m above the level of the watercourse immediately to the north of the site. The proposed Section through the tanks shown in **Figure 3** shows that the underground structures are intended to be excavated to a depth of approximately 10.3m. Thus during seasonal periods of surface water flow in the watercourse, it is entirely possible that the tanks will be within the saturated zone of the rock adjoining Wied Ħas-Saptan, and the design of the tanks must counteract the possible upthrust from the water, through appropriate measures. The walls of the tanks, especially on the North face, must also withstand the lateral hydraulic pressure of water, as indicated by Perit Mifsud.

4. The contributing catchment area from the Airport alone is around 171,900 square metres; the flow to the water course from the runway is directed through a tunnel into a infiltration basin system constructed in the 1970s. The area of the basin is approximately 7900 square metres, with a depth of around 4 courses i.e. about a metre. **Plates 1-3** refer. 7900 cubic metres would be generated by a rainfall of 45mm, and assuming no absorption by the ground. Such a storm is by no means an extreme event, and would correspond to a 1 in 20 year storm of 30 minutes duration. **Figure 4** refers.

5. The infiltration system at Ħas-Saptan is actually designed to retain water and encourage it to seep into the aquifer; it is not known how efficient it is. Limestone has a low transmissivity, but fissures and faults would greatly enhance the exfiltration of water. The system has a controlled valve outlet which appears to be unserviced. **Plate 4 refers**. A storm of higher intensity that the 1 in 20, 30-minute event will exceed the capacity of the system and any water which does not infiltrate may be discharged

[1] Proposed filling station, Enemed Co. Ltd., Has-Saptan, Malta. Assessment of geological and geotechnical issues for the Environmental Impact Assessment, Adrian Mifsud, June 2016

through overtopping or being discharged through overflow channels at its downstream end, which is just upstream of the Enemed site.

6. The watercourse channel Wied Ħas-Saptan downstream of the infiltration structures is approximately 1.5-2m deep as indicated earlier, and within the current Enemed facility it passes through a wide screen and then through 2 circular openings in a dam/bridge across the watercourse; **Plates 5 and 6** refer. Any blockage at these points may create backing up of the water levels during an extreme event, and may cause the water levels to rise in the channel, possibly for a short time exceeding the bank levels.

7. Should such a series of events arise, depending on the finished surface levels, the Enemed site could face some inundation. It is thus recommended that the surface access to the underground pump rooms be installed with watertight seals, and the electrical installations be kept as high as possible. It must be pointed out however that the current situation of the access to the deeper tanks on the north of the watercourse, which have an entrance at approximately the same elevation as the proposed site, does not seem to show any evidence or history of liability to surface flooding.

8. It is thus concluded that while acknowledging that the underground tanks could be subject to groundwater uplift, this can be designed against by various civil engineering measures. The inundation of the site appears more remote, and would be highly unlikely if the downstream part of the watercourse was kept clear of debris, and the upstream infiltration basin kept operational. Yet even should both these measures fail, the site should be able to be unaffected by inundation by having sealed off covers, and engineered tanks as set out earlier.

Perit Philip Grech, M.Sc.

Annex:

4 Figures and 6 Plates; all figures and plates by author except where source is acknowledged.

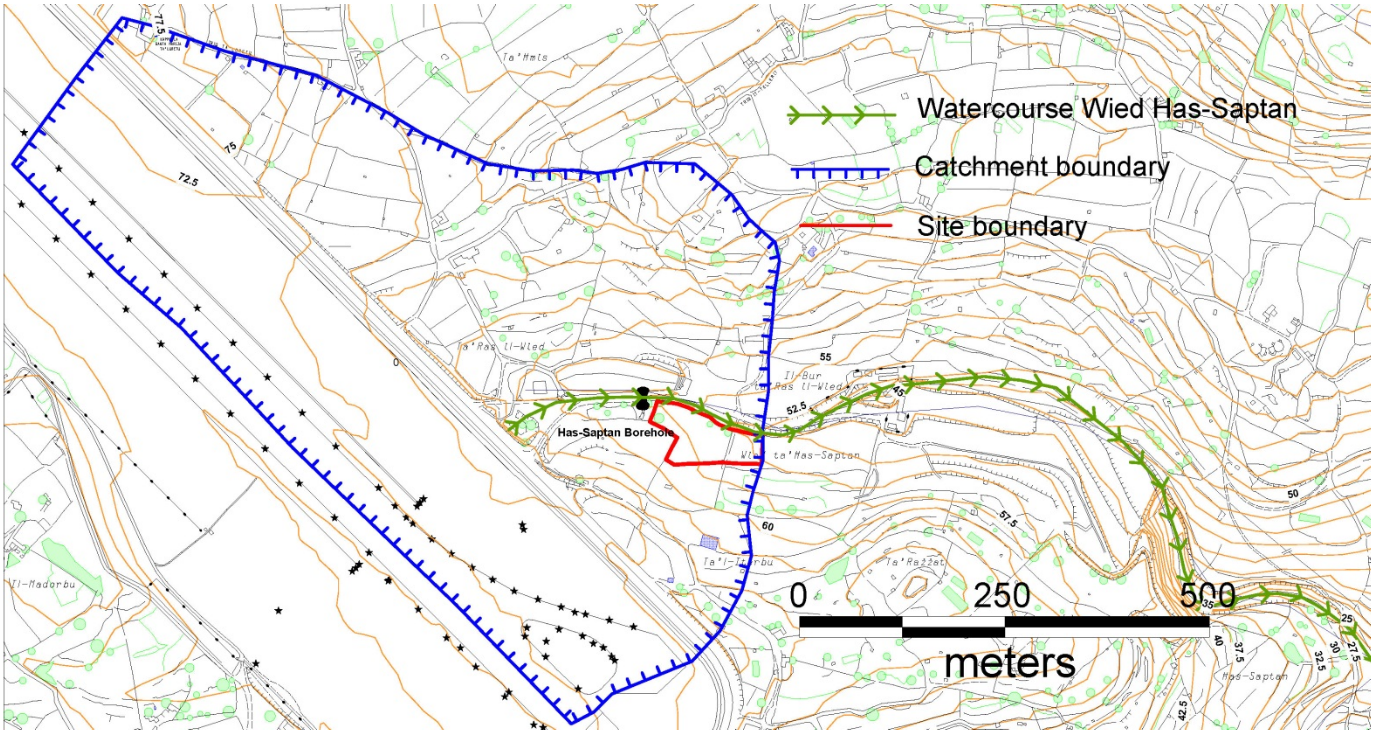

Figure 1: Hydrological layout plan showing site and contributing upstream catchment area.

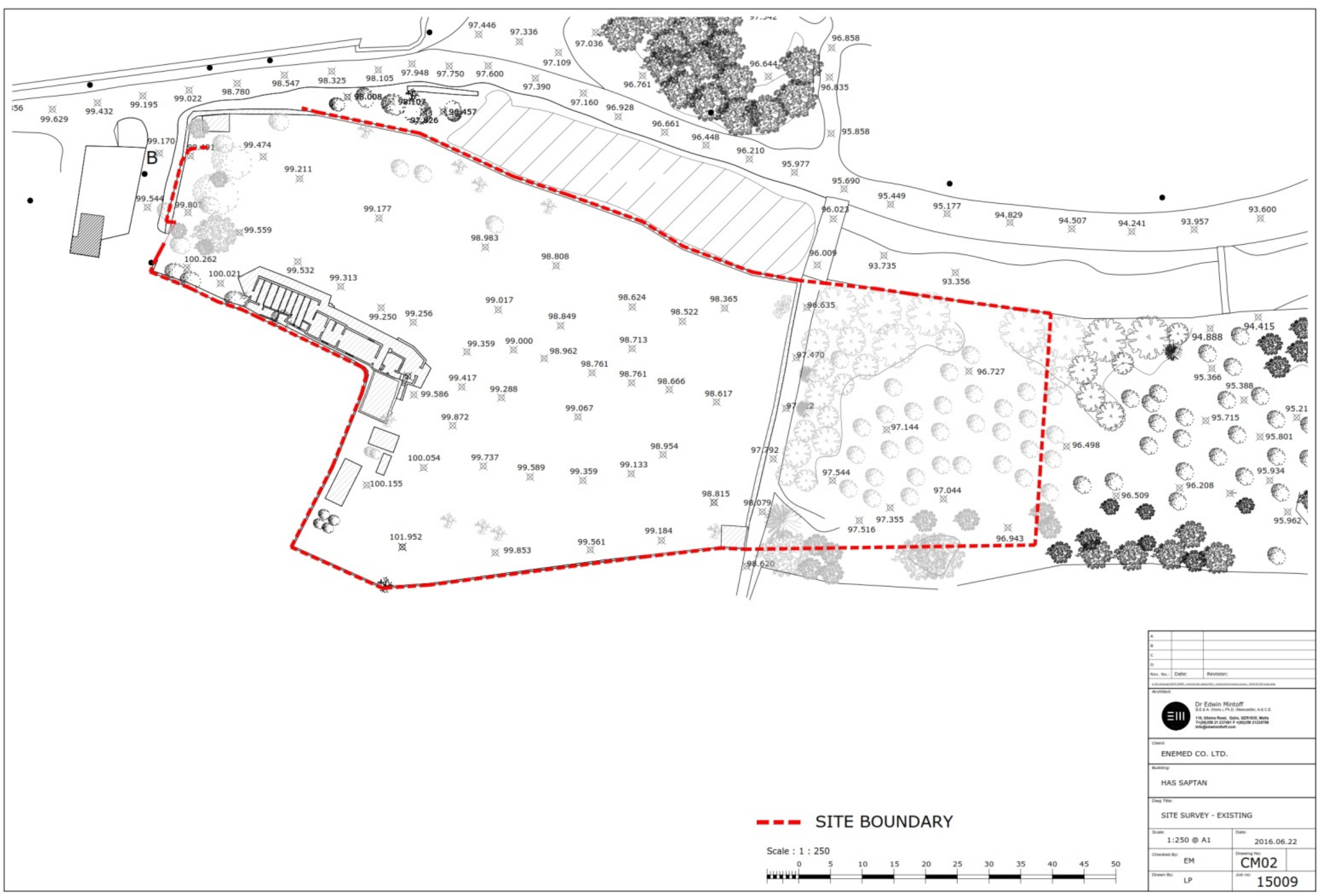

Figure 2: Site survey of Enemed area of interest, showing levels in water course and area for excavation. (*Source: Enemed*)

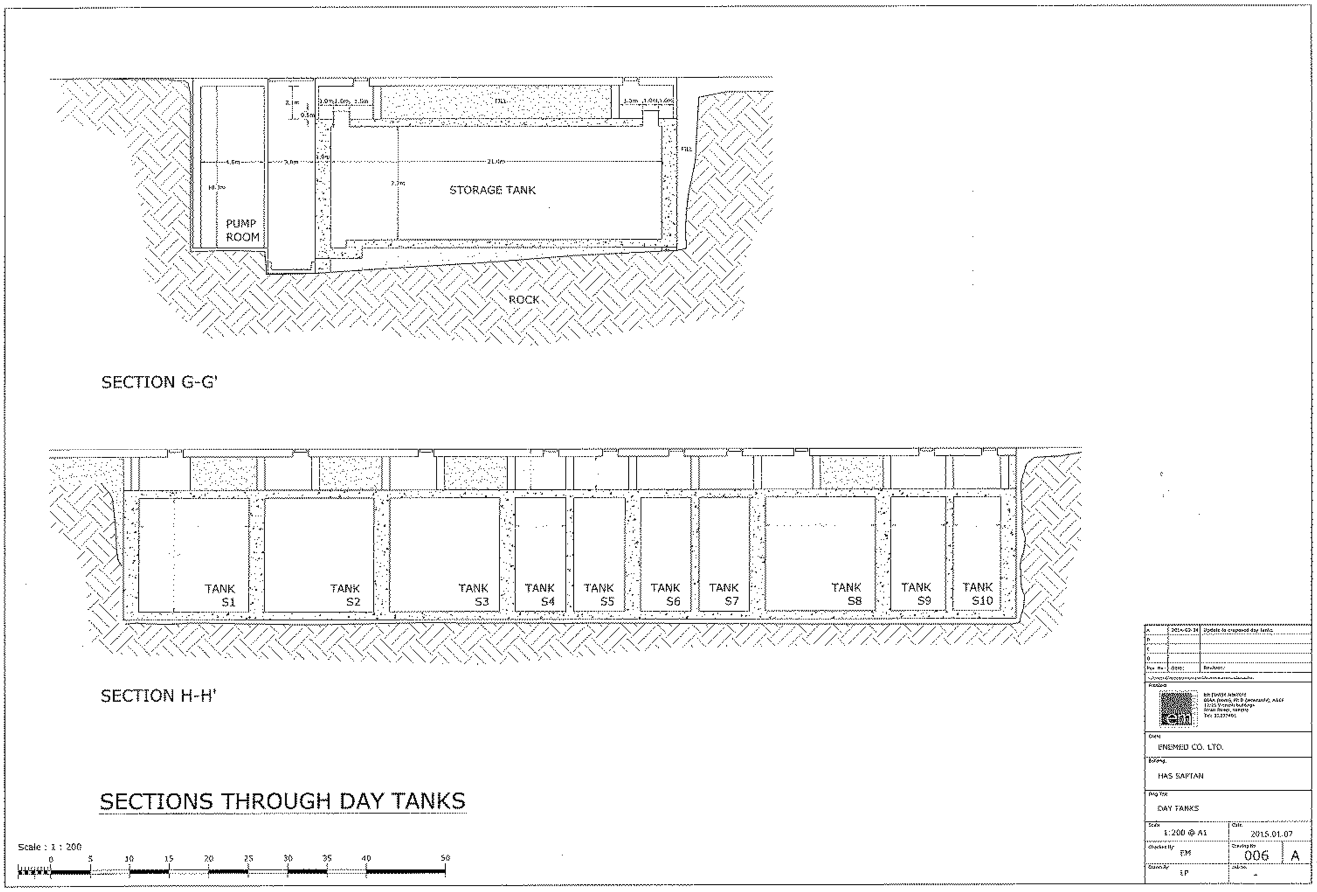

Figure 3: Cross section through excavation showing tank depth of 10.3 metres. (*Source: Enemed*)

Plate 1: Aerial photo of the Ħas-Saptan infiltration basin *(Source PA Mapserver)*

Plate 2: Inlet to Ħas-Saptan infiltration basin from Malta international Aiport main runway

Plate 3: General view of Ħas-Saptan infiltration basin

Plate 3: Internal view of Ħas-Saptan infiltration basin showing minimal depth of 4 courses (1m)

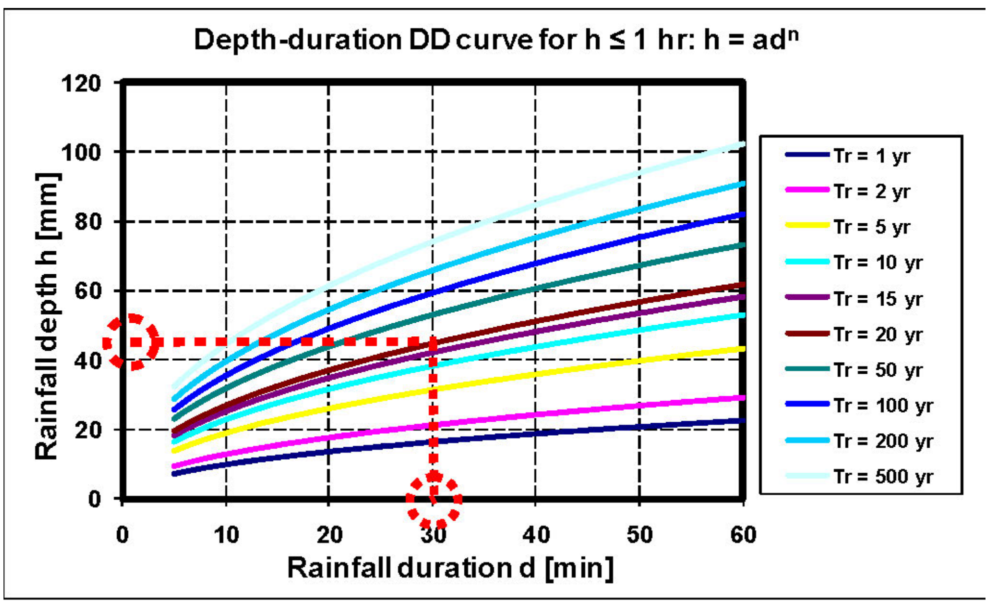

Figure 4: Depth-Duration probability annotated (in dotted line) for a 45mm depth event – 30 minutes: 1 in 20 years (*Source MRRA*[2])

[2] Figure 3.14, Hydrological and Hydrologic Report. Politecnica 2010 (Ministry for Resources and Rural Affairs)

Plate 4: Retaining wall at downstream end of the Ħas-Saptan infiltration basin, showing outlet valve at base.

Plate 5: Debris intercepting screen in Wied Ħas-Saptan upstream of existing facility.

Plate 6: Pair of discharge outlets from dam/bridge on Wied Ħas-Saptan downstream of existing facility.

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

Technical Appendix 3

AGRICULTURE BASELINE REPORT

Prepared by Dr Eman Calleja

Supporting Documents for

Environmental Planning Statement

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, Eman Calleja, who carried out the Agriculture Baseline Study for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such study was solely carried out by me.

1st August 2016

Date

Signature

Agriculture study in terms of the Environmental Planning Statement (EPS) prepared for TRK 160087: Demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

By

Dr. Eman Calleja **BSc, DSPU (Env. Rest.), MSc (Env. Mangt.), PhD (Warwick)**

July 2016

Table of Contents

1 BACKGROUND

The proposal involves the construction of a fuel dispensing station for refuelling of road tankers. The site, at Ħas-Saptan l/o Ħal Għaxaq, covers an area of approximately 6,600 m^2. The project is proposed by Enemed Co. Ltd, a Government-owned company that has taken over the operations of Enemalta's former Petroleum Division. Enemed Co. Ltd is one of the major suppliers of fuel to the Maltese market. Enemed Co. Ltd is hereinafter referred to as 'the Applicant'; the project is hereinafter referred to as 'the Scheme'. The Applicant intends to relocate the fuel dispensing station at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site. The Scheme will provide a refuelling service for road tankers supplying fuels to service stations throughout Malta. Gasoline, diesel, gasoil and other fuels will be dispensed from filling points connected to 14 new prefabricated underground day tanks compliant to the standard EN 12285. The fuel dispensing station will consist of six loading lanes with three loading arms in each lane supplying different fuels.

The day tanks will receive fuel on a daily basis from the existing underground Ħas- Saptan fuel storage facility via pipelines constructed within a new tunnel. A vapour recovery unit (VRU) will be installed and integrated with the road tanker loading system, to recover gasoline vapours from the road tankers and the day tanks during transfer from tank to road tanker and during tank-to-tank transfers. A calibrating tank will be installed next to the VRU, which will be used to calibrate the meters on the loading bay, thus ensuring accurate fuel delivery. An underground pump room will also be constructed, housing electrically driven fuel pumps equipped with ATEX motors and switchgear. These pumps will deliver fuel from the day tanks to the road tankers. The Scheme is expected to cater for around 40 road tanker refuelling trips daily.

The Scheme will also include an administration block and workshops for maintenance of plant, equipment and road tankers; the existing buildings on the western side of the site will be demolished. The entire site will be constructed of concrete hardstanding, with an impermeable self-healing membrane underlay. Oil-water separators will receive and treat surface water from all the outdoor areas of the Scheme. A fire detection and fire-fighting system will be installed at the Scheme. The day tanks will be served by a number of firewater ring mains as agreed with the Civil Protection Department, supplied by two diesel-driven fire pumps located in a dry chamber. The ring mains will supply sprinkler, deluge and foam injection systems designed to IP/NFPA standards. A fire safety and ventilation report has been prepared for the fuel dispensing element of the Scheme, while a fire strategy report has also been prepared for the Scheme's administration block. Explosion- and flame-proof lighting designed for use in hazardous areas (such as ATEX lighting) will be installed for security reasons.

1.1.1 Access and Parking

Access to the site will be through the current access road, which will be widened to accommodate the safe passage of road tankers. 50 parking spaces will be provided for employees just outside the Scheme site.

2 INTRODUCTION

The scope of the report is to carry out an Agriculture baseline study and Agricultural quality assessment of the Area of Influence. This study is aimed at fulfilling the requirements of the EPS Terms of Reference part 3.3 as prepared by ERA which is listed below:

> *"The study should identify any agricultural land within the area of influence of the development, and should provide a clear and reasonably detailed indication of:*
>
> *1. The physical quality and productivity of the land, justifying the indicators used in this regard. Soil depths, textures, and properties should also be described in the relevant level of detail;*

2. Whether the land is dry land, irrigated land, recently reclaimed land, long-abandoned land with an established trend toward regeneration of natural vegetation, or otherwise;

3. The main crops and trees cultivated in the surrounding area, as a meaningful indicator of longer-term quality and potential of the cultivable fields. In this regard, emphasis is to be laid on appropriate and representative indicator crops, avoiding overly precise but superficial field-by-field snapshots of all crops that happen to be under cultivation at a given point in time. For similar reasons, superficial indicators based on transitory factors (e.g. fallow land, currently abandoned land; or underutilised land) are insufficient and potentially distortive, and for a more representative baseline the investigation needs to look more deeply into how the land was used over the past years;

4. Any agro-ecosystems and related interactions including the living and non-living components (e.g. dry- stone rubble walls, associated natural and man-made habitats etc) that are currently coexisting with established agricultural activity or are being maintained in connection with such activity;

5. All relevant ancillary aspects (e.g. irrigation water sources, access routes, land drainage patterns, exposure and microclimate, holding sizes and configurations) that may be lost, displaced or otherwise affected by the proposed development; and,

6. Any baseline environmental pressures and exceedances (e.g. pollution) resulting from agricultural activity, that may be directly or indirectly relevant to the proposed development, particularly any aspects that will be displaced, abated or compounded as a result of the development.

In view of the above terms of reference, the following are included in the study:

- A desk study focussing on previous survey work undertaken within the study area provided as context to the results of the current survey work.

- A field-by-field survey of the area of influence to provide information regarding
  - Seasonal and standing crops,
  - Soil depths, textures, and properties,
  - Land use patterns including whether the land is dry land, irrigated land, recently reclaimed land, long-abandoned land with an established trend toward regeneration of natural vegetation,
  - The main crops and trees cultivated in the surrounding area,
  - Any relevant ancillary aspects (e.g. irrigation water sources, access routes, land drainage patterns, exposure and microclimate, holding sizes and configurations),
  - Any baseline environmental pressures and exceedances (e.g. pollution) resulting from agricultural activity.
- A description of the soil landscape types prevalent in the area.
- GIS mapping of the agricultural land.
- A list of policies and legislation that is applicable to this project in terms of its impact towards agriculture or the agricultural landscape.
- An assessment of the productivity of the land, by taking into consideration the land type and crop being grown. This will be based on the estimation of expected yields based on a study carried out by Calleja (2011) and current crop prices for 2015 (sourced from NSO).
- GIS mapping of the agricultural value of the land, and a spatial assessment of the productivity of the land taking into consideration the potential annual agricultural turnover.

3 METHODOLOGY

3.1 Baseline studies

The fields comprising the Area of Influence were surveyed in June 2016. A number of parameters were recorded including:

a) Seasonal and standing crops,
b) Soil depths, textures, and properties,
c) Land use patterns,
d) The main crops and trees cultivated in the surrounding area,
e) Any relevant ancillary aspects (e.g. irrigation water sources, access routes, land drainage patterns, exposure and microclimate, holding sizes and configurations,
f) Any baseline environmental pressures and exceedances (e.g. pollution) resulting from agricultural activity.

The data was entered into a GIS system using ESRI® ArcMap™ 10.3 for ease of reference and analysis. Land use was mapped using ArcInfo, to obtain an accurate representation of the prevalent land use in each plot or sub-plot. Crop pattern and use of irrigation was also plotted. Areas used were then extracted from ArcInfo.

Observations and records were taken from these access roads by peeking over boundary walls. In the inner areas which were not visible from the access roads, observations were augmented by studying aerial photographs published by the Planning Authority and Google Earth. In view of the lack of accessibility, the location of trees could not be identified and mapped out accurately to aid this assessment.

3.2 Assessment of agricultural quality

The assessment of agricultural and land quality is hereby being based on the following four factors:

1. Soil type and depth
2. Field size and accessibility
3. Land use and crops being cultivated
4. Mean crop prices.

The first two factors are highlighted in section 4. These give an indication of the inherent quality of the agricultural land and its productive potential.

The third factor - land use and crops - gives an indication of the economic potential of the agricultural land. This is predominantly influenced by the farmers' choice of crop, which in turn is based on a number of sub-factors, namely: amount of time farmer has available for farming (full time or part-time); soil quality and type; size of field and accessibility; availability of water for irrigation; current crop prices and returns. This led to an estimate range of potential income per tumolo (one tumolo is 1,124 m^2).

The data that fed into the assessment of this factor were obtained from semi-structured interviews with farmers in an agricultural survey carried out in July 2011 (Calleja, 2011). The crop prices were obtained from the four quarterly news releases of fruits and vegetables published by the National Statistics Office (NSO 2015a, 2015b, 2015c, 2016). More details of the methodology and data used are described in Appendix I.

The overall assessment of the land quality gave rise to an estimated income per tumolo per year in €/tumolo/year, that is based on the productive potential of the available land and availability of water for irrigation. These estimates were then entered into a GIS system using ESRI® ArcMap™ 10.3 for ease of reference and analysis.

4 AGRICULTURE STUDY

Figure 1 *Map showing the Area of influence*

4.1 Soil landscape type

The Area of Influence (AoI) lies just to the north eastern tip of the airport across Vjal l-avjazzjoni civili (Figure 1). The AoI falls within the Ghaxaq local council and encompasses the localities of Tal-Itorbu, Wied ta' Has-Saptan, Il-Bur ta' Ras il-Wied and Ta' Ras il-Wied (Figure 2). The AoI occupies an area of approximately 22.4 Ha (223,884 m^2) while the proposed site itself occupies around 6,600m^2. The predominant soil landscape type in the AoI is of moderately steep terraces on Globigerina limestone (Figure 7) having a combination of

Calcisols[1] and Luvisols[2] (Figure 8)(MALSIS, 2004; Sammut, 2006). The average soil depth in the area of the upper reaches of Wied Has-Saptan including the AoI is between 30 and 50 cm (Figure 9) though rocky areas of ground were observed around areas of garrigue and steppe in the western half of the AoI. According to a national soil survey (MALSIS, 2004; Sammut, 2006), the organic content of the soil in this area is known to be medium, between 2-6% (Figure 10). On the other hand, the concentration of heavy metals such as lead, copper and zinc in soil was found by MALSIS (2004) and Sammut (2006) to be above the threshold for one or more of these soil contaminants in this part of Malta (Figure 11). This has not been quantified however for this study.

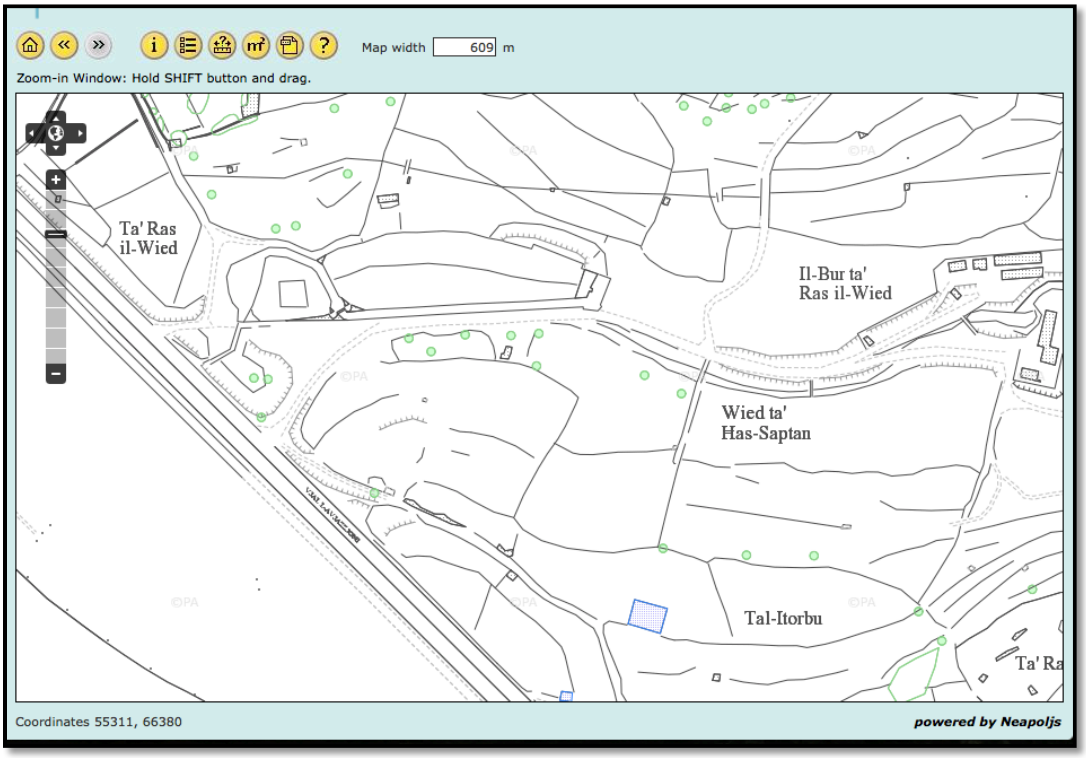

Figure 2 *Basemap of the AoI sourced from the PA mapserver*

[1] *"Calcisols are lime-rich soils with significant accumulation of secondary calcium carbonates, generally developed in dry areas. Dryness, and in places also stoniness, limit the suitability of these soils for agriculture, however, if irrigated, drained, and fertilised, calcisols can be highly productive."* Definition from SOER 2005 (Sammut, 2006)

[2] *"Luvisols are soils with a subsurface layer of high-activity reddish clay accumulation. They are normally fertile soils suitable for a wide range of uses."* Definition from SOER 2005 (Sammut, 2006)

4.2 Land use

The AoI is comprised of a number of land uses, agriculture being the largest of which, occupying 100,477 m^2 of land or 44.9% of the AoI (Table 1, Figure 5). 14.2% of the AoI is covered by trees, whilst 5.9% is occupied by ermes communities (including degraded garrigue and steppic assemblages). A large open reservoir occupying 13,180 m^2 is found in the upper reaches of Wied Has-Saptan. The reservoir does not hold water for the surrounding agricultural holdings but allows water to seep through. The remaining land is comprised of degraded, industrialised and reclaimed land, 18,300 m^2 being covered by spoil material.

Table 1. Major land uses at the Area of influence

Land use	Area (m^2)	Proportion of total AoI
Agriculture	100,477	44.9%
Ermes	13,222	5.9%
Reservoir	13,180	5.9%
Spoil	18,302	8.2%
Trees	31,793	14.2%
Other (roads, industrial, etc)	46,917	21.0%
Total	223,884	100%

Figure 3 *View of the western half of AoI*

Figure 4 *View of the eastern half of AoI*

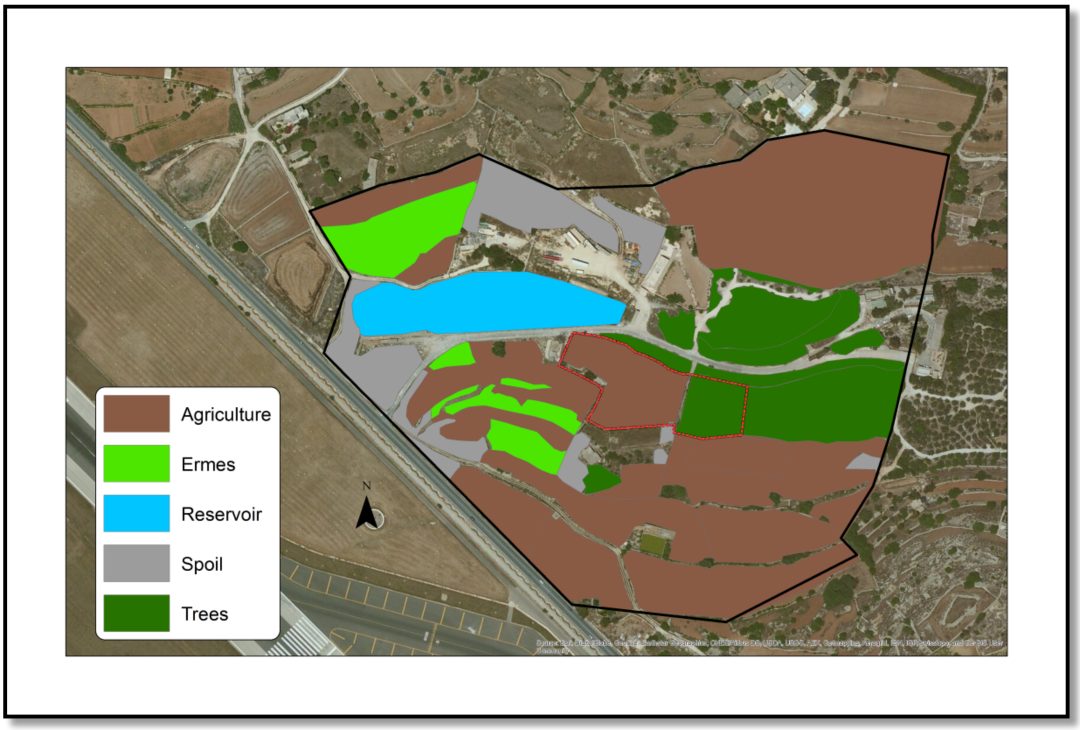

Figure 5 *Map of the major land uses in the AoI*

The area covered by trees is mostly comprised of a past afforestation project that took place in the 1950s, most of which (20,425 m^2) consists of Olives. The rest consists of alien and invasive species that are listed in Schedule III of the tree protection regulations, covering almost 10,000 m^2 of the AoI (Figure 6).

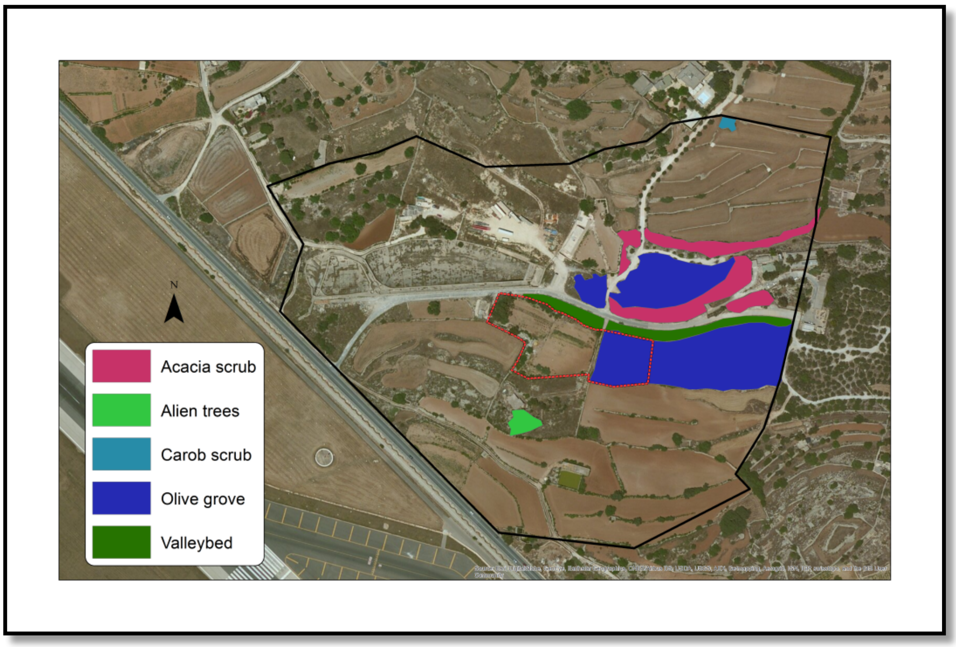

Figure 6 *Map showing the different types of tree cover in the AoI*

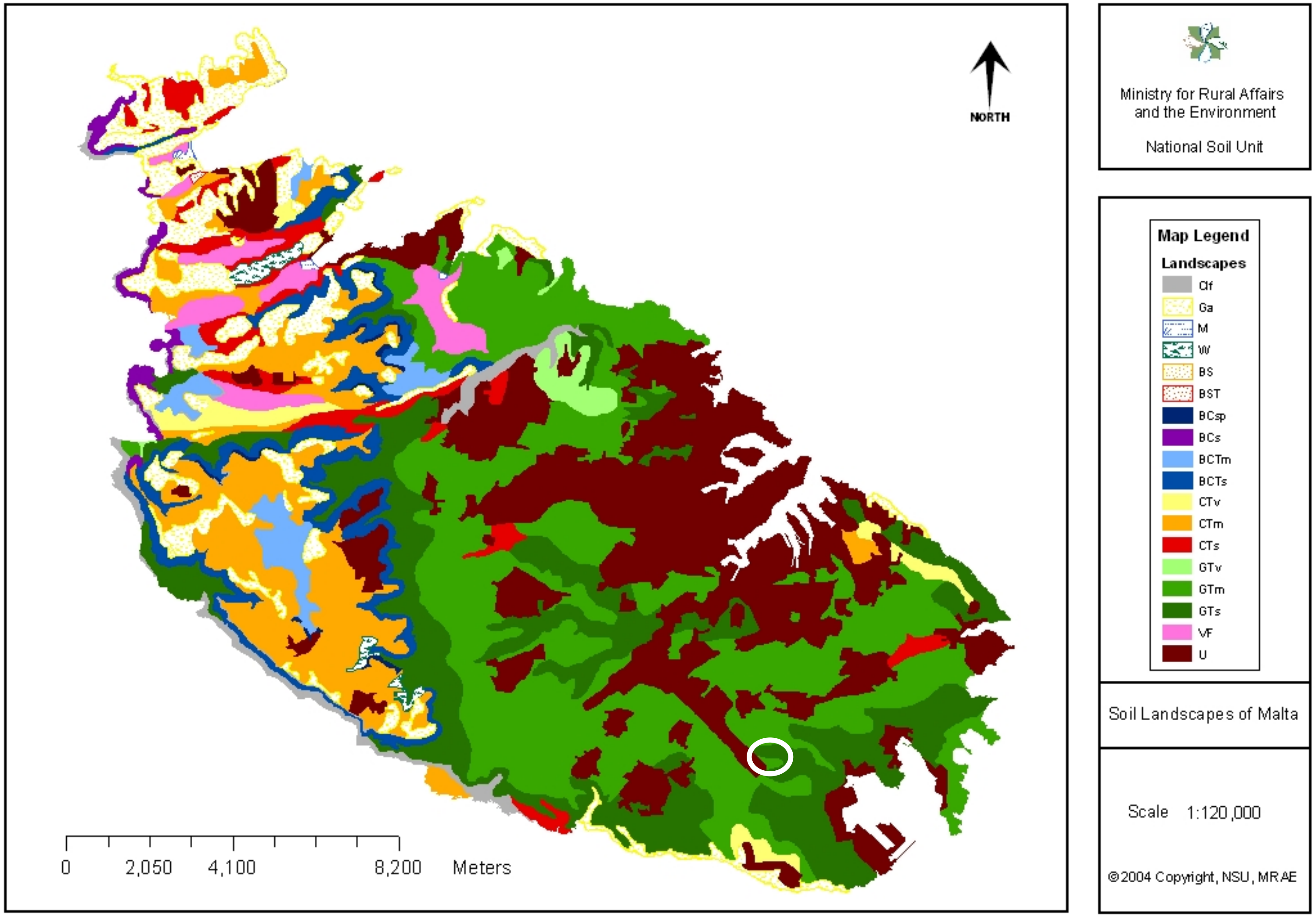

Figure 7 *Soil landscapes in Malta. The AoI is indicated with a white oval (MALSIS, 2004)*

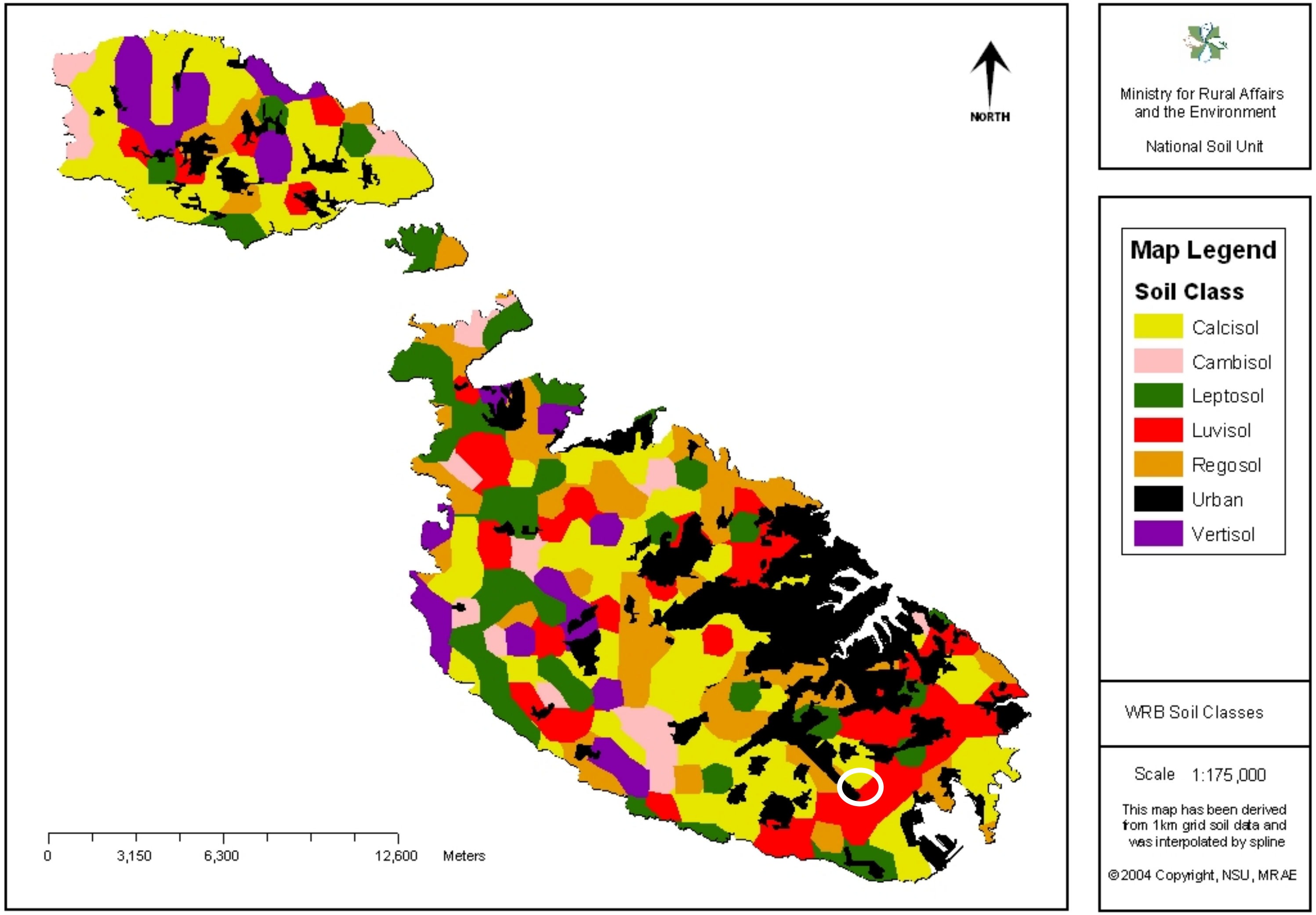

Figure 8 *Map showing the distribution of soil classes across the Maltese islands. The AoI is indicated with a white oval.*

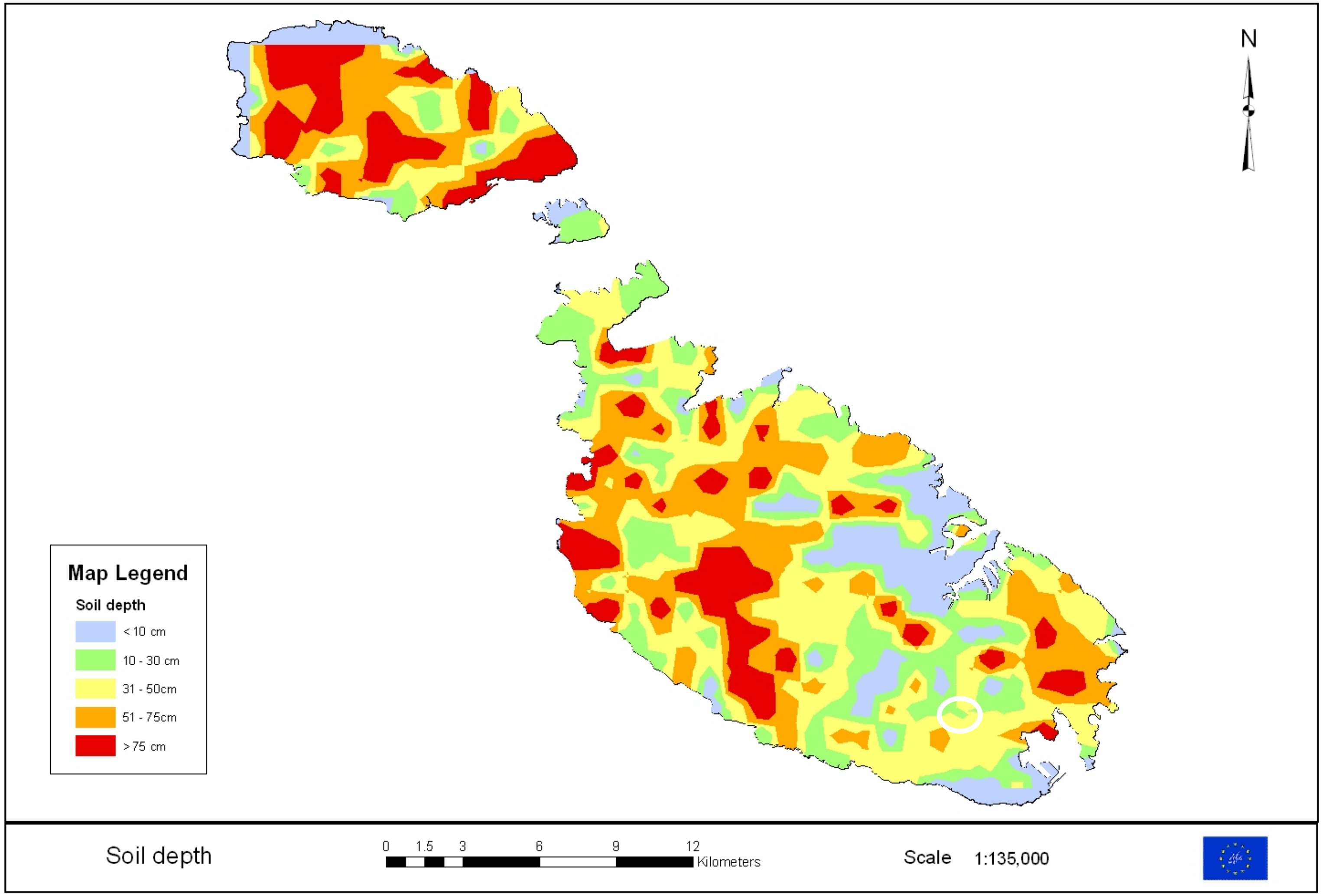

Figure 9 *Map showing kriged values of average soil depths in the Maltese islands surveyed by MALSIS (2004). AoI is indicated with a white oval.*

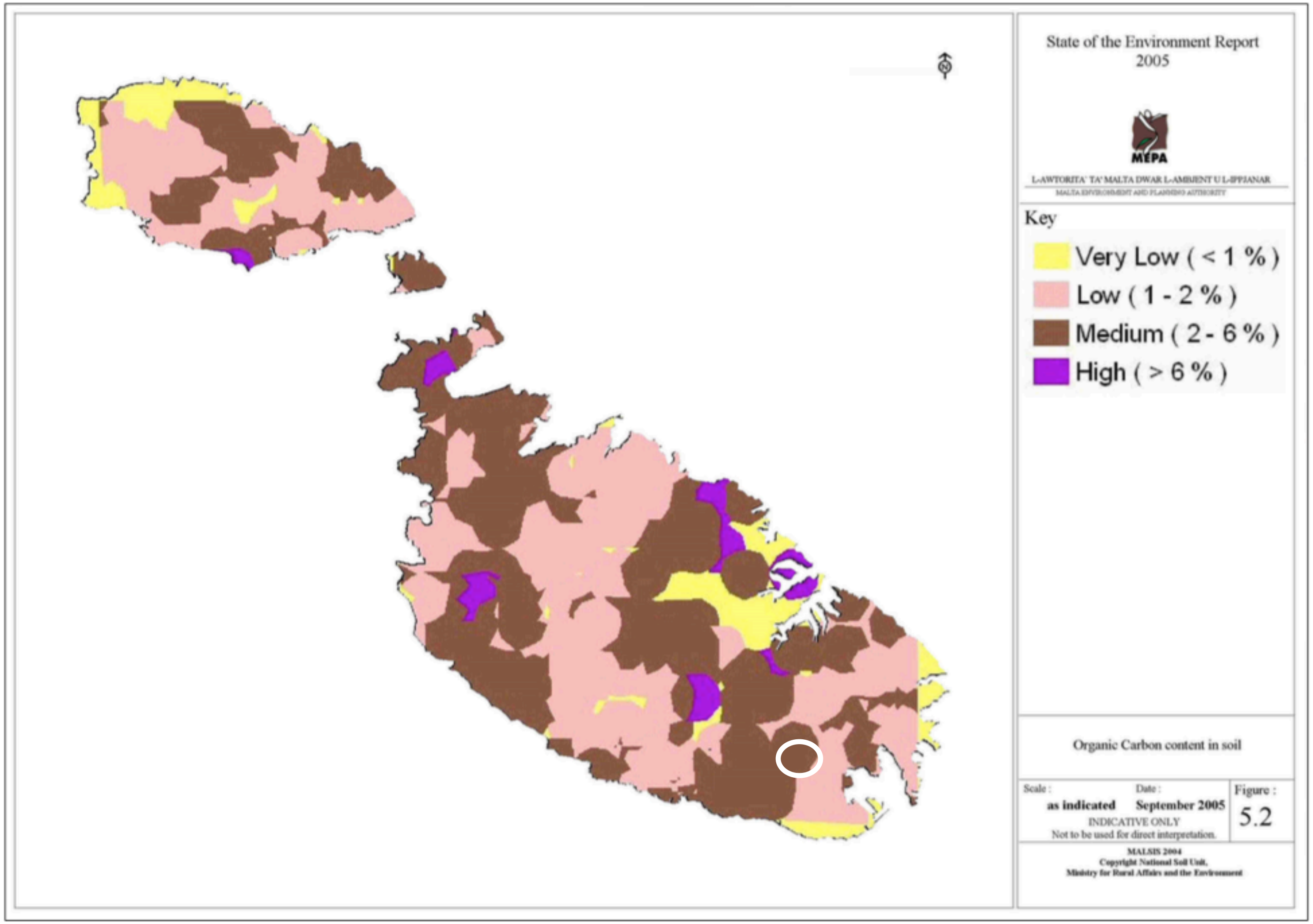

Figure 10 *Map showing soil organic content of the Maltese islands surveyed by MALSIS (2004). The AoI is indicated with a white oval.*

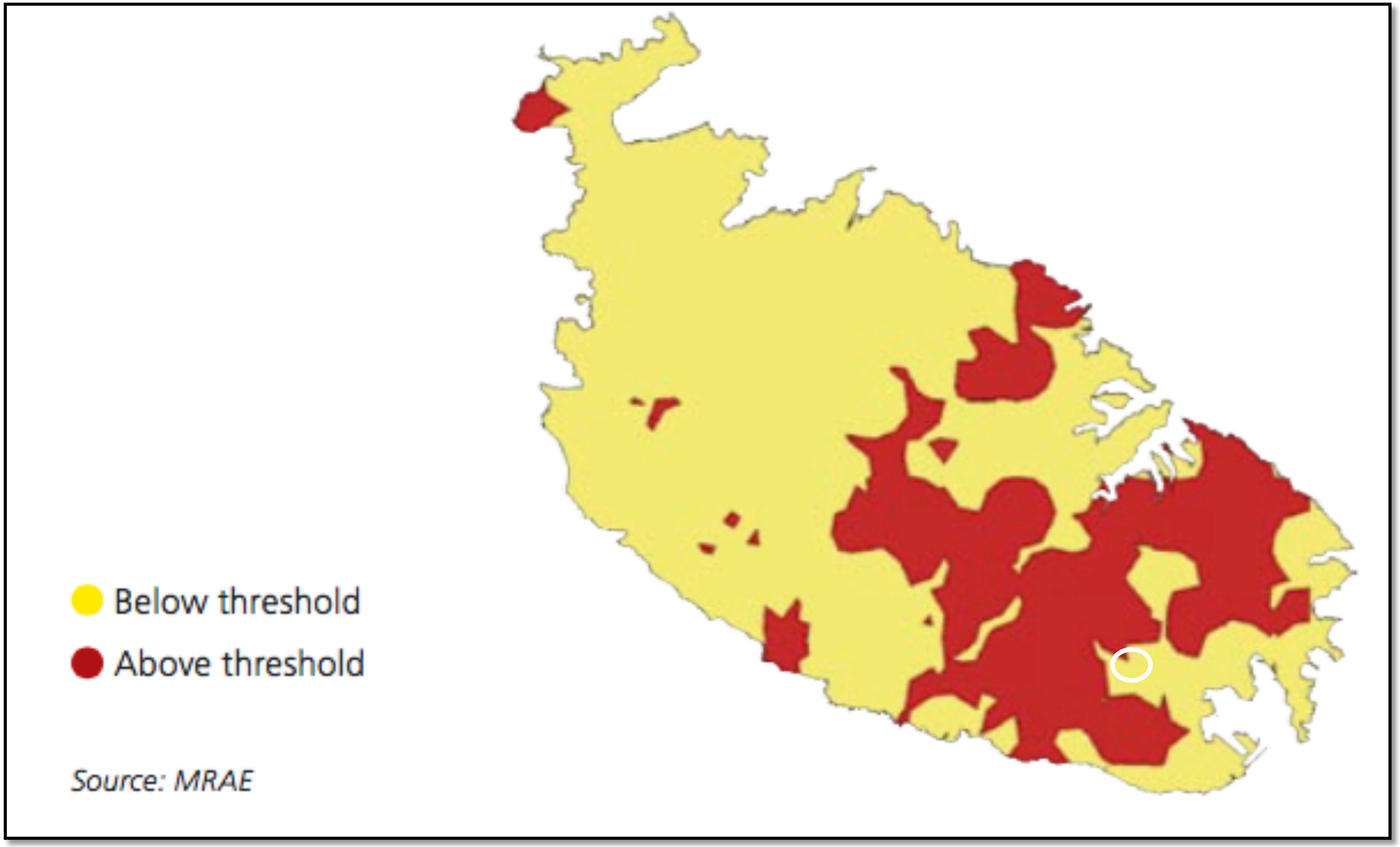

Figure 11 *Map showing concentrations of heavy metals in soils in Malta as surveyed by MALSIS (2004). AoI is indicated with a white oval.*

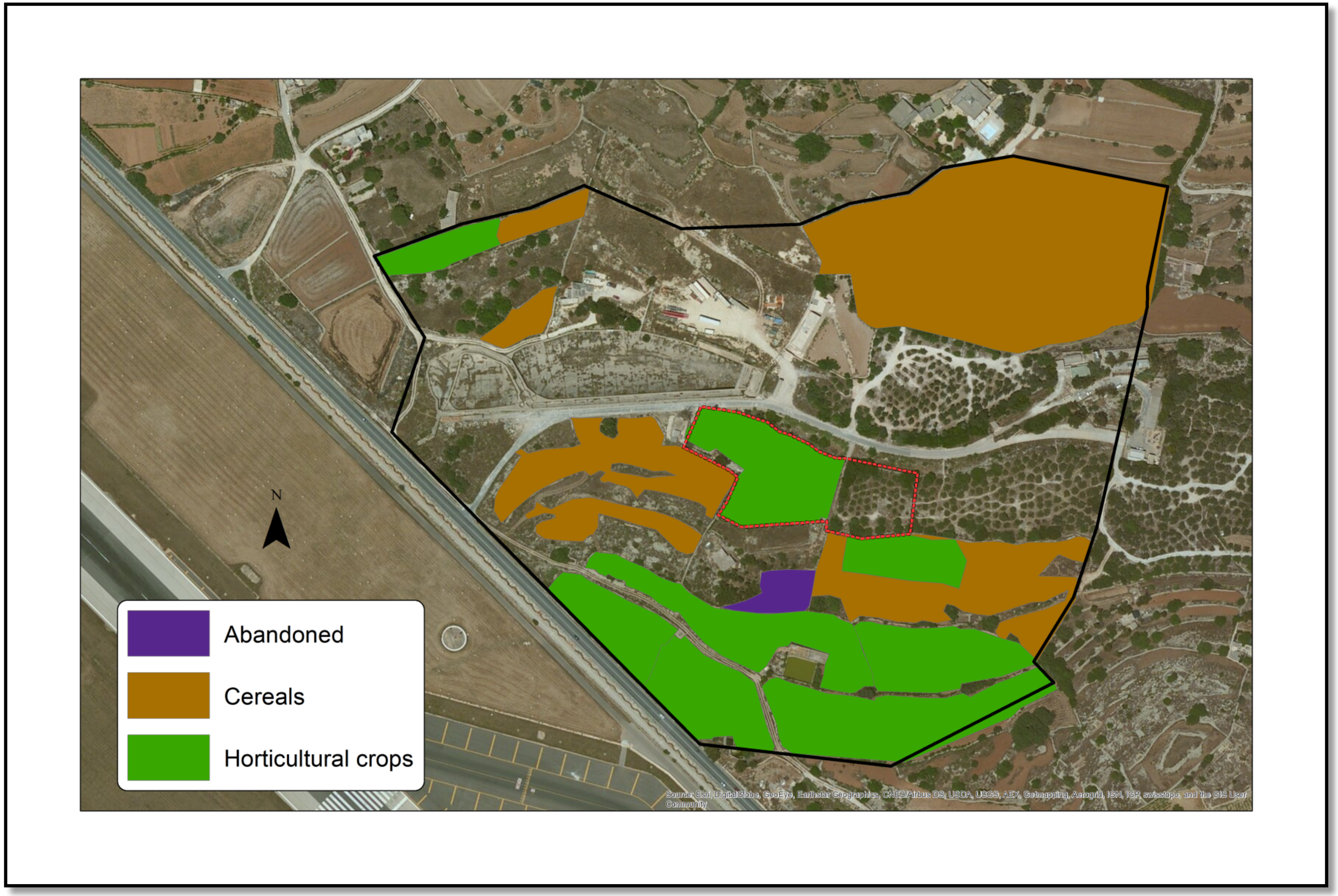

Figure 12 *Agricultural land use map for Area of Influence*

4.3 Agricultural land

The main crops grown in the area of influence were cereals. This crop was cultivated in more than half of the agricultural plots found, covering 52,600 m^2 or 52.4% of the agricultural land (Table 2, Figure 13). Almost all of it was grown on dry agricultural land (raba baghli). The average plot size was moderate, being around 2,280 m^2. The main cereals grown were wheat for animal fodder. The next most frequent agricultural practice was the cultivation of horticultural crops in 18 plots, covering 46,170 m^2 or 46% of the agricultural land, see Figure 14. The crops consisted of a variety of crops including water melons, melons, broad beans, onions, vines (not trellised but along the sides of fields), plums, peaches, japanese medlars and figs. The trees were all grown along the field margins rather than as groups of trees in fields. The average plot size was moderate but slightly larger than that used for cereals, being around 2,570 m^2. All of the horticultural land was irrigated, as evidenced by the supply of irrigation pipes along the field margins.

Table 2. Agricultural practices at the AoI.

Land use	Area (m^2)	No of plots	Proportion of total
Abandoned	1,685	1	1.7%
Cereals	52,622	23	52.3%
Horticultural	46,170	18	46.0%

Almost half of the utilised agricultural land in the area of influence was irrigated, amounting to 46,170 m^2. This was equivalent to all the agricultural land used for horticultural practices.

Table 3. Use of irrigation within the AoI

	Area (m^2)	Proportion of the AoI	Proportion of utilised agricultural land
Irrigated	46,170	20.6%	46.7%
Non-Irrigated	54,307	24.3%	53.3%

Evidence of irrigation was through the presence of piping running along several of the fields. Part of the proposed site itself lies on irrigated agricultural land that is used for horticultural purposes. Almost the entirety of the irrigated agricultural land, or 94.9%, is found within or immediately surrounding the proposed site in the area of Tal-Itorbu (Figure 15).

Figure 13 *Plots of agricultural land used for growing cereals such as wheat*

Figure 14 *Plots of agricultural land used for horticultural purposes.*

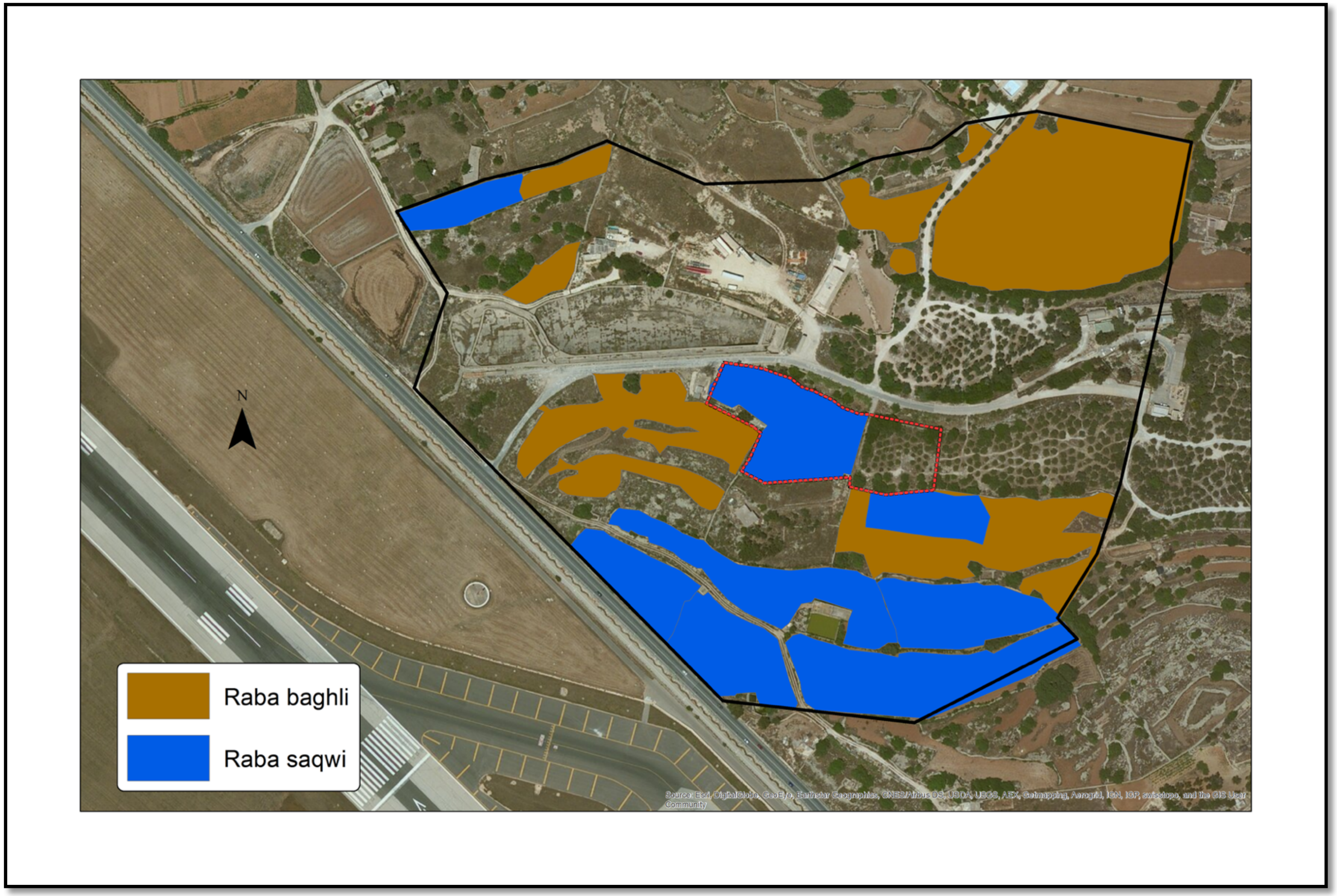

Figure 15 *Map of the irrigated and non-irrigated agricultural land within the AoI*

Figure 16 *Irrigated horticultural land use practices at Tal-Itorbu*

The plots of agricultural land were further mapped as separate holdings according to their location, access and presence of boundary walls. Seven separate holdings were mapped (Figure 20). The largest holdings were holding no 1 and holding no 7. The former consists of raba baghli and lies at il-Bur ta' Ras il-Wied on the south facing slope, covering around 33,760 m^2. Holding no 7 consists of raba saqwi and lies at Tal-Itorbu on the north facing slope, covering around 38,000 m^2. The two smallest holdings, no 2 & 3, lie on the south facing slope in the upper reaches of the valley (Figure 20). The mean plot size varied from around 1,200 m^2 to 4,000 m^2. The larger plots were on the north facing side of the valley between tal-Itorbu and the open reservoir.

From the practices apparent on the farms, the height of the boundary rubble walls (Figure 21) and the presence or absence of irrigation piping, it can be assumed that there are three types of farms. One type included the holdings that did not have a supply of water and grew cereals. This included holdings no 1, 3 and 4. These holdings were characterised by the cultivation of cereals, and low rubble walls. Access in all three was relatively easy as they were all located along a secondary access road. The second type consisted of hobby farms that were used for horticultural purposes on a part-time basis. The boundary rubble walls here were either high or of medium height (Figure 21), often being up to 2m high (Figure 17) as in holdings no 2 and 5. Holding no 6 had a 1.5m high rubble wall on its northern boundary adjacent to the Has Saptan olive grove. These properties were also characterised by the presence of high metal gates (Figure 18). The rubble walls between intermittent plots within the holding were low as is typical of the agricultural landscape in this area. Access to these holdings was good, through the availability of secondary access roads leading directly into the holding.

Table 4. The list of separate land holdings, their areas, and mean plot sizes.

Land use	Area (m^2)	No of plots	Mean plot size (m^2)	Proportion of total
Holding no 1	33,758	17	1,986	30.2%
Holding no 2	4,119	2	2,060	3.7%
Holding no 3	1,262	1	1,262	1.1%
Holding no 4	12,216	3	4,072	10.9%
Holding no 5	6,618	5	1,324	5.9%
Holding no 6	15,626	4	3,907	14.0%
Holding no 7	38,036	11	3,458	34.1%

Figure 17 *High boundary wall around holding no 5*

Figure 18 *Gated entrance to holding no 6*

These three holdings are considered as hobby farms due to their small size, presence of high walls which were most probably raised in the last few decades, and the cultivation practices which indicate a non-intensive use of the agricultural land. These holdings are also used for amenity purposes by the tenants/owners in view of the raising of high rubble walls for privacy. The third type of agricultural holding was the horticultural farm in holding no 7. This holding was large at around 3.8 Ha, and had a piping system running through all the fields. The property also had a large open reservoir roughly in the middle of the property, and all of the plots were adjacent to each other and well connected through access points in various areas. The mean plot size was large at around 3,500 m^2 and the rubble walls were low. The property also had a couple of heaps of manure which would be spread before the first rains. This all indicates that the tenant/owner uses this agricultural land more intensively than the other holdings with the objective of commercial production.

Figure 19 *The agricultural holding no 7 at Tal-Itorbu*

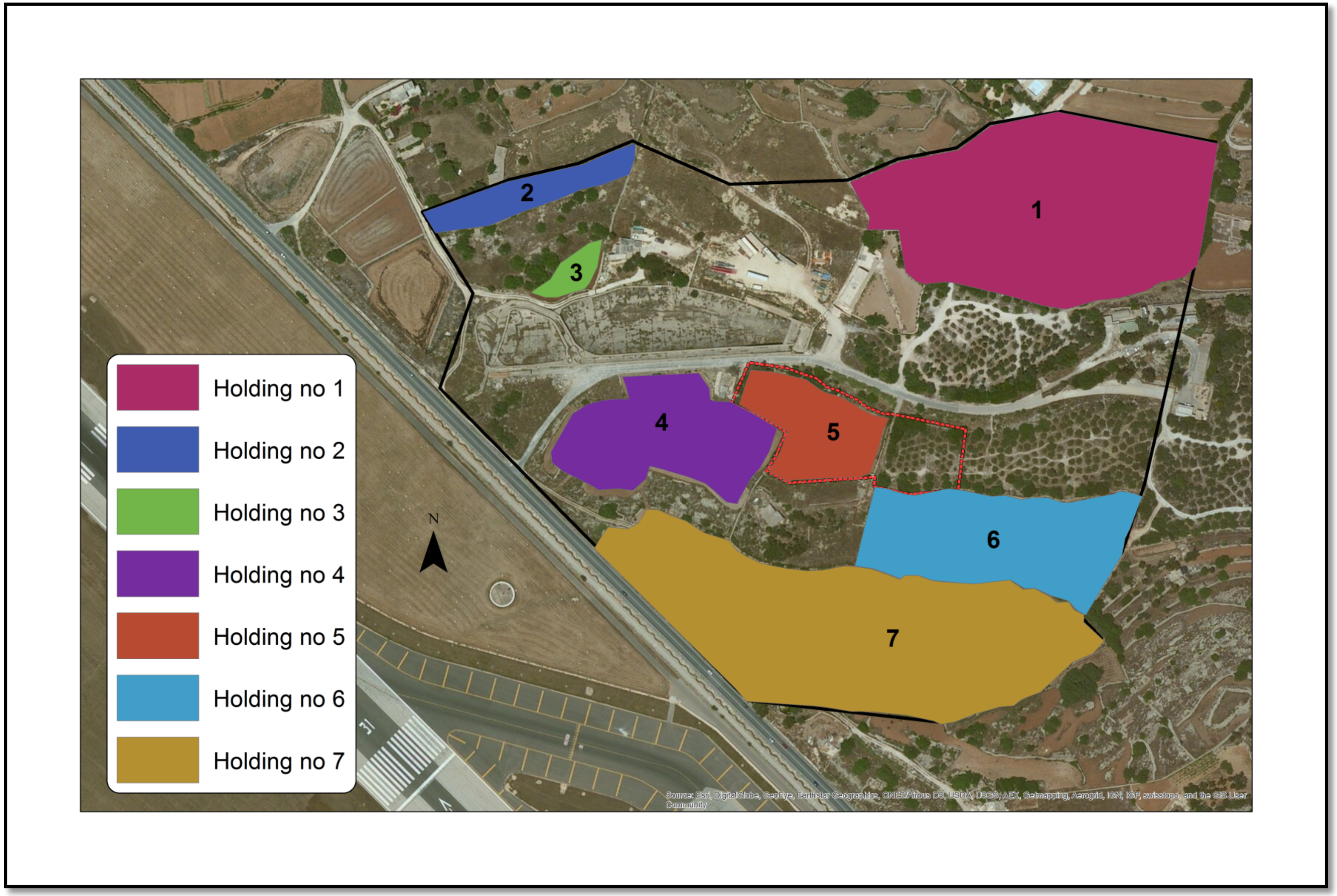

Figure 20 *Seven separate holdings were identified in the AoI and mapped.*

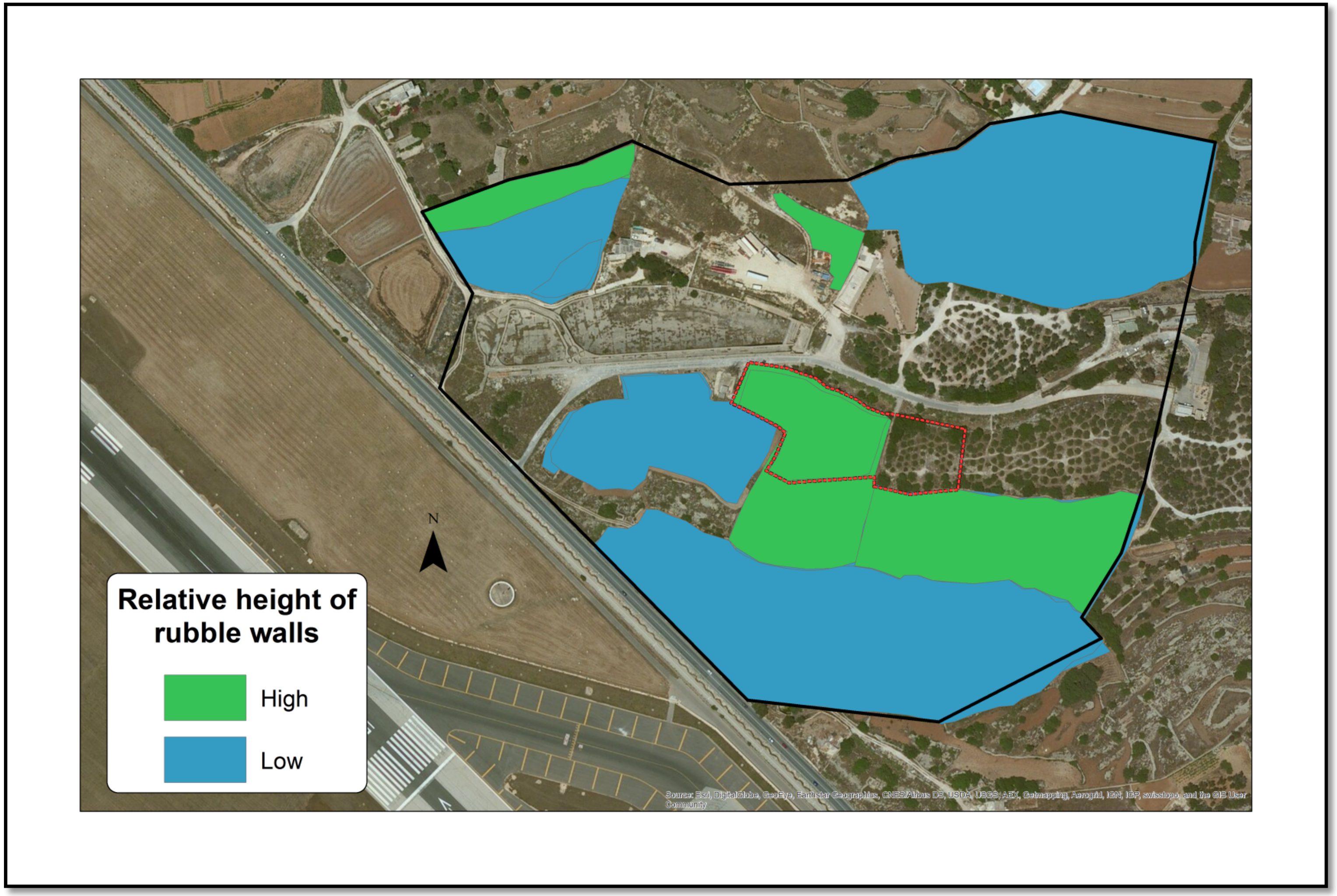

Figure 21 *The relative height of rubble walls in the AoI.*

5 AGRICULTURAL QUALITY AND VALUE

The surveyed area is made up of three sections; the fields in the south facing slope of the valley at il-Bur ta' Fuq il-Wied, the small fields north of the reservoir, and the fields on the north facing side of the valley between Tal-Itorbu and the road junction.

The average soil depth is on the whole shallow to moderate, being between 30 and 50 cm. The soil in holdings no 3 and 4 were shallower in view of the presence of exposed rocks and garrigue intermittently between or adjacent to the agricultural plots. Accessibility in the surveyed area is good, with most of the plots being accessible directly from the secondary road or through an adjacent field. Rubble walls were in a relatively good state of repair except for the agricultural holding no 4. To simplify the description of the agricultural quality and value, the three sections will be discussed separately.

5.1 *Il-Bur ta' fuq ilWied*

This section of agricultural land is considered to be of low to medium agricultural value. The relatively small size of the fields, lack of available water for irrigation and south facing exposure reduces the productivity of the land. On the other hand, the plots are all located together on one holding, the rubble walls were in a relatively good state and accessibility is good. Potential earnings in this holding could come from one winter crop per year, such as wheat (€120 per tumolo), broadbeans (€800 per tumolo depending on the market) or potatoes (around €1,000 per tumolo). The holding, could have annual potential earnings of up to €11,000 (Table 5), by using a well-planned crop rotation using different crops, however it is most likely being used for growing cereals, dropping gross potential income to up to €3,000 per annum.

The proposed works will not lead to any direct losses in income from agricultural practices through a loss of land along this holding, since none of the proposed changes, including the road widening, site construction or car park, are found along this stretch of land.

5.2 Holdings beside Has Saptan reservoir

This section of agricultural land was found to be of low to moderate agricultural value. Three agricultural holdings are found around the reservoir, no 2, 3 & 4. Of these, the latter two are of low agricultural value due to their size, lack of available water, partly degraded rubble walls and shallow soils. Moreover holding no 4 has been diminished in size over the last 30 years due to the dumping of spoil material in parts of the holding (Figure 5). On the other hand, holding no 2 does have a supply of water, however the plots are relatively small and have a south-facing aspect. Accessibility is good for all of the three holdings.

Potential earnings in holdings no 3 & 4 could come from one winter crop per year, such as wheat (€120 per tumolo), broadbeans (€800 per tumolo depending on the market) or potatoes (around €1,000 per tumolo). The holdings could have annual potential earnings of up to €600 for holding no 2 and €4,500 for holding 4 (Table 5). This is particularly so for holding 4 where a well-planned crop rotation using different crops could be applied. However, it is most likely that these two holdings have been used for growing wheat for many years, dropping gross potential income to around €150 per annum for holding 3 and €1,000 per annum for holding 4.

Potential earnings in holding no 2 are higher due to the availability of water. This would allow the farmer to cultivate two to three high earning rotations of crops a year. Potential crops could include various vegetables, including tomatoes, lettuce, cabbages, capsicums and watermelons. In view of the availability of water for irrigation and condition of the rubble walls, the holding is considered as being of moderate agricultural value, having potential earnings of up to €1,500 to €10,000 a year (Table 5).

The footprint of the proposed project will impinge on part of Holding no 4 as the road will be widened. The extent and location of the road works is not yet known to allow an estimation of the potential lost income from direct impact. Neither of holdings no 2 or 3 will be impacted from direct loss of land since the proposed works will occur on the other side of the reservoir.

Table 5. Annual potential agriculture-related earnings from the 7 holdings in the AoI.

Category being impacted	Area of utilizable land (m^2)	Potential income in € per tumolo	Potential earnings per holding /€
Holding no 1	26,010	up to 500	up to 11,000
Holding no 2	3,757	500 to 3000	1,500 to 10,000
Holding no 3	1,491	up to 500	up to 600
Holding no 4	10,178	up to 500	up to 4,500
Holding no 5	4,244	500 to 3000	1,800 to 11,000
Holding no 6	15,626	500 to 3000	6,000 to 20,000[3]
Holding no 7	28,909	Over 3000	over 75,000

5.3 Holding no 5

This section of agricultural land was found to be of moderate agricultural value. The availability of water, presence of high rubble walls sheltering the crops, good accessibility and moderately shallow soil, provides good conditions for two to three rotations of high earning crops per year. It is most likely that the land here has been reclaimed on spoil material deposited in the 1970s and 1980s, providing even deeper soil conditions for plant growth. In spite of this, the site is most likely used as a hobby farm (Section 4.3), making it unlikely that more than two cropping cycles per year are undertaken. In view of the above, and evidence of the site's use for non-agricultural uses, the gross potential earnings of this holding

[3] The upper value is lower since water for irrigation is only available in part of the holding.

could be between €1,800 to €11,000 a year (Table 5), depending on the crop grown and intensity of the cropping systems.

The footprint of the proposed project will impinge entirely on holding no 5. In fact, this agricultural holding will make up three quarters of the proposed site for development. In view of the above, the owner/tenant of the holding will not only loose the income foregone in the absence of the agricultural enterprise, but will also lose any capital costs invested in the site.

5.4 Holding no 6

This section of agricultural land was found to be of moderate agricultural value. The partial availability of water, presence of well-preserved rubble walls, good accessibility and moderately shallow soil, provides good conditions for agricultural production. Nevertheless, it is apparent that water is available for only part of the site, unlike the adjacent holdings no 5 and 7. More than half of the site can only be used for one crop per year grown during winter. Two crop cycles are only grown in a section of the holding. In view of the above, and evidence of the site's use for non-agricultural uses, the gross potential earnings of this holding are estimated to be between €6,000 to €20,000 a year (Table 5), depending on the crop grown, use of water for irrigation and intensity of the cropping systems.

The proposed works will not lead to any direct losses in income from agricultural practices through a loss of land along this holding, since none of the proposed changes, including the road widening, site construction or car park, are found within this stretch of land. This holding does however border the proposed site to the north.

5.5 Tal-Itorbu

Holding no 7, located on this section of agricultural land, was found to be the largest and most productive of all the agricultural holdings, and has the highest earning potential. The relatively good condition of the fields, use of water for irrigation, availability of a reservoir on site, good access and good soil depth, provide the farmer with the potential to lead to high turnovers and economic returns. Potential earnings could easily be over €3,000 per tumolo per annum, reaching potential turnovers for the entire holding of over €75,000 a year. This income could come from growing at least two successive crops of vegetables per year throughout the whole farm whilst still using a suitable crop rotation system. The major limiting factor affecting potential returns here would be the amount of time the farmer puts into his holding. Using two or three crop cycles per year throughout the farm is very time consuming for the farmer, who would probably need to be a full timer to cultivate this amount of land under intensive cultivation practices throughout its 3 Ha of utilisable agricultural land.

The proposed works will not lead to any direct losses in income from agricultural practices through a loss of land along this holding, since none of the proposed changes, including the road widening, site construction or car park, are found along this stretch of land.

5.6 Potential impacts

The direct impact from loss of agricultural land due to construction, road widening and the new parking areas for the site, is expected to be restricted to the entirety of Holding no 5, parts of holding no 4 and potentially part of holding 6. The remaining holdings will not be affected. Nevertheless, there are other issues that concern agriculture including accidental oil and fuel spills and soil contamination in the surrounding agricultural landscape.

The accidental spilling of oils or fuels in or around the site may have an impact on the surrounding agricultural landscape. Spills though rare, may lead to soil contamination from total petroleum hydrocarbons (TPH) and heavy metals. This could affect the toxicity of the soil. If, however, appropriate precautions are taken place such as those listed in the Project Description Statement, this should not be a problem. In fact, research in different countries has indicated that soil pollution around such depots or facilities only occurs where accidental spills (Adeniyi & Afolabi, 2002, Klein et. al, 2012) burning accidents or accidental explosions (Li, et. al, 2012) occurred. Contamination was low in other areas where accidental spillage was avoided. If such contamination is to be avoided for the proposed project, not only should accidental leaks be avoided, but so should any runoff from the site.

Even if accidental contamination does take place, this is unlikely to have any effect on the high quality agricultural land in Holding no 7, since the site is separated by two more holdings and several rows of walls. The only major threat would be from the risk of major disasters, which in this case would affect the agricultural land hundreds of metres beyond the extent of the AoI.

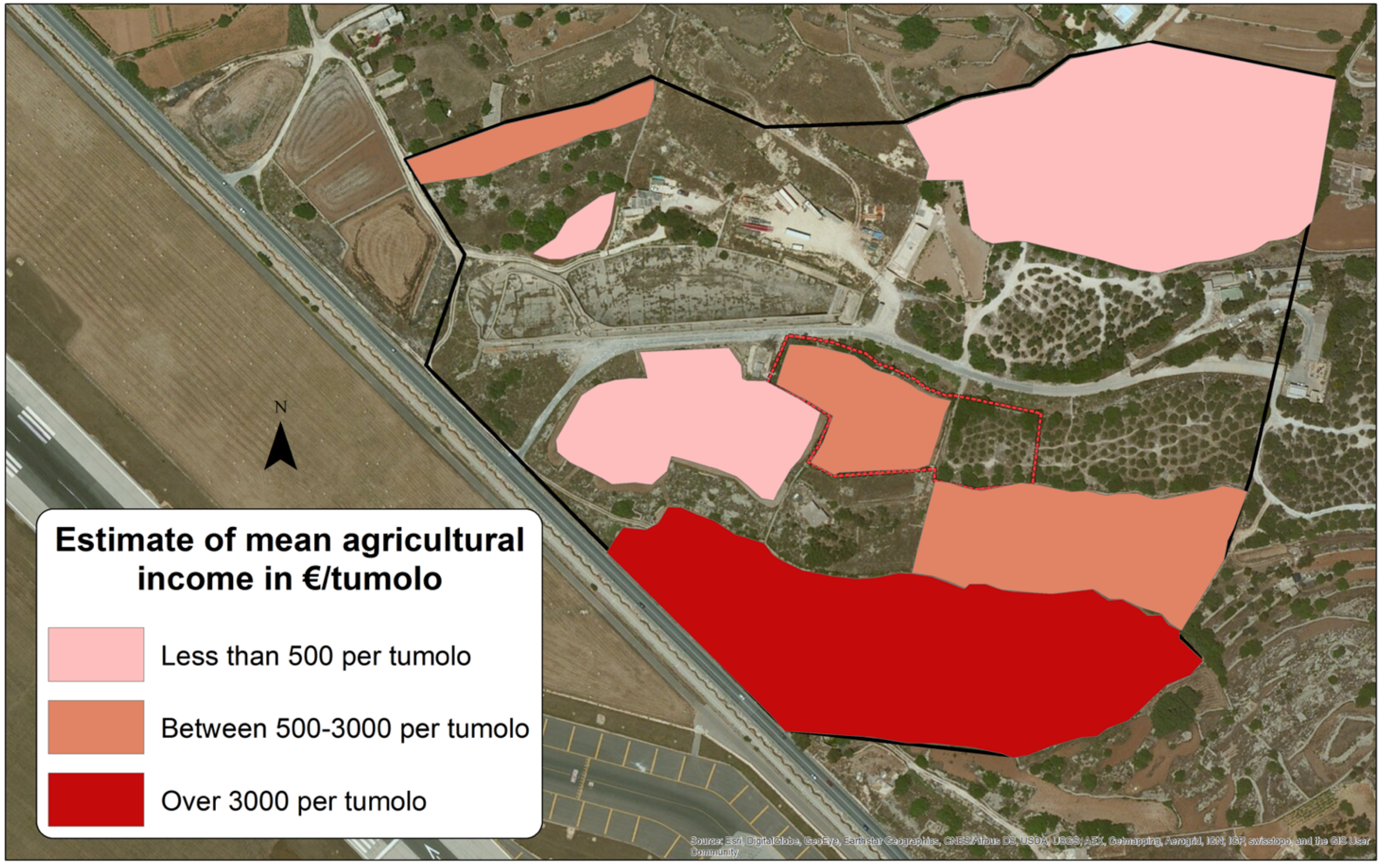

Figure 22 *Map showing the potential mean agricultural income that could be earned from the respective Agricultural holdings.*

6 RELEVANT LEGISLATION AND POLICIES

In this section, the implications of legislation and policies for the area of influence are examined.

6.1 Local plan policies

Table 6. The Area of Influence is covered by a number of local plan policies

Designation	Policy	Reference
Areas of Agricultural Value	SMAG 01 South Malta Local Plan (Figure 23, Figure 24)	*"MEPA will continue to protect agricultural land from all types of inappropriate development. Within Agricultural Areas, as indicated on the relevant Environmental Constraints Maps, only buildings, structures and uses essential to the needs of agriculture will be permitted and then only if it can be demonstrated to the satisfaction of MEPA that they will not adversely affect water supplies, soil and landscape, and accord with all other policies within this Local Plan."*
Wied Has Saptan as an Area of High Landscape Value	SMCO 06 South Malta Local Plan	*"MEPA designates the areas identified on the respective Policy Maps as Areas of High Landscape Value (AHLV) as per Section 46 of the Development Planning Act, 1992 and Structure Plan policy RCO 3. There shall be a strong presumption against the creation of new built structures (including cultivation and animal husbandry related structures) in AHLVs. The*

Designation	Policy	Reference
		guidance provided in the Explanatory Memorandum to the Structure Plan clauses 15.34 to 15.40 shall also apply. MEPA will ensure that any developments falling within such areas will not result in the creation of light pollution. MEPA will favour proposals for compatible and sensitive positive interventions and activities (particularly informal recreational activities in the form of walking or cycling footpaths as well as educational initiatives) intended to upgrade and rehabilitate Areas of High Landscape Value. In sites which have been degraded by development activities, a rehabilitation and monitoring program needs to be established by the developer and agreed with MEPA to ensure that the proposed interventions are in line with other policies related to conservation as well as protection and management of the natural and cultural resources."
Has-Saptan Fuel Storage Facility	SMGH 07 South Malta Local Plan	*This Local Plan confirms the committed use of the Has-Saptan Fuel Storage Facility site for the storage of fuel. No further intensification or expansion of existing uses will be permitted on this site. MEPA will, however, favourably consider the relocation of such facilities to a more appropriate location in future. Should this occur a plan is to be submitted by the operator of this facility indicating details of the dismantling operations as well as of the rehabilitation and re-*

Designation	Policy	Reference
		use of the site for informal recreation, provided safety can be assured."

6.2 Rural Policy and Design Guidance document, 2014

The rural policy and design guidance document for agriculture published in 2014 (MEPA, 2014), describes a number of policies that are applicable to this project, however since the scheme is considered to be a national project, policy 1.2A comes into force.

6.2.1 POLICY 1.2A NATIONAL POLICY PROJECTS

"Any project of national interest arising from National Government Policies which departs from the policies formulated in this document shall be assessed on its own merits subject to consultation with the Departments/Authorities/ Committees concerned."

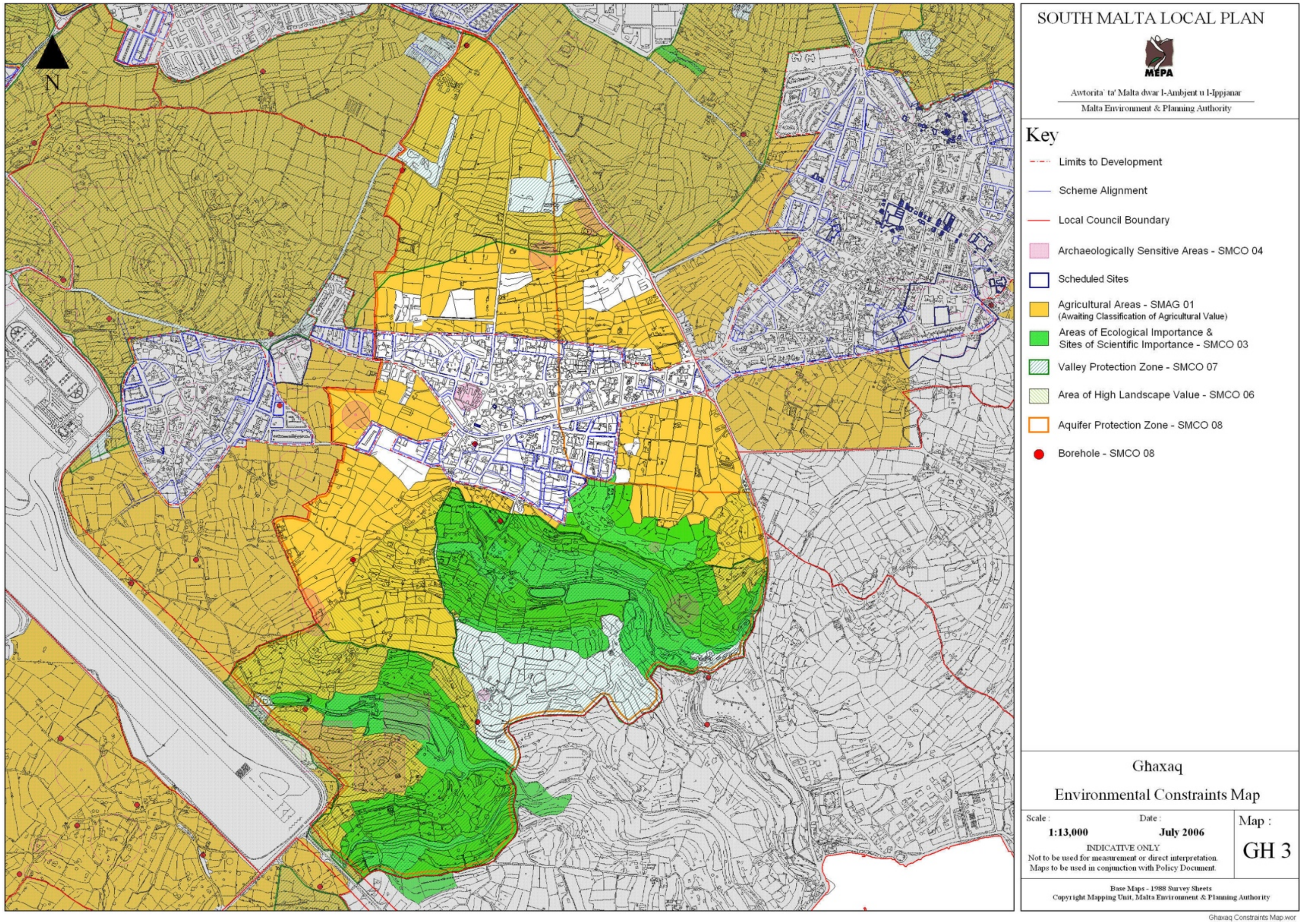

Figure 23 *Map showing Areas of Agricultural areas awaiting classification as Agricultural Value through policy SMAG 1 (MEPA, 2006)*

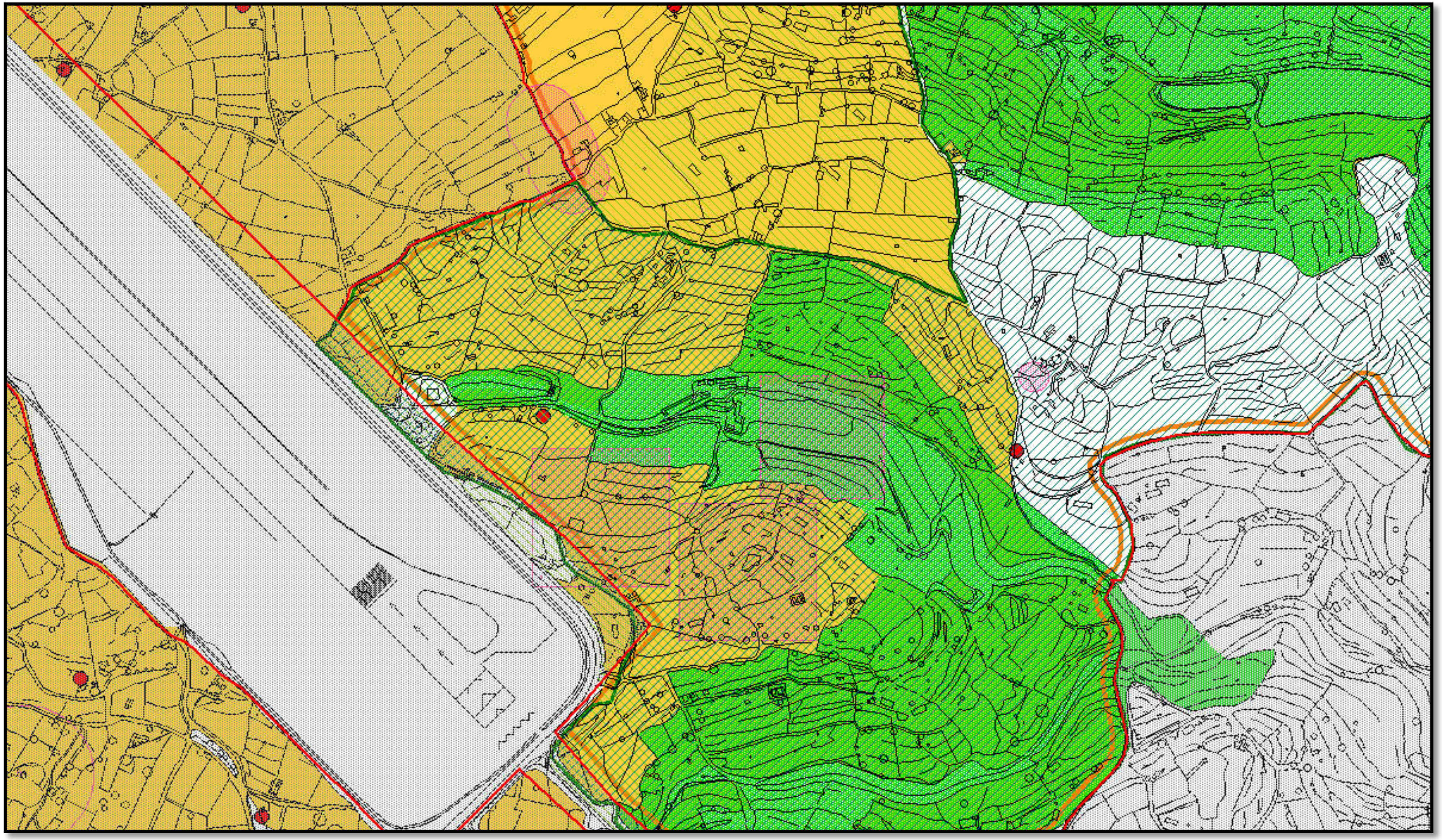

Figure 24 *Enlargement of the previous map showing all of the 7 agricultural holdings in the AoI marked as Agricultural areas (MEPA, 2006)*

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8 APPENDIX I

The data obtained through this exercise (Calleja, 2011) consisted of crop spacing and mean crop yield. Crop spacing gave an indication of the planting density and quantity of plants per hectare. The crop yield in turn gave an indication of the yield of crop per plant. By multiplying the crop yield per plant with the planting density, the expected crop yield per tumolo in kg/tumolo, was obtained.

The fourth factor, mean crop prices, gives an indication of the real turnover obtained per plot. It is based on the selling price of the crop in 2015 (price that the farmer gets for his crop). Thus it only considers the actual selling price and not the cost price. Since investigating profit or loss was beyond the scope of this study, the cost price of the crop was not considered. Thus all the monetary values discussed in section 5 reflect the actual economic turnover in 2015. The main sources of data were the four quarterly news releases of fruits and vegetables published by the National Statistics Office (NSO, 2015a, 2015b, 2015c, 2016). The prices were crop specific. For crops grown in both season, the means were calculated as follows: wet season was taken to be from October to March; dry season was calculated on the April to September prices. For those crops that were not sold at the Pitkali markets, such as wheat[4], the prices were obtained from other sources. The mean price was calculated as the mean price per kilo for that season (except for wheat).

[4] Price obtained from farmers through interviews

*Table 7.**Crop planting distances and prices for 17 different crops**. The plant spacing refers to the space between the plants and between adjacent rows. The first number refers to the space between plants and the second number refers to the space between rows. The spacing symbols refer to feet (‘), inches (“) or metres (m). The number of plants per tumolo is estimated from the plant spacing in the previous column. The yield per plant was obtained from the farmers through interviews. In most cases the price is described in the last column as € per tumolo except for trees, for which the price per tree is given.*

Crop	Spacing	Plants per tumolo	Yield per plant (kg/plant)	Price of crop (€/kg)	Price per tumolo (€)
Aubergines	2’ x 4’	1,512	2	0.613	1,853
Broad beans	2’ x 4’	1,512	0.8	0.669	809
Cabbage	1.5’ x 1.5’	5,375	2.85	0.219 (wet) 0.207 (dry)	3,354 (wet) 3,170 (dry)
Cauliflower	2’ x 4’	1,512	1.10	0.308	512
Courgettes	2’ x 4’	1,512	2	0.775 (wet) 1.105 (dry)	2,344 (wet) 3,341 (dry)
Lettuce	1.5’ x 1.5’	5,375	0.685	0.262 (wet) 0.201 (dry)	965 (wet) 740 (dry)
Melons	2’ x 4’	1,512	4.5	0.374	2,545
Onions			2,500 kg per tumolo	0.649	1,622
Peach trees			10	0.772	7.72/tree
Peppers	2’ x 4’	1,512	2	0.832 (wet) 1.097 (dry)	2,515 (wet) 3,317 (dry)
Plum trees			25	1.055	26.37/tree
Potatoes			3,276 kg per tumolo	0.327	1,071
Spring onions	2’’ x 1’3’’	58,080	0.015	0.269	234
Strawberries		5,000	1.5	2.562	19,215
Tomatoes	2’ x 4’	1,512	4	0.873 (wet) 1.050 (dry)	5,280 6,350
Water melons	2’ x 4’	1,512	12.5	0.278	5,254
Wheat			40 bales/tumolo	€2.90/bale	116

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

Technical Appendix 4

ECOLOGY BASELINE REPORT

Prepared by Adi Associates Environmental Consultants Ltd

Supporting Documents for

Environmental Planning Statement

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, Krista Farrugia, who carried out the Ecology Study for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such study was solely carried out by me on behalf of Adi Associates Environmental Consultants Ltd.

1st August 2016

Date

Signature

TN 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZJONI, ĦAS-SAPTAN, GĦAXAQ

ECOLOGY BASELINE REPORT

Version 1: June 2016

Report Reference:

Adi Associates Environmental Consultants Ltd, 2016. Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, at Ħas-Saptan, off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq (TN 160087). Ecology Baseline Report. San Gwann, June 2016; iv + 22pp.

PLEASE CONSIDER YOUR ENVIRONMENTAL RESPONSIBILITIES BEFORE COPYING THIS REPORT

Quality Assurance

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, at Ħas-Saptan, off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq (TN 160087)
Environmental Planning Statement
June 2016

Report for: **Enemed Co Ltd**

Revision Schedule

Rev	Date	Details	Written by:	Checked by:	Approved by:
0.0	June 2016	Submission to client	**Krista Farrugia** Director	**Rachel Xuereb** Consultant	**Adrian Mallia** Managing Director

File ref: G:_Active Projects\EIA\EMD005 - Has Saptan EPS\Baseline studies\Ecology\Ecology Baseline Study Report.docx

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FIGURES

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APPENDIX

1. INTRODUCTION

1.1. This Ecology Baseline Survey was carried out as part of the Environmental Planning Statement (EPS) that was commissioned by Enemed Co. Ltd, a Government-owned company that has taken over the operations of Enemalta's former Petroleum Division. Enemed Co. Ltd is one of the major suppliers of fuel to the Maltese market. Enemed Co Ltd is hereinafter referred to as 'the Applicant'.

1.2. The Applicant intends to relocate the fuel dispensing station currently located at the 31st March 1979 fuel installation at Birżebbuġa to a site at Ħas-Saptan l/o Ħal Għaxaq (**Error! Reference source not found.**), which covers an area of approximately 6,600 m^2. The proposal is for the construction of a fuel dispensing station for refuelling of road tankers. Hereafter in this EPS, the development is referred to as 'the Scheme'.

1.3. This Study considers the baseline ecology at the Scheme site and its surroundings including habitats, fauna, and flora. The potential key ecological issues are outlined below:

Key Issues
• **Loss of habitat** • **Disturbance to habitats and species as a result of the Scheme (including dust emissions, noise, and lighting)** • **Risk of spillages**

1.4. The Terms of Reference provided by ERA are:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and
- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.5 Terrestrial Ecology

The assessment should include:
1. An investigation of the ecology of the site and its surroundings (including, flora and fauna), ensuring adequate coverage of all relevant species and ecosystem components;
2. A reporting of the conservation status and ecological condition of the area and the state of health of its habitats, species and ecological features, as relevant;
3. A reporting of all protected, endangered, rare, unique, endemic, high-quality, keystone, invasive/deleterious, or otherwise important species, habitats, ecological assemblages, and ecological conditions found in the area under study; and
4. A prediction of the potential impacts of the proposed project on the ecology of the site and its surroundings, including loss, damage or alteration of habitats and species including alteration in the habitats and species' condition/state of health as measured through indicators used/specified for assessment of status in relevant EU policy.

In particular, the study should identify all relevant species and assemblages (e.g. protected species or habitats, key species relevant to habitat characterisation, and monitoring indicators), and assess their abundance and distribution patterns as well as the species' ecological niches. The findings should be supported by adequate maps and photographs. Classification of habitat types and species should be conducted in accordance with recognised classification systems (e.g. EUNIS and Palaearctic), to ERA's satisfaction.

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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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.

Figure 1: Location of the Scheme

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METHODOLOGY

Area of Influence

1.5. The Area of Influence (AoI) for potential impacts on the land and land use that is likely to be affected by the Scheme has been defined to ensure that areas that are sensitive in terms of ecology that may be impacted by the project are included in the study. The AoI is shown in **Figure 2**.

Objectives of the Assessment

1.6. The objectives of the Assessment were to:

- Describe the biotic assemblages and communities present within the site area and evaluate their importance;
- Carry out a baseline ecological survey of the AoI;
- Carry out a tree survey within the AoI;
- Identify, describe and analyse the relevant international / Maltese legislation and protocols, agreements, etc., as well as Government / ERA / PA policies;
- Identify the threats and opportunities posed by the Scheme in respect of the findings;
- Predict the impacts of the Scheme on the ecological value of the area;
- Assess the significance of the impacts on the ecology of the area; and
- Describe the mitigation measures designed to minimise adverse impacts on ecology and enhance any beneficial impacts on the ecological features of the area.

Legislation, Policies and Guidance

International legislation

1.7. International legislation relevant to the ecology of the AoI is mainly that protecting specific habitat types / biotopes or individual species. Of particular relevance are:

- The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention);
- The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention);
- The European Union's Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (the 'Wild Birds Directive'); and
- The European Union's Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive').

Local legislation

1.8. Local legislation relevant to the ecology of the AoI is mainly that protecting individual features, habitats, or species. Of particular relevance are:

- Act XXIX of 1973 (Fertile Soil (Preservation) Act, Cap 236) and the *Preservation of Fertile Soils Regulations* Legal Notice 104 of 1973, S.L. 236.02;
- Legal Notice 200 of 2011 (Trees and Woodland (Protection) Regulations, 2011)(549.64);
- Legal Notice 79 of 2006 as amended (Conservation of Wild Birds Regulations, 2006) (S.L. 549.42); and
- Legal Notice 311 of 2006 (Flora, Fauna and Natural Habitats Protection Regulations, 2006), as amended (S.L. 549.44) and its subsidiary Government Notice 112 of 2007.

Guidelines

1.9. The most relevant policy guidance is the former MEPA's Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands. This document provides detailed guidance on the types of plants that can be used for landscaping purposes in rural, urban, or agricultural situations. The guidance includes methods of planting and lists of species suitable for the different areas.

Baseline survey methodology

1.10. The Ecology Method Statement was accepted by ERA on 30th June 2016.

1.11. The ecology survey was undertaken by Ms Krista Farrugia of Adi Associates. It was carried out in June 2015 and in June 2016.

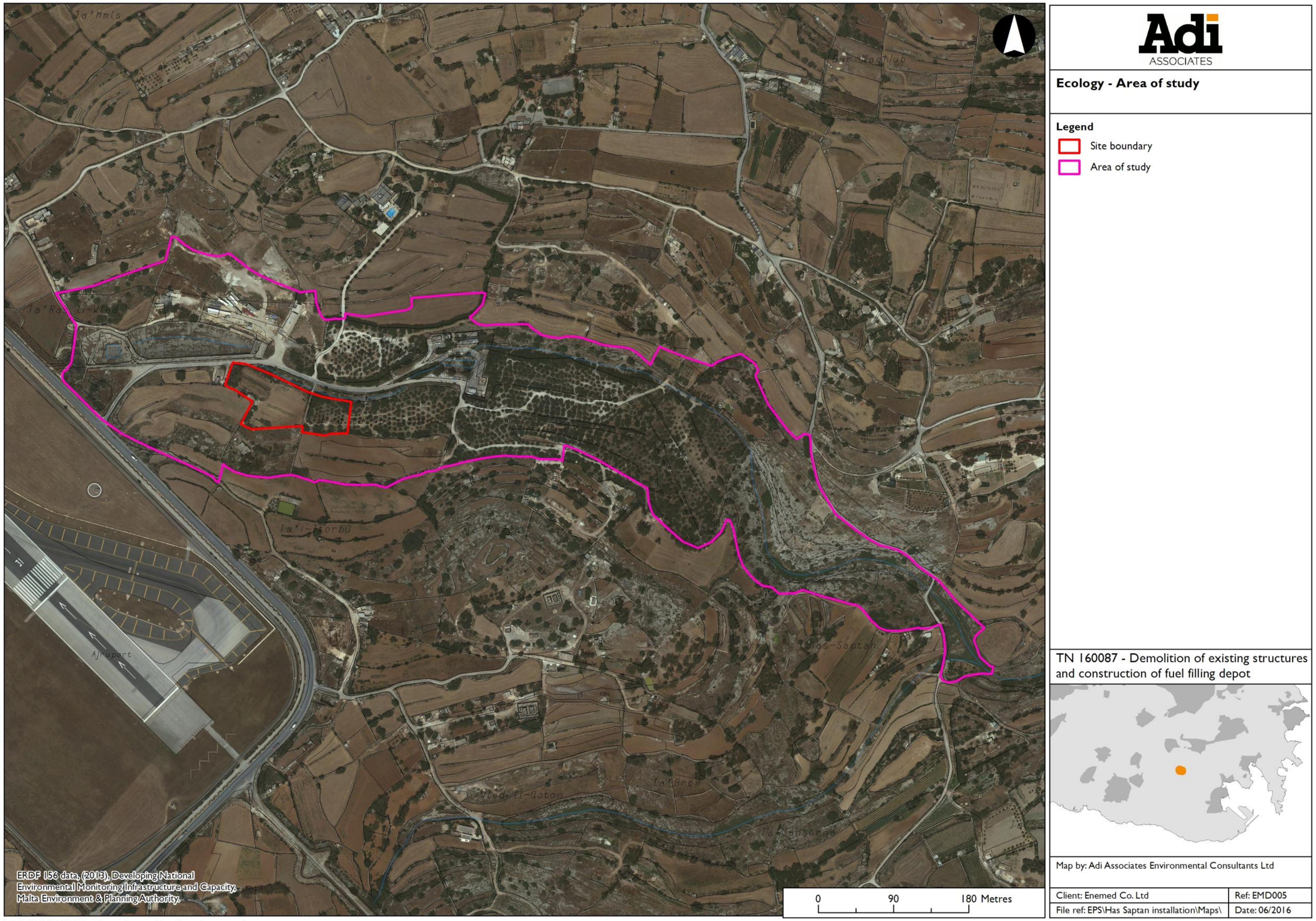
1.12. The Ecology Study comprised:

- A habitats survey of the AoI indicated in **Figure 2**. The survey included a description of the biotic assemblages and communities, which were characterised based on indicator species, mainly vegetation. Classification of terrestrial community types followed the scheme outlined in Schembri, 1991 and modified by Schembri et al., 1999. Nomenclature of plant communities followed the Palaearctic Habitat Classification system (Devillers & Devillers-Terschuren, 1996) and also cross-referred with Annex I of the Habitats Directive (transposed to Schedule I of LN 311 of 2006). Species lists of fauna and flora recorded from the area were produced. A desk study of previous ecological surveys and other baseline data known from the area was also included. Beyond the Enemalta facility, the valley bed adjacent to the site was also surveyed;
- The identification, description, and analysis of the relevant international / Maltese legislation and protocols, agreements, etc., and Government / ERA / PA policies, and a summary of the threats and opportunities posed by the schemes in respect

of the findings; and

- A description of the ecological importance of the habitats and species / biotic assemblages and communities.

Figure 2: Area of Study of Ecology Survey



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ECOLOGY BASELINE SURVEY

1.13. Part of the site is located in a proposed Area of Ecological Importance (AEI) and Site of Scientific Importance (SSI) as identified in the South Malta Local Plan through policy **SMCO 03**. The site also lies within a Valley Protection Zone.

1.14. The site itself consists partly of agricultural land and partly of an olive-carob planted woodland that has developed into a high maquis, particularly in the eastern stretch of this area (refer to **Figure**).

1.15. The approach to the site is bounded by agricultural land to the south of the access road. At the boundary with the road, small areas of disturbed land are present dominated by opportunistic species such as *Foeniculum vulgare* and *Avena sterilis*. A number of *Ceratonia siliqua* trees [L.N. 200 of 2011: Schedule II] were also noted to the north of the approach road (refer to **Error! Not a valid bookmark self-reference.**) growing within disturbed ground.

1.16. Further along the approach road, to the north lies a large reservoir, north of which a couple of abandoned fields were noted that included species such as *Glebionis coronaria*, *Foeniculum vulgare* and *Opuntia ficus-indica,* which also supported a number of *Ceratonia siliqua* trees.

1.17. A number of tree species grow at the boundary of the road and the agricultural land that lies within the Scheme site, including the invasive alien species *Acacia karoo* [L.N. 200 of 2011: Schedule III], as well as *Eucalyptus* sp. [L.N. 200 of 2011: Schedule III], *Ficus carica*, and a couple of specimens of the protected *Crataegus* cf. *monogyna*. *Arundo donax* also grows adjacent to the trees at the roadside.

1.18. Moving east within the site, the agricultural land is separated from the beginnings of an olive grove by a bridge that passes over a ditch. Species growing in the ditch include species typical of disturbed areas such as *Dittrichia viscosa* and also *Arundo donax*. At the boundary of the bridge the alien species *Acacia karoo* is dominant. However, moving away from the bridge, further east, *Olea europaea* trees [L.N 200 of 2011: Schedule II; RDB: Rest (MI)?] are dominant and *Ceratonia siliqua* grows at the boundary with agricultural land which also borders the site. The lichen *Ramalina frondosa* is found growing on many of the *Olea europaea* trees. The lichen *Xanthoria parietina* and the moss *Tortella* cf. *nitida* were also noted. Further east and away from agricultural land, the area becomes even more naturalised and supports large *Olea europaea* trees and *Ceratonia siliqua* forming a high maquis that includes other maquis species growing beneath the dominant trees, including *Pistacia lentiscus* and *Asparagus aphyllus*. *Hyparrhenia hirta* is dominant in the clearings; *Satureja microphylla*, *Daucus carota* (*Graphosoma* sp. bugs were noted on some specimens)*, Prasium majus, Piptatherum miliaceum*, *Chenopodium* cf. *opulifolium*, *Carthamus lanatus, Galactites elegans, Hypochaeris achyrophorus, Sonchus* cf. *oleracus*, *Symphiotrichum squamatum*, *Diplotaxis tenuifolia*, *Sinapis alba*, *Convolvulus arvensis*, *Scabiosa maritima*, *Lotus ornithopodioides*, *Medicago obicularis*, *Medicago polymorpha*, *Trifolium campestre*, *Mentha pulegium*, *Micromeria microphylla*, *Malva linnaei*, *Malva silvestris*, *Brachypodium distachyon*, *Briza maxima*, *Bromus madritensis*, *Cynodon dactylon*, *Lagurus ovatus*, *Orchis* sp., *Stipa* *capensis*, *Vulpia ciliate*, *Plantago lagopus*, *Rumex conglomeratus*, *Valantia muralis*, *Verbascum sinuatum*, *Asphodelus aestivus*, *Vitis vinifera, Allium* cf. *commutatum* and *Carlina corymbosa* were all recorded during the field survey growing in the undergrowth of the trees and in the clearings. *Capparis orientalis* [L.N. 311 of 2006: Schedule VIII] was also recorded frequently. Species such as *Avena sterilis* and *Foeniculum vulgare* are more noticeable at the peripheries of the wooded area, indicating that these areas are more disturbed. The woodland area includes some more noticeable pathways although it generally thickens further east. This area wraps around the current Ħas-Saptan facility. Further north, west of Ħas-Saptan, a copse of *Ceratonia siliqua* forms a boundary with agricultural land. To the east, the maquis area gives way to a rocky clearing supporting a garrigue community[1].

1.19. Although this area was originally planted as part of a rehabilitation project (following the dumping of construction waste from the development of the existing Ħas-Saptan operation) the ecological value of the area today is noted in particular in relation to the maquis species that have become established.

1.20. Trees at the northern boundary of the road leading to Ħas-Saptan are mainly the invasive alien species *Acacia karoo*. To the south, a rocky outcrop dominated by *Hyparrhenia hirta* and opportunistic species such as *Dittrichia viscosa*, is present. A copse of *Acacia karoo* is located at the boundary with the woodland opposite the site.

1.21. The land south of the maquis area largely constitutes agricultural land with some rocky outcrops that were either viewed from a distance or noted from the aerial photos. These areas were not easily accessible and were not surveyed in detail.

1.22. The valley beyond the site is disturbed in some areas. One of the valley sides has been subjected to dumped material upon which trees such as *Cupressus sempervirens* and *Eucalyptus* sp. have been planted. There is an area of rubble from the mound that is spilling into the valley bed. A structure that may be a dwelling and a field within which trees have been planted also lie on the same side of the valley.

1.23. On the opposite side of the valley, a rocky area supports a steppe community dominated by *Hyparrhenia hirta*. Some old boundary and rubble walls are also present; rubble mounds have also been dumped in the area. **Figure 5** and **Figure 6** show the rubble dumped on the valley sides. Other species growing on the rocky valley side include *Jacobaea maritima*, *Dittrichia viscosa*, *Opuntia ficus-indica*, *Capparis orientalis*, *Antirrhinum siculum*, *Teucrium fruticans*, *Teucrium flavum*, *Erica multiflora*, *Rhamnus oleioides*, *Ficus carica*, *Foeniculum vulgare*, *Sedum sediforme, Convolvulus elegantissimus* and *Asparagus aphyllus*. An Acacia tree was also noted. A number of trees were growing close to and on the valley bed including *Ceratonia siliqua*, *Ficus carica* and *Rhamnus oleioides*, other valley species recorded include a thick growth of *Rubus ulmifolius*, *Smilex aspera,* and *Acanthus mollis*.

[1] This garrigue area could not be surveyed in detail due to the presence of dogs.

1.24. A road also winds close to the valley and crosses it via a bridge. The valley bed beyond the bridge within the Area of Influence is dominated by *Arundo donax*.

1.25. Species of conservation significance (including invasive, alien or environmentally-incompatible species) noted during the survey are listed in **Table 11.**

Table 1: Species of conservation significance

Species	Vernacular name	LN 311 of 2006 (Flora, Fauna and Natural Habitats Protection Regulations)	LN 200 of 2011 (Trees and Woodlands Protection Regulations)	RDB status
Ceratonia siliqua	Carob		Schedule II	R, Rest (MED + MI)
Crataegus monogyna	Hawthorn		Schedule II	
Capparis orientalis	Caper	Schedule VIII		
Carlina involucrata (also *Carlina corymbosa*)	Carline Thistle			Rest (MED)
Olea europaea	Olive		Schedule II	Rest (MI)?
Rhamnus oleioides	Lesser Bucktorn		Schedule I	
Acacia karoo	Acacia		Schedule III[2]	
Eucalyptus sp.	Eucalyptus		Schedule III[2]	

[2] Refers to invasive, alien or environmentally-incompatible species.

Figure 3: Ecology survey

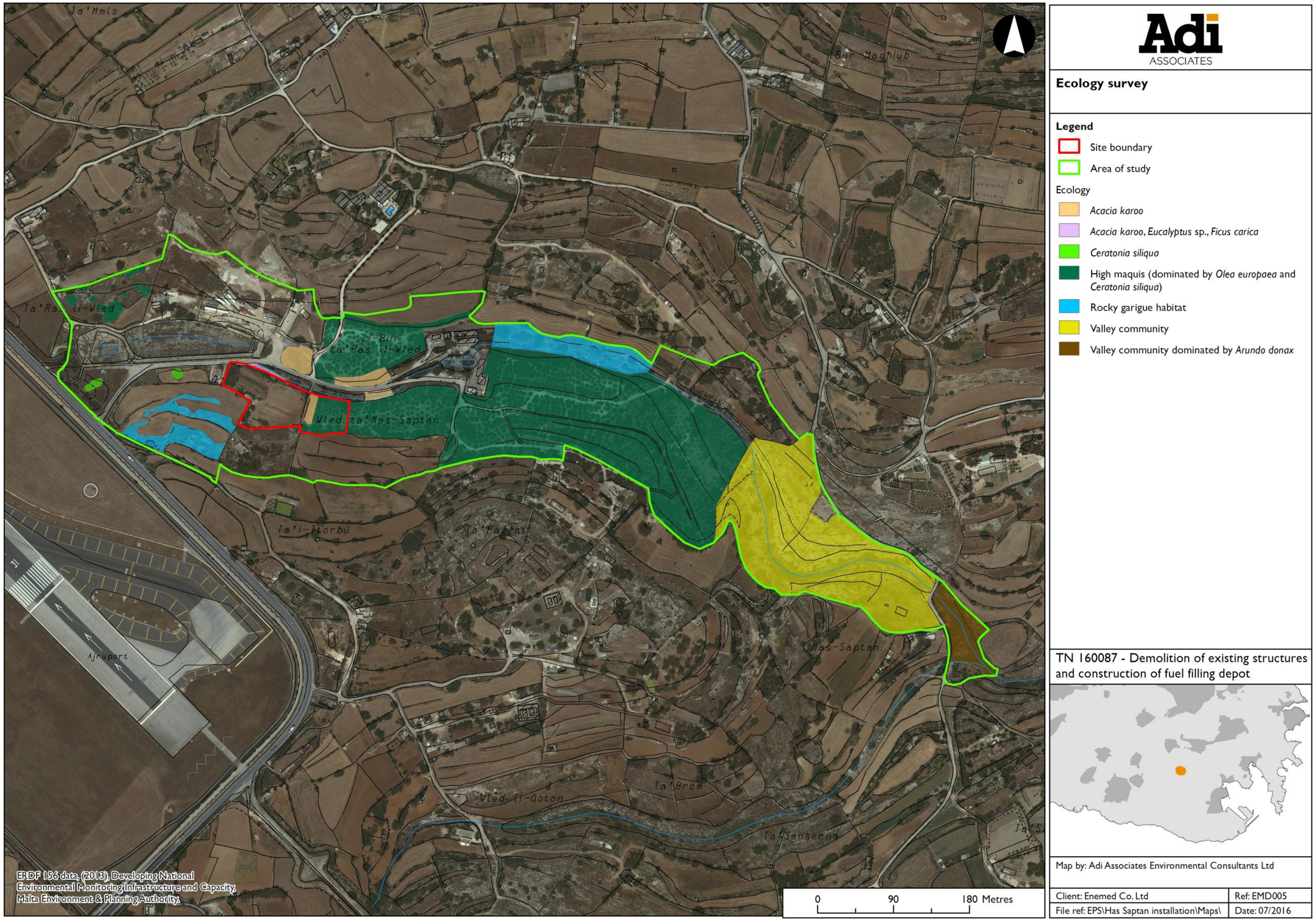

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Figure 4: High maquis dominated by *Olea europaea*

Figure 5: Rubble mound dumped on valley side

Figure 6: Rubble on opposite valley side

Appendix 3: Schedules to LN 200 of 2011 and LN 311 of 2006

Table A1: Schedules listed in Legal Notice 200 of 2011: Trees and Woodlands (Protection) Regulations

Schedule	Scope
Schedule I	Strictly protected trees
Schedule II	Trees Protected in Selected Areas
Schedule III	Invasive, Alien or Environmentally-Incompatible Species

Table A2: Schedules listed in Legal Notice 311 of 2006: Flora, Fauna and Natural Habitats Protection Regulations

Schedule	Scope
Schedule I	Natural habitat types whose conservation requires the designation of special areas of conservation
Schedule II	Animal and plant species of community interest whose conservation requires the designation of special areas of conservation
Schedule III	Animal and plant species of national interest whose conservation requires the designation of special areas of conservation
Schedule IV	Criteria for selecting sites eligible for identification as sites of national importance and of international importance and designation as special areas of conservation
Schedule V	Animal and plant species of community interest in need of strict protection
Schedule VI	Animal and plant species of national interest in need of strict protection
Schedule VII	Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures
Schedule VIII	Animal and plant species of national interest whose taking in the wild and exploitation may be subject to management measures
Schedule IX	Identification and monitoring
Schedule X	Endemic species not covered by Regulation 26

Appendix 4: Red Data Book Keys

Table A3: Key to Red Data Book categories

Code	Criterion
Endemic	Taxon endemic to the Maltese Islands
X	Taxon extinct from the Maltese Islands
E	Taxon is endangered in the Maltese Islands
R	Taxon is rare in the Maltese Islands
RR	Taxon is very rare in the Maltese Islands
I	Status of taxon in the Maltese Islands is not known
Rest(MI)	Taxon has a restricted distribution in the Maltese Islands
Rest(MED)	Taxon has a restricted distribution in the Mediterranean region
?	Following any other symbol signifies uncertainty in the information given

Table A4: Scope of categories

Category	Scope
Endangered	Taxon is in danger of extinction due to populations having become severely depleted or due to a drastic reduction in habitat
Vulnerable	Taxon is likely to become endangered in the near future if the factors threatening it continue to operate (over-exploitation, extensive destruction of habitat, environmental disturbance)
Rare	Taxon is not at present endangered or vulnerable but because of its rarity in the Maltese Islands is at risk
Very rare	Taxon is at risk because it is very rare in the Maltese Islands either because it is restricted to a particular locality or to a habitat type itself rare in the Maltese Islands or because it is thinly scattered
Indeterminate	Taxon may or may not be under threat but insufficient information is currently available

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

Technical Appendix 5

CULTURAL HERITAGE BASELINE REPORT

Prepared by Adi Associates Environmental Consultants Ltd

Supporting Documents for

Environmental Planning Statement

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, Chantal Cassar, who carried out the Cultural Heritage Baseline Study for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such study was solely carried out by me on behalf of Adi Associates Environmental Consultants Ltd.

1st August 2016

Date

Signature

ASSOCIATES

TN 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD, AT ĦAS-SAPTAN, OFF VJAL L-AVJAZZJONI, ĦAS-SAPTAN, GĦAXAQ

CULTURAL HERITAGE BASELINE REPORT

Version 1: June 2016

ASSOCIATES

Report Reference:

Adi Associates Environmental Consultants Ltd, 2016. Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, at Ħas-Saptan, off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq (TN 160087). Cultural Heritage Baseline Report. San Gwann, June 2016; iv + 19pp.

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Quality Assurance

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, at Ħas-Saptan, off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq (TN 160087)
Environmental Planning Statement
June 2016

Report for: **Enemed Co Ltd**

Revision Schedule

Rev	Date	Details	Written by:	Checked by:	Approved by:
0.0	June 2016	Submission to client	**Chantal Cassar** Lead Archaeologist	**Rachel Xuereb** Director	**Adrian Mallia** Managing Director

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Environmental Management System MCCAA MSA EN ISO 14001:2004 Reg. No. E002

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CONTENTS

FIGURES

TABLES

APPENDIX

1. INTRODUCTION

1.1. This Cultural Heritage Baseline Survey was carried out as part of the Environmental Planning Statement (EPS) that was commissioned by Enemed Co. Ltd, a Government-owned company that has taken over the operations of Enemalta's former Petroleum Division. Enemed Co. Ltd is one of the major suppliers of fuel to the Maltese market. Enemed Co Ltd is hereinafter referred to as 'the Applicant'.

1.2. The Applicant intends to relocate the fuel dispensing station currently located at the 31st March 1979 fuel installation at Birżebbuġa to a site at Ħas-Saptan l/o Ħal Għaxaq (**Error! Reference source not found.**), which covers an area of approximately 6,600 m^2. The proposal is for the construction of a fuel dispensing station for refuelling of road tankers. Hereafter in this EPS, the development is referred to as 'the Scheme'.

1.3. This Study considers the cultural heritage baseline at the Scheme site and its surroundings.

1.4. The terms of reference (ToR) provided by ERA in respect of cultural heritage prescribed the following:

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).

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

- Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;
- National legislation, policies and plans (e.g. Structure Plan; National Environment Policy);

and

- Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

3.6 Architectural, Archaeological, Historical and Cultural Heritage and related Material Assets
Refer to Appendix 2

5.0 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 EPS. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], 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 ERA'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 be not 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.

5.5 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 ERA (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 2: TERMS OF REFERENCE FOR A CULTURAL HERITAGE ASSESSMENT (AS PROVIDED BY THE SUPERINTENDENCE OF CULTURAL HERITAGE, AS REVISED IN OCTOBER 2013)

1.0 Preamble

The proposed project would involve development over an extensive area and may lead to intensification of activity over a larger area. Potential impacts may occur within the footprint of the project, in the immediate environs, and along access routes to the site. Potential impacts may include direct and immediate material impacts, as well as subsequent impacts that might arise from the modification of the existing situation.

2.0 Scope and Definitions of the EIA

For the purposes of this document, cultural heritage is defined by Article 2 of the Cultural Heritage Act (2002). This includes movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance.

2.1 The study area shall include the total footprint of the proposed development.

2.2 In the context of this particular application, cultural heritage considerations may include:
- Features of archaeological value and potential;
- Military or civil architecture from the Knights period to British period;
- Vernacular structures; and
- Field systems and agricultural features such as irrigation systems.

The above cultural heritage definitions and considerations are not to be considered as exhaustive. The EIA must consider all other forms of cultural heritage, both known and unknown.

2.3 The Environmental Impact assessment will:
- Describe the Cultural Heritage assets within the study area;
- Analyse the cultural heritage features within the context of the cultural landscape;
- Assess the physical, spatial and visual impacts of the proposed development on the cultural heritage assets; and
- Propose corrective measures for the protection of the cultural resources.

3.0 Methodology

In quantifying the cultural heritage assets within the study area, and assessing the impacts of the proposed development, the EIA will undertake:
- Description and assessment of the property;
- Desktop and archival research limited to the study area;
- Fieldwork and research, including "field walking", topographic survey and remote sensing as may be necessary within the site. All fieldwork has to be authorised by the Superintendence of Cultural Heritage as defined below under point 4;
- Consultations with any relevant bodies, including the Superintendence of Cultural Heritage, Heritage Malta, the University of Malta, NGOs and Local Councils;
- Compilation of an inventory of the cultural heritage assets identified within the study area. The features of cultural heritage are to be described and plotted with grid references, on Data Capture Sheets, the design of which should be approved in advance by the Superintendence of Cultural Heritage. The Data Capture Sheets will be presented as an appendix to the EPS. The analysis of the features will be included in the main report; and
- A cultural heritage Risk Assessment Map examining the various impacts of the proposed project is to be included in the EIA.

4.0 Authorisation by the Superintendence of Cultural Heritage

As per Cultural Heritage Act 2002, any form of investigation or prospection required for the identification of cultural heritage (including excavation, field walking, topographic survey and remote sensing) may only be undertaken by the Superintendence of Cultural Heritage or with its written approval.

ERA PTOTECTIVE INVENTORY OF THE MALTESE CULTURAL HERITAGE HERITAGE DATA CAPTURE SHEET				Ref. No.
Location	Category	Type	Site Location (Address)	
Eastings	Northings	Feature	Period - Year	
S.S. No. 1 S.S. No. 3	S.S. No. 2 S.S. No. 4	Description		
Date				
Negative No.	Film No.			
Present Utilization				
Existing Legal Protection		GN. Number	GN. Date	
Comments				

Buffer Zone	A	B	C	D	E	Others
Eastings						
Northings						

Site Map
Scale 1 : 2500

Archaeological Characteristics – Sketch/Scaled drawings:	
Condition:	Degree of Protection (Structure Plan policies UCO7 or ARC 2):
State of Security:	Proposed Utilization:
Basic Bibliography:	
Compiled by: Checked by: Date:	Revised by: Checked by: Date:

Figure 1: Scheme Site

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ASSESSMENT METHODOLOGY

Objectives of the Assessment

1.5. The objectives of the cultural heritage baseline were to:

- Identify, document, and present information on the known archaeological and cultural heritage features within the AoI;
- Identify the potential for additional archaeological remains within the AoI, from desk study research and through field survey; and
- Assess the cultural heritage significance of the AoI.

Standards and Policy Guidance

1.6. Guidance on and planning policy relating to the protection of archaeology and cultural heritage is provided by the *Cultural Heritage Act 2002*, Legal Notice 160 of 1997 (the *Rubble Walls and Rural Structures Regulations,* S.L.552.01), the *Structure Plan for the Maltese Islands 1990*, and, in relation to the Scheme Site, the *South Malta Local Plan 2006*.

Cultural Heritage Act

1.7. 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). It also includes "*archaeological, palaeontological or geological sites and deposits, landscapes, groups of buildings…which have an historical value*". In section 3, the Act 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,..., 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*".

1.8. Furthermore, "*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 sub-article (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).

1.9. The restrictions on archaeological excavations are 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*". Details on the rights and obligations for all parties in the eventuality of an archaeological discovery are described in Sections 43(3), 43(4), 43(5), 43(6), and 43(7) of the Act.

Rubble Walls and Rural Structures (Conservation and Maintenance) Regulations

1.10. Legal Notice 160 of 1997 (S.L.552.01) protects all rubble walls and non-habitable rural structures in view of their historical and architectural importance, their exceptional beauty, their affording a habitat for flora and fauna, and their vital importance in the conservation of the soil and water. Walls may be sensitively repaired without the competent authority's prior authorisation. Certain areas may also be declared to be Rubble Wall Conservation areas in which no alterations to the location or construction of rubble walls and the traditional methods of their repair and maintenance will be permitted without the written approval of the competent authority. In such Conservation areas, the Minister for the Environment may order the owner or occupier to repair and re-erect all the rubble walls within the area, and to continue to maintain them. The dismantling of such walls requires a permit from the competent authority.

Structure Plan policies

1.11. The Structure Plan[1] contains policies relating to the classification of archaeological features. The classification system is outlined in Policy **ARC 2** and Policy **ARC 3**; Policy **ARC 6** and Policy **ARC 7** provide further guidance on the classification system.

1.12. Policy **ARC 2** provides for a four-tier classification system, with Class A representing the most important sites / features, where development that is considered would adversely affect the natural setting of the site / feature will not be allowed. The policy prescribes a development-free buffer zone of at least 100 m around the periphery of a Class A site / feature. Class B sites / features are regarded as very important, to be preserved at all costs, where adequate measures must be taken to preclude any damage from immediate development. In the case of Class C sites / features, every effort must be made for preservation, but these features may be covered up after proper investigation, documentation and cataloguing, with provision for subsequent access being provided. Class D features are those of which there are numerous examples; these features may be covered up or destroyed after recording.

1.13. Permissible effects of development on archaeological remains are addressed in Policy **ARC 3**: "… *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,*

[1] Although the Structure Plan has been superseded by the Strategic Plan for Development and the Environment (SPED), the latter does not provide guidance on the classification of archaeological features. For this reason, reference will be made to the Structure Plan.

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".

1.14. As provided by Policy **ARC 7**, any catalogued archaeological feature may be included in the National Protective Inventory (NPI), for which protection is provided by means of Policy **ARC 6**.

1.15. The Structure Plan is weak on the protection of individual archaeological artefacts; the principal thrust of the Structure Plan is to protect sites, buildings and monuments. Artefacts are afforded better protection under the *Cultural Heritage Act*.

1.16. The relevant policies of the *South Malta Local Plan 2006* are described in detail in **Chapter 4** of the EPS.

Policy Importance of Archaeological Features

1.17. The classification of archaeological features according to their policy importance is guided by legislation, including the *Cultural Heritage Act 2002*, the *Environment Protection Act 2016*, the Structure Plan policies, and Government and / or Legal Notices regarding specific archaeological and cultural heritage features. Each of these assigns its own degree of importance and remedies. In applying these to the EIA process three categories are used:

- Features of International Importance (major importance);
- Features of National Importance (major importance); and
- Features of Local Importance (minor importance).

1.18. **Table 11** summarises the cultural significance of different features.

Table 1: Protection ratings and cultural significance

Cultural Significance	Class	Grade	Protection
Major	A	1	Conserve plus 100 m buffer zone
National Importance			
Medium	B	2	Conserve
Local Importance			
Minor	C	3	Record
			May be covered
None	D	-	May be covered, destroyed, or recycled
Uncertain	E	-	Further investigation is required

1.19. The laws, policies, classification systems, etc., pertaining to the conservation of buildings or other structures have been assigned to these categories of policy importance as follows:

Features of International Importance

1.20. Cultural features of international importance are those:

- Protected specifically by legislation;
- Qualifying as Class A features under Structure Plan Policy **ARC 2**; or
- Similarly identified by the Minister responsible for cultural heritage or the Superintendence of Cultural Heritage.

Features of National Importance

1.21. Features of international importance would also be of national importance. Additionally, cultural features of national importance are those:

- Qualifying as Class B features under Structure Plan Policy **ARC 2**; or
- Similarly identified by the Minister responsible for cultural heritage or the Superintendence of Cultural Heritage.

Features of Local Importance

1.22. Cultural features of local importance are those:

- Qualifying as Class C or Class D features under Structure Plan Policy **ARC 2**; or
- Similarly identified by the Minister responsible for cultural heritage or the Superintendence of Cultural Heritage.

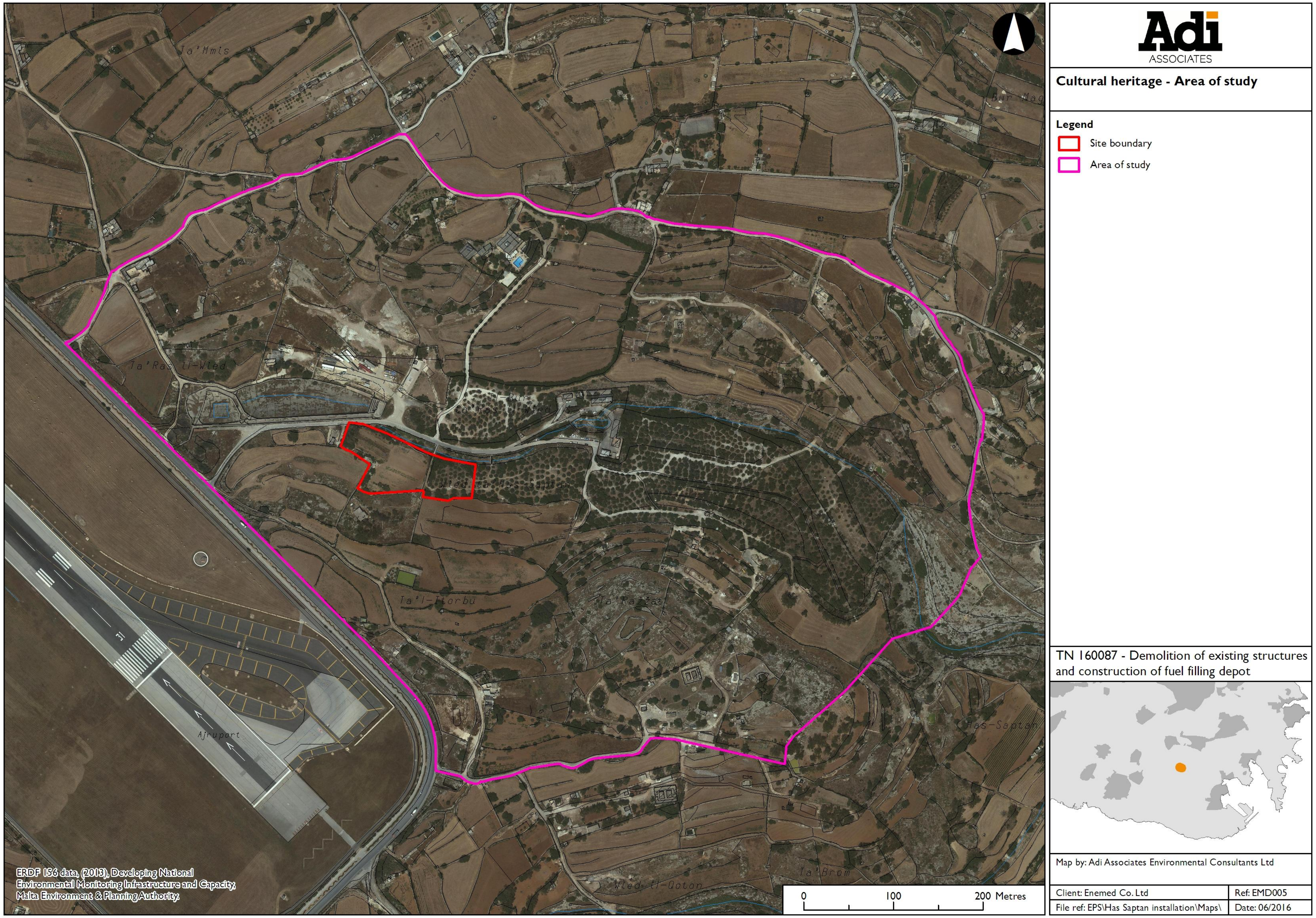
Remaining Features

1.23. All catalogued cultural heritage features may be included in the NPI, and those not already protected are afforded protection under Structure Plan Policy **ARC 6**, which provides that all sites / features listed in the NPI will be protected in accordance with the Environment and Development Planning Act (now the Environment Protection Act and the Development Act) powers and by reference to the classification ratings outlined in Structure Plan Policy **ARC 2**.

Area of Influence

1.24. The Area of Influence (AoI) for the cultural heritage study is illustrated in **Figure 2**.

Figure 2: Area of Influence for Cultural Heritage Study



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Competence of Surveyors

1.25. The cultural heritage study was undertaken by archaeologist Chantal Cassar; the impact assessment was coordinated by Adi Associates, in consultation with the archaeologist.

Methodology

1.26. The methodology for the cultural heritage assessment involved:

- A baseline survey of the cultural heritage assets (artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological assets) and an evaluation of their importance;
- An assessment of the impact of the construction and operation of the Scheme on the cultural heritage assets and an evaluation of the significance of these effects;
- Input to the design and operational plan for the Scheme to minimise potential adverse impacts on the cultural heritage assets; and
- A description of mitigation measures designed to minimise adverse impacts on cultural heritage.

Literature Search

1.27. The literature search included primary and secondary sources: a study of toponomy, analysis of cartographic and photographic material; analysis of primary and secondary written sources; and analysis of conservation legislation.

Mapping

1.28. The archaeological, rural, vernacular, historical, and cultural heritage features within the AoI were mapped primarily by means of a field survey but also through consultation of documentary sources and place-name evidence. The fieldwork took the form of a site-surface survey (field-walking); no aerial reconnaissance or sub-surface survey, including excavations, was carried out. The fieldwork was carried out on 18th June 2015.

Cataloguing

1.29. The relevant information for each feature was recorded on cards and using digital media, in the format currently used by ERA. Each feature was individually identified using a consecutive numbered reference; the information for each feature includes:

- A short written description of the feature;
- Co-ordinates recorded up to 5 digits for each Eastings and Northings, based on the local UTM grid reference;
- Locality and address;
- Site map (scale 1:2500);

- Colour photograph(s);
- Sketch of the feature showing the most significant details (wherever possible);
- Conservation importance of the site / feature (proposed grading in accordance with Structure Plan policies);
- Existing and / or proposed legislative and physical protection;
- Current and proposed use / enhancement;
- References; and
- Name of surveyors and date of compilation.

Evaluation

1.30. An archaeological assessment and significance of the archaeological, rural, vernacular, historical, and cultural heritage features was undertaken from the desk-top and field study. The conservation importance of the identified sites / features has been identified with reference to relevant legislation standards, guidance and practices and described above.

BASELINE SURVEY RESULTS

Cultural Heritage Features

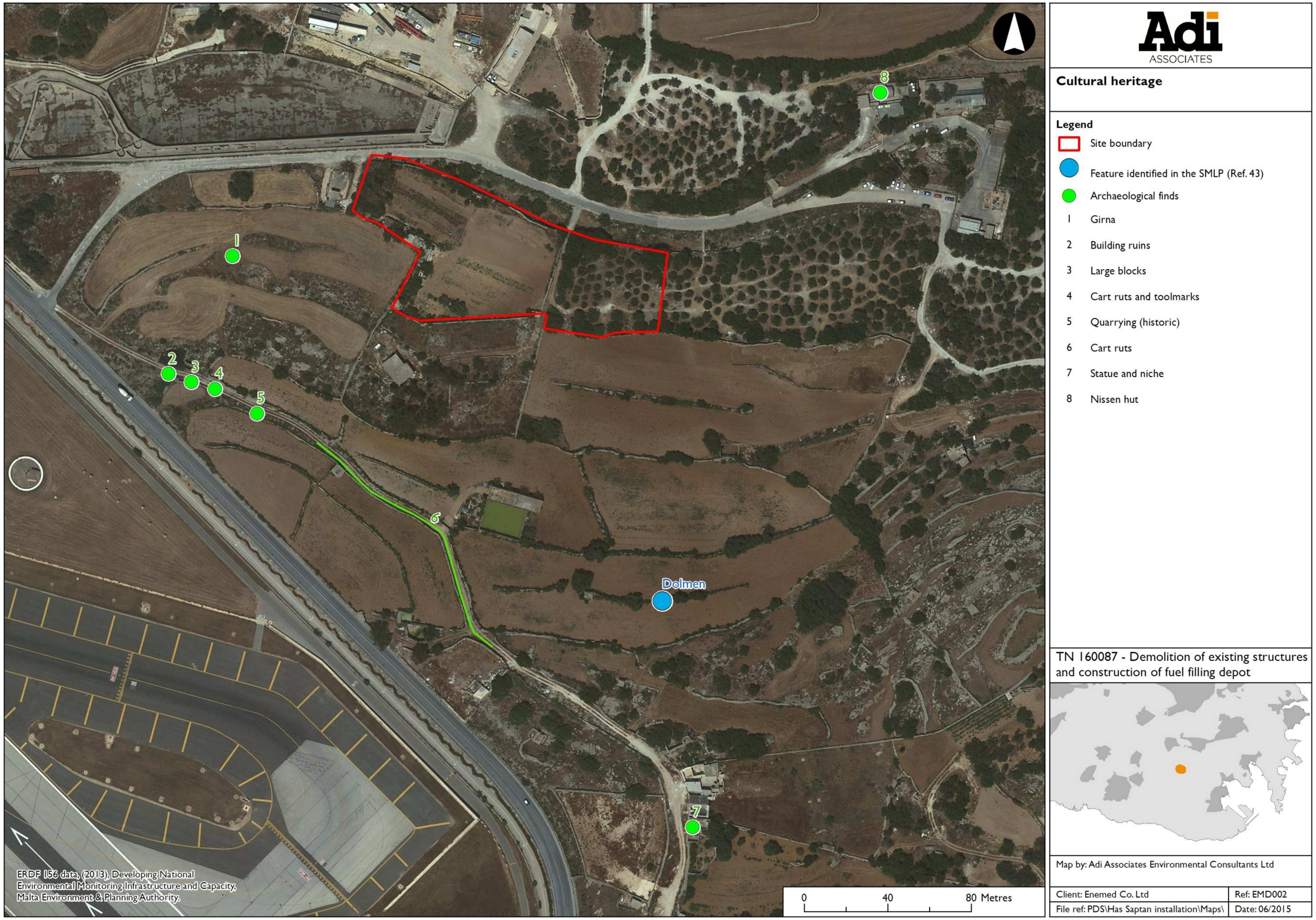
1.31. The Scheme site is located in an area known for agricultural and funerary archaeological discoveries.

1.32. Part of the Scheme site lies in an area designated as an Archaeologically Sensitive Area, as the site overlaps with the buffer area for a Class B dolmen (plotted in **Figure**). Appendix C of the South Malta Local Plan (SMLP) indicates that the dolmen was built into a wall which enclosed a field on high ground to the west of Id-Dawwara.

1.33. **Figure 3** shows the location of vernacular cultural features within the AoI. A detailed description of each of the cultural heritage features is given in **Appendix 1.** Notably, there are no scheduled cultural heritage sites or features located within the Scheme site or in its immediate vicinity.

1.34. Various previously undocumented archaeological artefacts were noted in the Area of Influence outside the Scheme site during the survey, particularly along a side road parallel with Triq Ħal Far (features 2 to 7 in **Figure** refer). The features identified during the survey and in the SMLP were also catalogued in the format currently used by ERA (**Appendix 1**); coordinates are provided in WGS84 UTM.

Figure 3: Cultural heritage features



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1.35. Along this road, cart ruts were noted with tool marks at their centre (**Figure**). These paired grooves, which are found widely across Malta and Gozo, are usually associated with quarrying; in fact a shallow quarry was also noted at the beginning of the side road where the cart ruts started. Cart ruts or tracks are "*grooves cut or worn into the rock [that] can be found practically anywhere bare rock is exposed*" (Trump 2004: 379).

Figure 4: Cart ruts

1.36. Large stone blocks were also noted in the rubble wall confining this road (**Figure**), which contrast with the rubble masonry with which most of the wall is built. These blocks can date back to the Knights period in Malta. Ruins of a possible farmhouse can be seen in the vicinity of this rubble wall (**Figure6**). The blocks in the rubble wall might have been reutilised from these nearby ruins.

Figure 5: Rubble wall with large stone blocks

Figure 6: Ruins

1.37. During the survey a statue depicting St Mary was identified on a rural building (**Figure 717**). The colour scheme used for this statue and the craftsmanship indicate that it probably dates to the medieval period in Malta. The size of the niche and its proportions in relation to the statue indicate that the niche is likely to be dated to a later period.

Figure 71: Medieval statue

1.38. A Maltese corbelled stone hut ('girna') was also noted west of the Scheme site. The existing Ħas-Saptan fuel storage facility also includes a Nissen hut.

1.39. Rubble walls were also noted at the Scheme site and in the surroundings. Some of the walls are built with traditionally sized rubble stones whilst others (including at the Scheme site) show frequent interventions with the introduction of larger sized blocks.

Appendix 1: Cultural Heritage Data Capture Sheets

ASSOCIATES

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

Technical Appendix 6

LANDSCAPE AND VISUAL ASSESSMENT REPORT

Prepared by Adi Associates Environmental Consultants Ltd

Supporting Documents for

Environmental Planning Statement

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, Krista Farrugia, who carried out the Landscape and Visual Assessment Study for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such study was solely carried out by me on behalf of Adi Associates Environmental Consultants Ltd.

1st August 2016

Date

Farrugia

Signature

ADI ASSOCIATES

TN 160087

DEMOLITION OF EXISTING STRUCTURES AND CONSTRUCTION OF FUEL FILLING DEPOT INCLUDING ANCILLARY OFFICES, FACILITIES AND WIDENING OF ACCESS ROAD

ĦAS-SAPTAN L/O ĦAL GĦAXAQ

LANDSCAPE AND VISUAL AMENITY ASSESSMENT

Version 2: August 2016

Report Reference:

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RESPECT THE ENVIRONMENT – KEEP IT DIGITAL

Quality Assurance

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, Ħas-Saptan l/o Ħal Għaxaq
Landscape and Visual Amenity Assessment
August 2016

Report for: **Enemed Co Ltd**

Revision Schedule

Rev	Date	Details	Written by:	Checked by:	Approved by:
00	Jul 2015	Submission to Client	**Krista Farrugia** Senior Environmental Consultant	**Rachel Xuereb** Director	**Adrian Mallia** Managing Director
	Aug 2016	Submission to ERA	Krista Farrugia Senior Environmental Consultants	**Rachel Xuereb** Director	**Adrian Mallia** Managing Director

File ref: Document1

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APPENDIX

1. INTRODUCTION

1.1. The project is proposed by Enemed Co. Ltd, which has taken over the operations of Enemalta's former Petroleum Division. Enemed Co. Ltd is the major supplier of fuel to the Maltese market, and is the only importer and distributor of gasoline (petrol) on the islands. Enemed Co. Ltd is hereinafter referred to as 'the Applicant'; the project is hereinafter referred to as 'the Scheme'.

1.2. As described in the Project Description Statement (PDS) [1], the Scheme constitutes a proposal for the construction of a fuel filling depot for refuelling of road tankers. The site, at Ħas-Saptan l/o Ħal-Għaxaq (**Figure 1.1**), covers an area of approximately 6,600 m^2 and is currently largely composed of an agricultural field and an olive-carob afforested area. The Applicant intends to relocate the fuel depot at the 31st March 1979 fuel installation at Birżebbuġa to the Scheme site.

1.3. This report addresses the potential impacts of the Scheme on landscape and visual amenity. It describes the existing landscape and visual amenity of the Application Site and its surroundings, and assesses how this might change through the development of the Scheme.

1.4. 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.

1.5. 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.

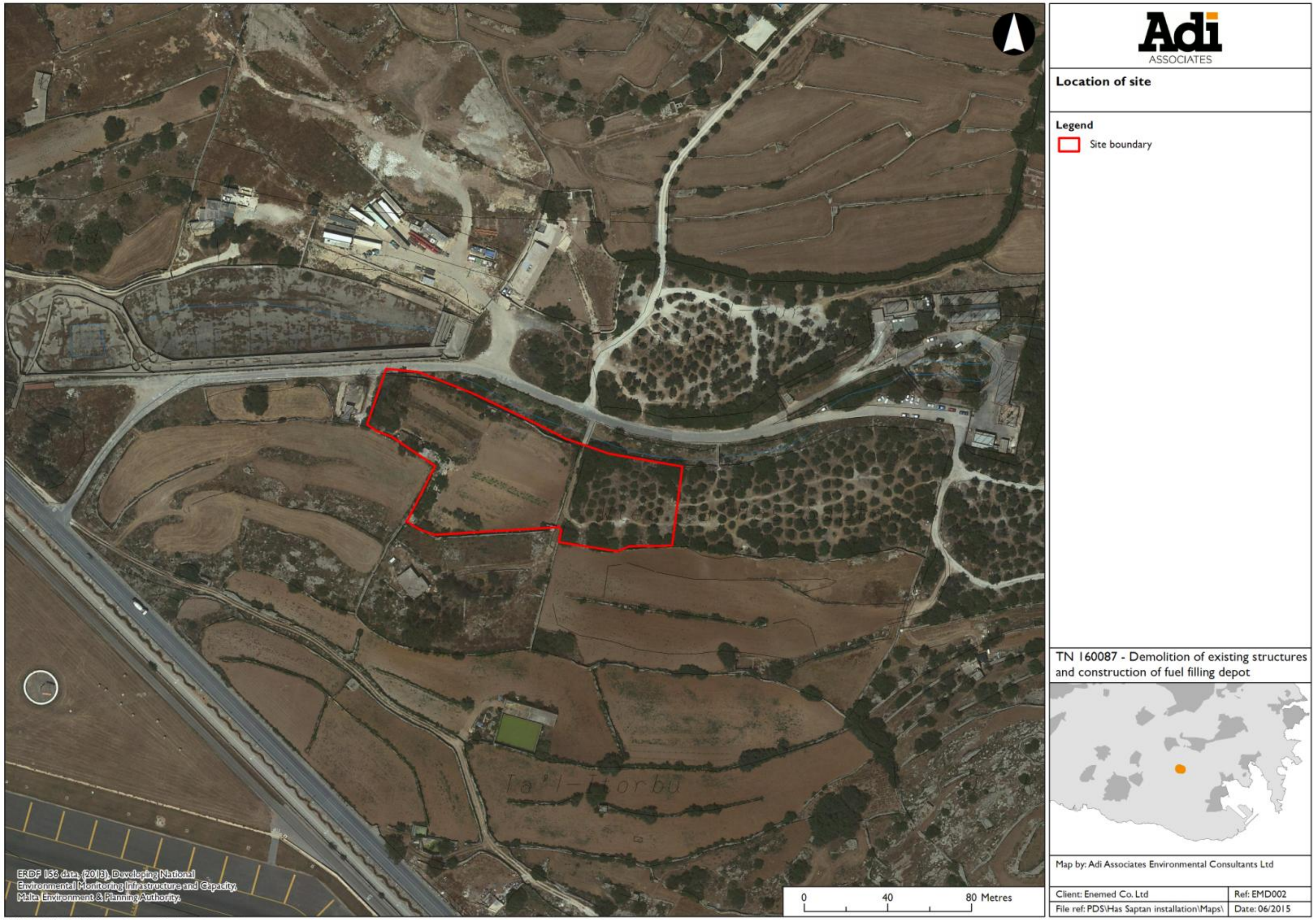
1.6. The key issues for the assessment are:

Key Issues:

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

[1] Adi Associates Environmental Consultants Ltd, 2015. Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road. Project Description Statement prepared in support of TN 160087.

Figure 1.1: Scheme site location



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OBJECTIVES OF THE ASSESSMENT

1.7. 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)[2] for the Scheme and identify the key viewpoints and receptors;
- Input 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

1.8. 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.

South Malta Local Plan

1.9. The South Malta Local Plan (SMLP) 2006 is relevant to the Scheme. The Scheme site is located on the outskirts of Ħal-Għaxaq. **Figure 1.2** presents the Environmental Constraints Map for Għaxaq, which illustrates that the site lies within an Area of High Landscape Value as determined through policy **SMCO 06** stating:

> *MEPA designates the areas identified on the respective Policy Maps as Areas of High Landscape Value (AHLV) as per Section 46 of the Development Planning Act, 1992 and Structure Plan policy RCO 3. There shall be a strong presumption against the creation of new built structures (including cultivation and animal husbandry related structures) in AHLVs. The guidance provided in the Explanatory Memorandum to the Structure Plan clauses 15.34 to 15.40 shall also*

[2] In accordance with the Guidelines for Landscape and Visual Impact Assessment (Third Edition) (2013), the term Zone of Theoretical Visibility (ZTV) is being used in place of the term Zone of Visual Influence (ZVI) since it makes clear that the area thus defined shows land from which the proposal may theoretically be visible and does not take account of potential screening by vegetation and buildings.

apply. MEPA will ensure that any developments falling within such areas will not result in the creation of light pollution.

MEPA will favour proposals for compatible and sensitive positive interventions and activities (particularly informal recreational activities in the form of walking or cycling footpaths as well as educational initiatives) intended to upgrade and rehabilitate Areas of High Landscape Value. In sites which have been degraded by development activities, a rehabilitation and monitoring program needs to be established by the developer and agreed with MEPA to ensure that the proposed interventions are in line with other policies related to conservation as well as protection and management of the natural and cultural resources. The priority areas in this respect are:

i. Wied tal-Baqqiegha (Zebbug) and Wied Hesri (Siggiewi);

ii. The slopes flanking Wied ta' Kandja (Siggiewi);

iii. Wied Qirda (Zebbug/Siggiewi);

iv. Ghar Hanzir and Wied Sillani (Siggiewi);

v. Wied il-Kbir (Siggiewi/Luqa);

vi. Wied ta' Has Saptan (Ghaxaq);

vii. Wied ta' Hal Saflieni (Luqa);

viii. Wied il-Qoton (Ghaxaq);

ix. The rocky steppe at ta' Haxum (Ghaxaq);

x. The promontory of Ghassa tal-Munxar (Marsaskala);

xi. The afforested sites along Is-Swar tal-Kottonera (Zabbar, Fgura); and

xii. Between Zonqor Point (Marsaskala) and Blata l-Bajda (Xghajra).

Landscape Assessment Study of the Maltese Islands

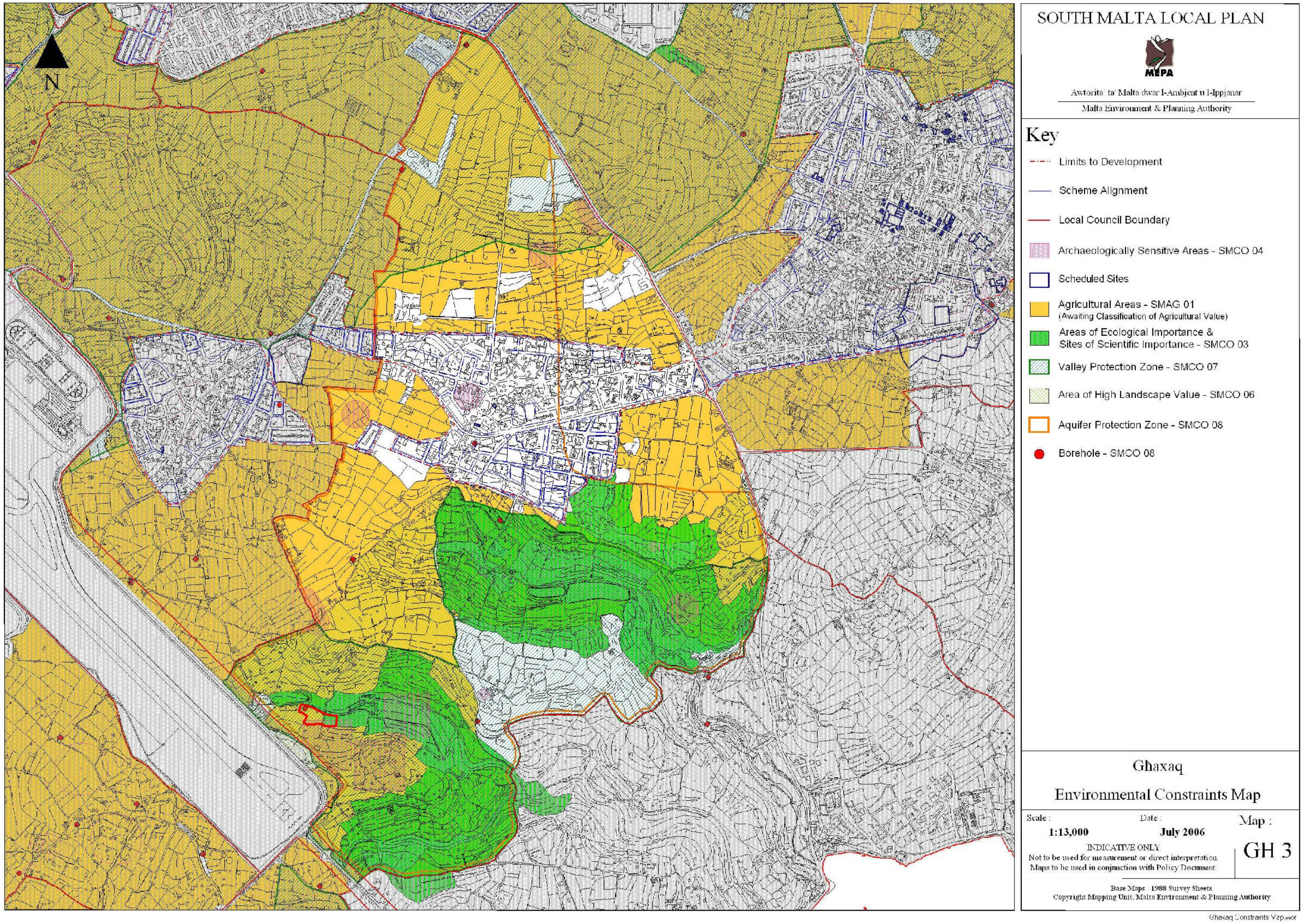
1.10. MEPA's Landscape Assessment Study of the Maltese Islands was undertaken in 2004 as part of the Structure Plan Review. The Study does not provide an assessment methodology to use in order to consider the impacts of a specific development; it does, however, provide a useful baseline assessment of the prevailing landscape character of the Maltese Islands. The primary purpose of the Study appears to have been as a topic paper to identify Areas of High Landscape Sensitivity and inform the Structure Plan Review.

1.11. The Study identifies the Application Site as lying within the Marsaxlokk Bay Basin Landscape Character Area.

STANDARDS AND GUIDELINES

1.12. In view of the fact that there are no Malta-specific landscape and visual amenity assessment guidelines, the landscape and visual assessment was 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). The photomontages were carried out in accordance with MEPA's (2015) *Best Practice Guide – Visual Simulations*.

Figure 1.2: Ghaxaq Environmental Constraints Map (from the South Malta Local Plan), including Scheme site boundary



2. ASSESSMENT METHODOLOGY

DESK STUDY METHODOLOGY

Landscape assessment

2.1. 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 and reference to geological and land use aspects described in the PDS;
- 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

2.2. 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.

2.3. 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.

2.4. 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 2.1**.

Table 2.1: Landscape character sensitivity

Landscape Character Sensitivity (directly affected areas)		
High	**Medium**	**Low**
A landscape character area / local landscape tract in which defining characteristics are susceptible to change	A landscape character area / local landscape tract in which some defining characteristics may be susceptible to change	A landscape character area / local landscape tract in which defining characteristics are less susceptible to change
Landscape Character Sensitivity (indirectly affected areas)		
High	**Medium**	**Low**
A landscape character area / local landscape tract in which defining characteristics are susceptible to change	A landscape character area / local landscape tract in which some defining characteristics may be susceptible to change	A landscape character area / local landscape tract in which defining characteristics are less susceptible to change

Magnitude of change to landscape resource

2.5. 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 2.2** presents criteria for magnitude of change to a landscape resource.

Table 2.2: Magnitude of change to landscape resource

High	Medium	Low	Imperceptible change
An obvious change in landscape characteristics and character	Discernible changes to landscape characteristics and character	Small changes to landscape characteristics and character	A largely imperceptible change to landscape characteristics and character

Visual amenity assessment

2.6. 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 3 representative viewpoints. The viewpoints were selected on the basis of the view from where the Scheme would be expected to be depicted on the ground following ground-truthing, and ensuring that these are public viewpoints. The existing views from these locations were photographed, photomontages created, and the visual amenity and changes thereto as a result of the Scheme appraised.

2.7. The viewpoints include 2 short distance views and one medium distance view. These views are from publicly accessible locations identified within the ZTV as shown in **Figure 2.1**.

Sensitivity of visual receptors

2.8. 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.

2.9. 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.

2.10. 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.

2.11. 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 landscape and visual amenity 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 assessment does not address the effects of loss of view from private properties, land ownership, etc.

Magnitude of visual change

2.12. 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 2.3** defines magnitude of visual change.

Table 2.3: Magnitude of visual change

High	Medium	Low	Imperceptible Change
A substantial change in view affecting a large number of viewers	A moderate change in view affecting many/some viewers	A smaller change in view affecting a low number of viewers	A small, barely perceptible or no change in view.

Field survey methodology: landscape

2.13. A comprehensive field survey was undertaken in July 2015, 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.

2.14. **Table 2.4** describes the identified landscape receptors.

Table 2.4 Landscape Receptors

Landscape elements	Broad plain: Dominated by the Malta International Airport (MIA) and runways, providing an open feel and long distance views out of the area to include views of the sea at Birżebbuġa and visibility of the cranes at the Freeport. Apart from the airport and associated structures, such as the hangars, the plain supports a rural environment dominated by dry farmland and interspersed with settlements. Parish churches present focal points on the skyline throughout the plain; a number of countryside chapels are also noted. Areas dominated by quarries are also located on the plain, and are mainly noticeable from short-distance views.
	Valleys: The valleys to the east of the airport, leading to Birżebbuġa, including Wied il-Qoton and Wied Has-Saptan, are associated with agricultural land; the valley sides are relatively steep in areas.
Landscape characteristics	The MIA is located in the middle of the plain and allows a number of long distance views out of the area. In addition to the airport, the plain is largely made up of dry farmland, traditional village settlements, and quarries.
	The valley systems leading to Birżebbuġa, in the vicinity of the MIA, present a relatively rural scene and a green environment with little negative effects from dumping.
Landscape character	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 3.1**.

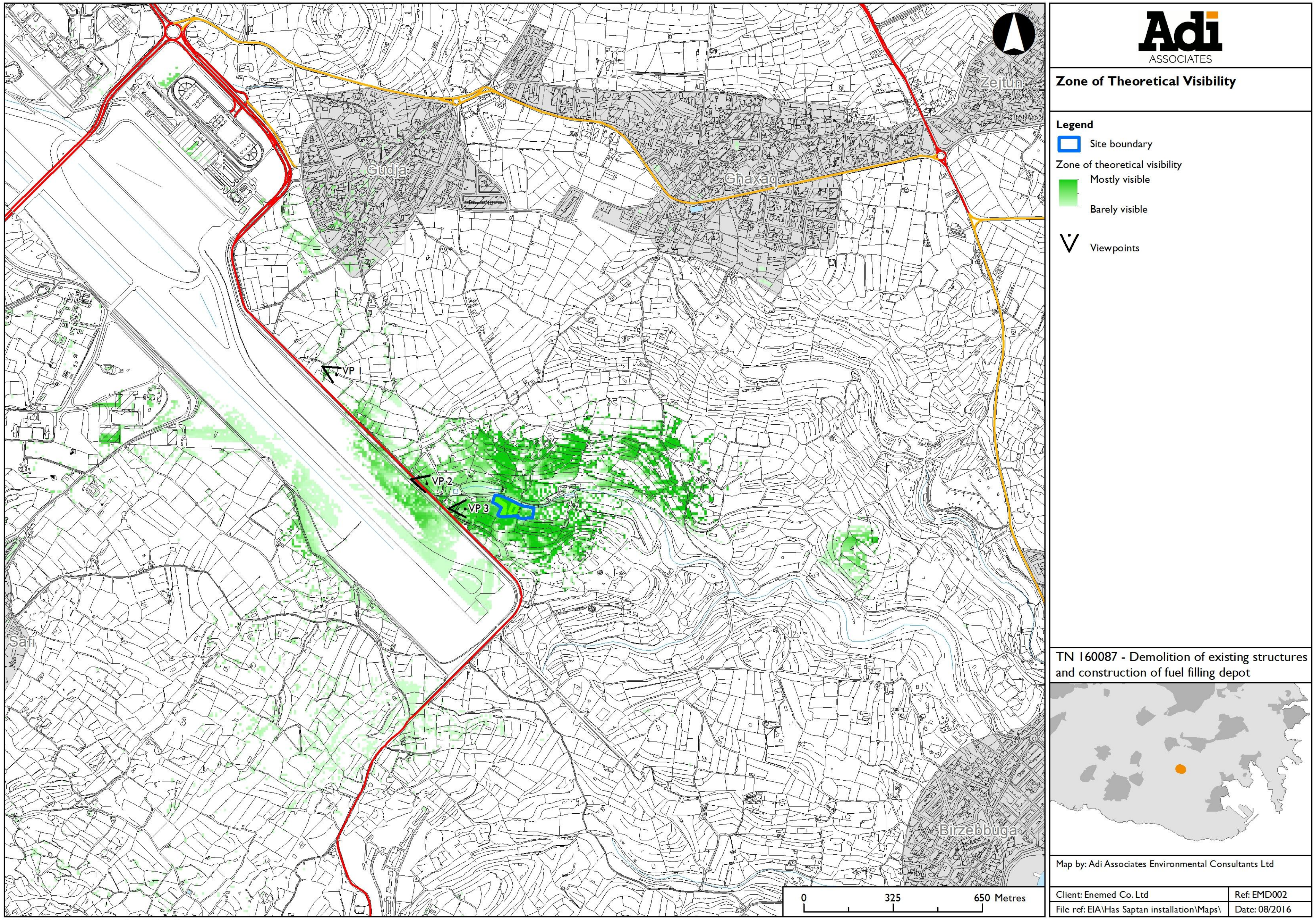
Field survey methodology: visual amenity

2.15. 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.

2.16. 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;
- Visitors viewing the area from a medium distance viewpoint;
- Road users (vehicle occupants and pedestrians); and
- Workers.

Figure 2.1: Zone of Theoretical Visibility and selected viewpoints



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DETERMINING IMPACT SIGNIFICANCE

2.17. 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

2.18. The significance of landscape impacts has been defined based on the sensitivity and magnitude criteria as described in **Table 2.1** and **Table 2.2**, 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 would 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 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

2.19. 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.

2.20. 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.

2.21. **Table 2.5** identifies impact significance in a tabular format. It should be noted that there is a gradual transition between categories and magnitude and sensitivity are not necessarily evenly weighted such that the final decision on significance comes down to a professional judgement. Impact significance is recorded as one of the four categories (not significant, minor, moderate, or major).

Table 2.5 Identification of Impact Significance

		Magnitude of change			
		Imperceptible	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Low**	Not significant	Not significant or Minor	Minor	Minor or moderate
	Medium	Not significant	Minor	Moderate	Moderate or major
	High	Not significant	Minor or moderate	Moderate or major	Major

3. EXISTING CONDITIONS

Landscape

3.1. The Scheme Site is situated northwest of the Malta International Airport, a dominant feature in the landscape (in particular, runways and taxiways) and along the access road to the existing Has-Saptan fuel storage facility. The site is located on a large plain. The landscape around the site is largely rural although other features such as residences sporadically occur.

3.2. The agricultural land in the area is relatively well maintained and a number of chapels are also present in the surrounding countryside. For instance, the Ta' Loreto chapel is located in an area surrounded mainly by fields (although it is located close to the arterial road leading to Ħal-Far). The fields in this area and associated rubble walls are well maintained and country lanes that receive little traffic lead to the valley and provide a pleasant sense of Maltese countryside despite the proximity to the airport. As the land gently slopes downwards, long-distance views to the east from this area allow a narrow view of the sea in the south of Malta (Marsaxlokk Bay); cranes from the Freeport at Birżebbuġa, and the Delimara power station chimney are also visible.

3.3. The afforested area dominates the landscape to the east of the site (part of which is included in the Scheme site boundary). The trees and their undergrowth become increasingly dense moving further into the depths of the afforested area, providing a sense of remoteness and naturalness. However, the existing fuel storage facility, north and east of the area is discernible in the immediate vicinity both visually and audibly.

3.4. A large reservoir is located to the north of the site and a storage facility is located adjacent to it, resulting in detraction from the otherwise largely rural setting.

Landscape Characterisation

3.5. 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 3.1**); 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 3.1** and described in **Table 3.1**).

Figure 3.1: Landscape Character Areas and Local Landscape Tracts

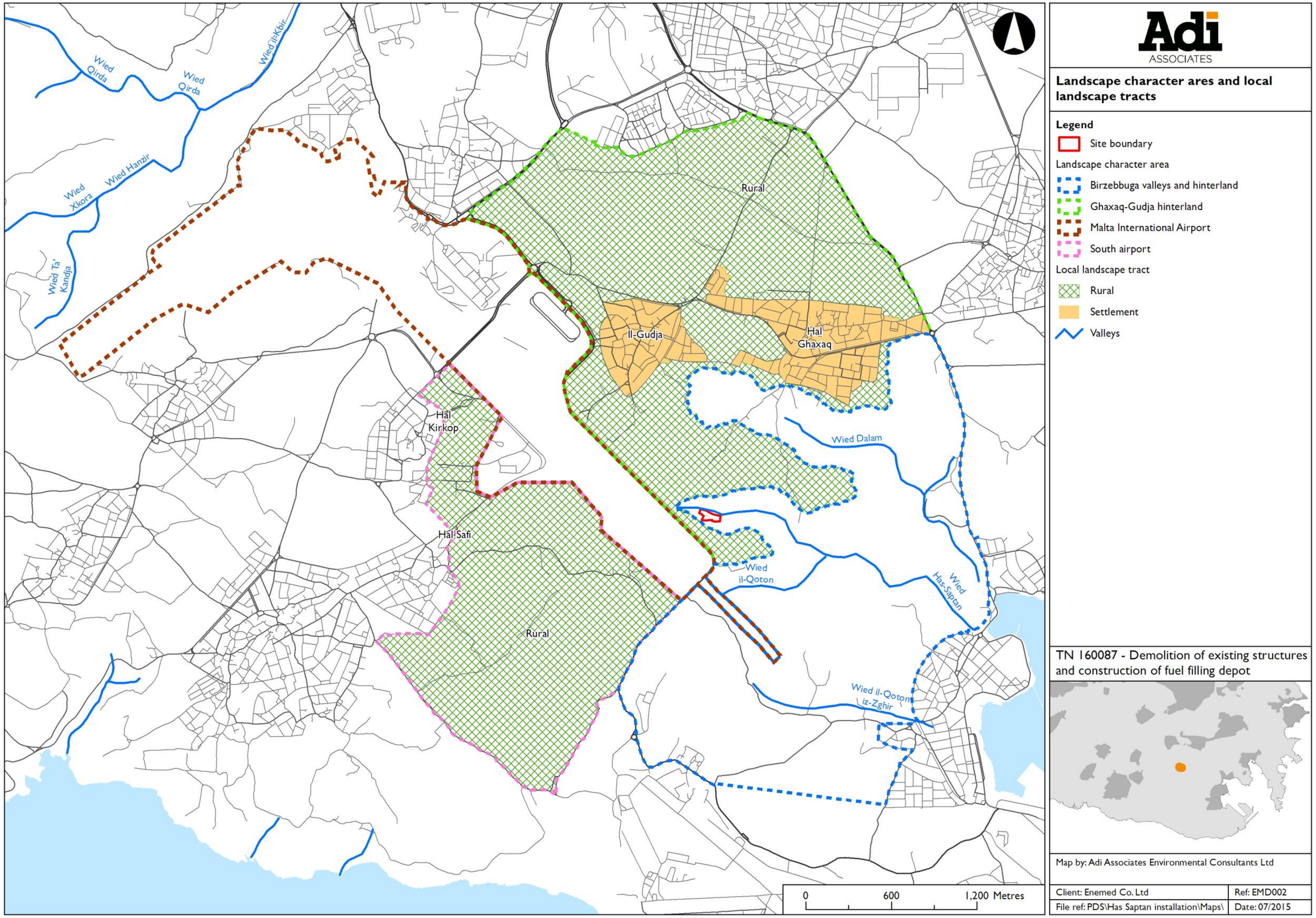

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Table 3.1: Landscape Character Types and Landscape Character Areas

Defined area / Attribute	**Summary Description**
Character Areas	
Malta International Airport	○ Includes the entire footprint of the MIA, which is largely taken up by the runways but also includes associated buildings of which aircraft hangars are dominant. Other structures include the old airport buildings. *Landscape Sensitivity* Moderate
South Airport Hinterland	○ Dry farming agricultural land ○ Cultural heritage features including chapels and rubble walls ○ Large carob trees *Landscape Sensitivity* ○ High
Għaxaq Gudja Hinterland	Also largely situated on the plain, Local Landscape Tracts in this area include: ○ The settlements of Għaxaq and Gudja ○ Agricultural land *Landscape Sensitivity* ○ Moderate
LLT: Settlements	○ Traditional villages, each of which include a parish church that breaks the skyline *Landscape Sensitivity* ○ Moderate
LLT: Agricultural land	○ Dry farming ○ Cultural heritage features including chapels and rubble walls ○ Large carob trees *Landscape Sensitivity* ○ High
Birżebbuġa Valleys & Hinterland	Valleys leading to Birżebbuġa dominate this character area and are designated AHLVs in accordance with the Local Plan, including Wied il-Qoton and Wied ta' Ħas-Saptan. Valley sides include terraced fields. Enemalta fuel storage tank facility located in Wied ta' Ħas-Saptan, in the vicinity of the Special Area of Conservation (SAC), Għar Dalam. *Landscape Sensitivity* High

Visual amenity: Zone of Theoretical Visibility

3.6. **Figure 2.1** 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, where applicable. The initial selected viewpoints are shown in **Figure 2.1**.

3.7. When preparing the photomontages, it was identified that the Scheme would not be visible from viewpoint 1. Therefore, the visual assessment was carried out on viewpoints 2 and 3.

Application Site visibility

3.8. 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 3.2** 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 Application Site is partially visible from the selected viewpoints.
- 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.
    - Part of the Scheme will be visible from the selected viewpoints, although it is more visible from VP3.
- 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.
    - The selected viewpoints are panoramic 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.
    - The selected viewpoints are sequential.

Table 3.2: Summary of Application Site visibility from viewpoints

	Viewpoint	**Viewpoint**
	VP2	**VP3**
Distance of viewpoint from Scheme (m)	285 m	140 m
Extent of Scheme visibility	Partial	Partial
Proportion of Scheme visible	40% (car passengers) 10% (drivers)	90%
Focus on Scheme due to proximity	Panorama	Panorama
Transient or sequential view	Sequential	Sequential

ASSOCIATES

4. CHANGES IN THE LANDSCAPE AND VISUAL AMENITY

4.1. 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

4.2. 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.

4.3. **Table 4.1** details the landscape assessment.

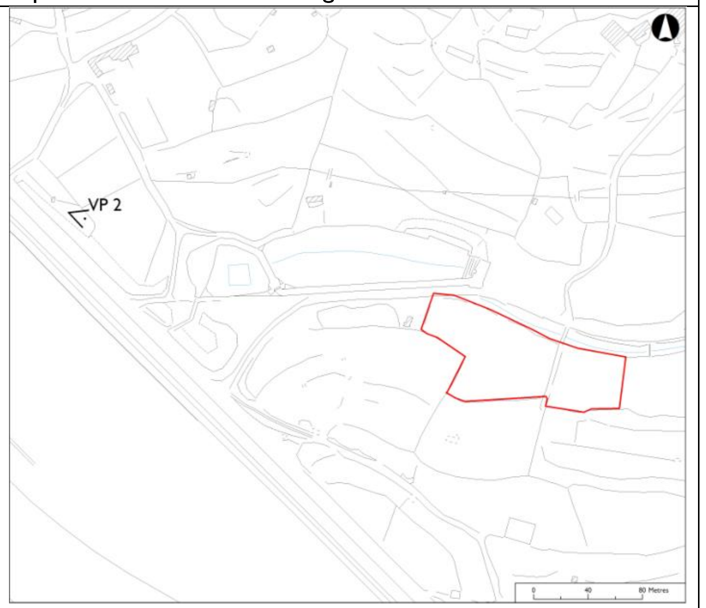
Table 4.1 Changes in landscape character and the significance of the impacts

Location	Changes	Effects & Significance
Malta International Airport Character Area	No changes.	No changes. ***Impact: Not significant***
South Airport Hinterland Character Area	No changes.	No changes. ***Impact: Not significant***
Għaxaq Gudja Hinterland Character Area LLT: Settlements	No changes.	No changes ***Impact: Not significant***
Għaxaq Gudja Hinterland Character Area LLT: Agricultural land	Although the Scheme footprint is not directly within this LCA, tanker movement will pass through this LCA (40 road tanker trips a day, or 5 an hour on average), as a result the road will be upgraded, and the general rural nature of the area will be affected to a high degree during operation.	High/large scale changes (including upgrading/widening of the road) in an area of high sensitivity and designated for its high landscape value. ***Impact: Major significance***
Birżebbuġa Valleys & Hinterland	The construction of a new building that includes the regular arrival of trucks for fuelling will result in a change to the rural and semi-natural character of the area. The magnitude of change is thus expected to be high.	High/large scale changes in an area of high sensitivity and designated for its high landscape value. ***Impact: Major significance***

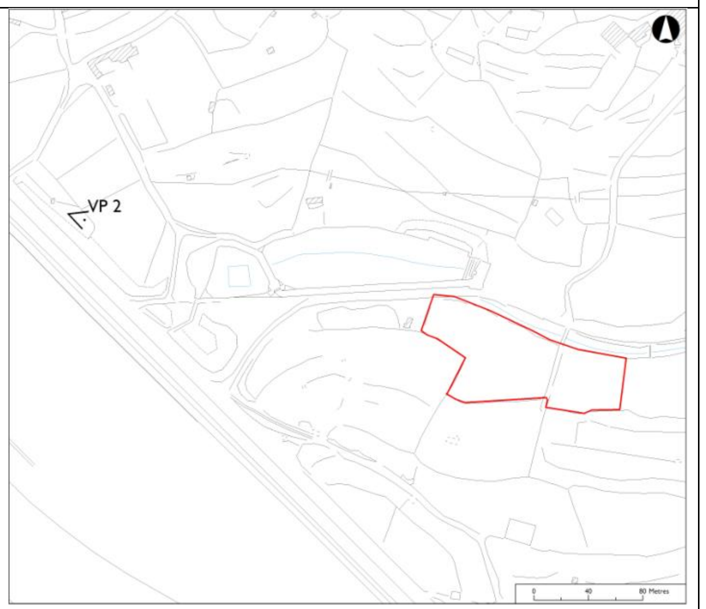
Changes in Visual Amenity and their Significance

1.47. Changes to the visual amenity were assessed from suitable viewpoints as described above and presented below. From viewpoint 2 (Vjal l-Avjazzjoni) two views are presented – that of the passenger and that of the car driver.

Viewpoint 2: Vjal l-Avjazzjoni, Luqa - – view for car passengers

Viewpoint 2	Date: 6th August 2016	 **VIEWPOINT REFERENCE 02** Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 07 EXISTING VIEW ; This image must be viewed at a comfortable arm's length
Location	Luqa	
Key features	The view is unobstructed by any large or dominant features allowing for a long-distance, wide pan rural view. Rural structures such as walls are part of the view. Moderate visual amenity, moderate intrinsic value.	
Sensitive receptors	Car passengers. Low to moderate numbers of low to moderate sensitive receptors. Low to moderate numbers of low to moderate sensitive receptors.	
Change to Visual Amenity	The Scheme is partly shielded by vegetation and does not break the skyline, resulting in a small to moderate change to the view.	
Impact	A small to moderate change to the overall view of moderate intrinsic value affecting a low to moderate number of low to moderate sensitive receptors. Impact: Minor to moderate significance.	 **VIEWPOINT REFERENCE 02** Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 08 PROPOSED VIEW; This image must be viewed at a comfortable arm's length
	 	

Viewpoint 2: Vjal l-Avjazzjoni, Luqa – view for drivers

Viewpoint 2	Date: 6th August 2016
Location	Luqa
Key features	The view is partly the road of view in front of the driver and partly the view to the side of the road that is mainly rural with shrubs and trees. Moderate visual amenity, moderate intrinsic value.
Sensitive receptors	Car drivers. Moderate numbers of low sensitive receptors. Moderate numbers of low sensitive receptors.
Change to Visual Amenity	The Scheme is only very partially visible to the side of the view, resulting in a very small change to the view.
Impact	A small change to the overall view of moderate intrinsic value affecting a moderate number of low sensitive receptors. Impact: Minor significance.
	

VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 07
EXISTING VIEW ; This image must be viewed at a comfortable arm's length

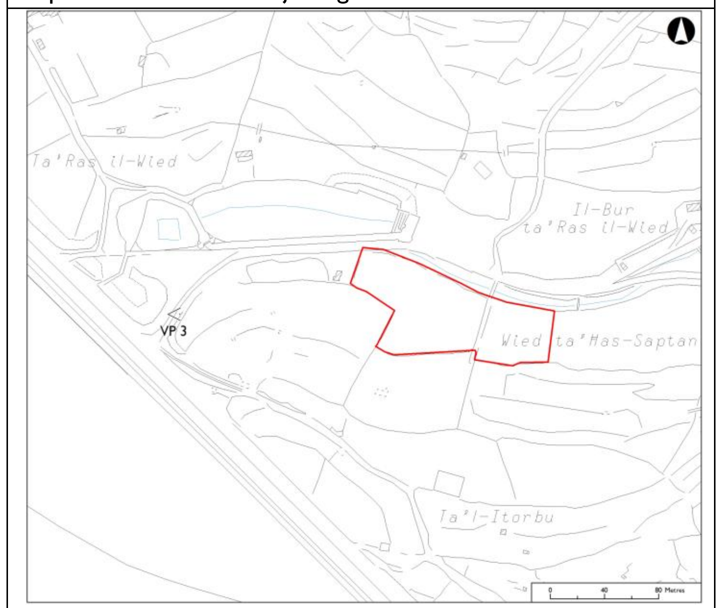
VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 08
PROPOSED VIEW ; This image must be viewed at a comfortable arm's length

Viewpoint 3: Lane off Vjal l-Avjazzjoni, Luqa

Viewpoint 2	Date: 6th August 2016
Location	Luqa
Key features	The view is unobstructed by any large or dominant features allowing for a long-distance, wide pan rural view. Rural structures such as low rubble walls are seen in the fore of the photograph whereas vegetation dominates the rest of the view. The power station is seen in the right hand corner of the view, in the distance. Moderate visual amenity, moderate intrinsic value.
Sensitive receptors	Pedestrians. Low numbers of high sensitive receptors. Low numbers of high sensitive receptors.
Change to Visual Amenity	The Scheme shields the vegetation and results in a large change to the view.
Impact	A large change to the overall view of moderate intrinsic value affecting a low number of high sensitive receptors. Impact: Moderate to major significance.

VIEWPOINT REFERENCE 03 Year 0 Distance to proposed development: 140m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1128 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 11
EXISTING VIEW ; This image must be viewed at a comfortable arm's length

VIEWPOINT REFERENCE 03 Year 0 Distance to proposed development: 140m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1128 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 12
PROPOSED VIEW; This image must be viewed at a comfortable arm's length



4.4. The impact of the Scheme on the visual amenity of the area portrayed in the above photographs and photomontages vary from minor to moderate / major. Significance is dependent on the scale of change to the landscape and visual amenity of the area, the intrinsic value of which was classified as moderate, and the sensitivity of receptors who will view the Scheme.

5. SUMMARY OF IMPACTS

5.1. **Table 5.1** summarises the impact assessment.

5.2. Major landscape impacts were identified on account of the landscape value of the site and the introduction of the proposed facility in an otherwise largely rural landscape. In addition to the Scheme building, the landscape assessment was also concerned with the amount of large vehicles going to and leaving the facility on a daily basis (Scheme operation), which will also have a significant effect on the landscape of the area.

5.3. Only two suitable viewpoints were identified where the Scheme is considered likely to result in an impact. The impact on visual amenity is minor to major, depending on the view point.

5.4. Residual impacts remain the same as the impacts identified in the impact assessment.

Table 5.1: Summary of Impacts on Landscape and Visual Amenity

Asset Impacted	Beneficial/ Adverse / Neutral	Nature, scale and type of impact						Policy Importance	Probability of impact occurring	Significance of impact	Proposed mitigation measures	Significance of residual impact
		Const'n / Oper'n	Extent of impact (Nat. / Local / Site)	Direct / Indirect	S-term / L-term	Perm / Temp	Revers / Irrevers	(Internat. / National / Local)	(Likely / Unlikely / Remote / Uncertain)	(Major / Minor / Not significant)		(Major / Minor / Not significant)
Landscape												
Malta International Airport Character Area	Neutral	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Not significant	None	Not significant
South Airport Hinterland Character Area	Neutral	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Not significant	None	Not significant
Għaxaq Gudja Hinterland Character Area LLT: Settlements	Neutral	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Not significant	None	Not significant
Għaxaq Gudja Hinterland Character Area LLT:	Adverse	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Major significance	None	Major significance

Asset Impacted	Beneficial/ Adverse / Neutral	Nature, scale and type of impact						Policy Importance	Probability of impact occurring	Significance of impact	Proposed mitigation measures	Significance of residual impact
		Const'n / Oper'n	Extent of impact (Nat. / Local / Site)	Direct / Indirect	S-term / L-term	Perm / Temp	Revers / Irrevers	(Internat. / National / Local)	(Likely / Unlikely / Remote / Uncertain)	(Major / Minor / Not significant)		(Major / Minor / Not significant)
Agricultural land												
Birżebbuġa Valleys & Hinterland	Adverse	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Major significance	None	Major significance
Visual Amenity												
Viewpoint 2 Vjal l-Avjazzjoni-car passengers	Adverse	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Minor to moderate significance	None	Minor to moderate significance
Viewpoint 2 Vjal l-Avjazzjoni – drivers	Adverse	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Minor Significance	None	Minor significance
Viewpoint 3 – Lane off Vjal l-Avjazzjoni	Adverse	Oper'n	Local	Direct	L-term	Perm	Revers	Local	Likely	Moderate to major	None	Moderate to major

APPENDIX

Base Photos and Photomontages

Viewpoint 2: Base photo (passenger view)

VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 07

EXISTING VIEW ; This image must be viewed at a comfortable arm's length

Viewpoint 2: Photomontage

VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 08

PROPOSED VIEW; This image must be viewed at a comfortable arm's length

Viewpoint 2 – Base photo (driver view)

VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 07

EXISTING VIEW ; This image must be viewed at a comfortable arm's length

Viewpoint 2 – Photomontage (driver view)

VIEWPOINT REFERENCE 02 Year 0 Distance to proposed development: 285m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1116 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 08

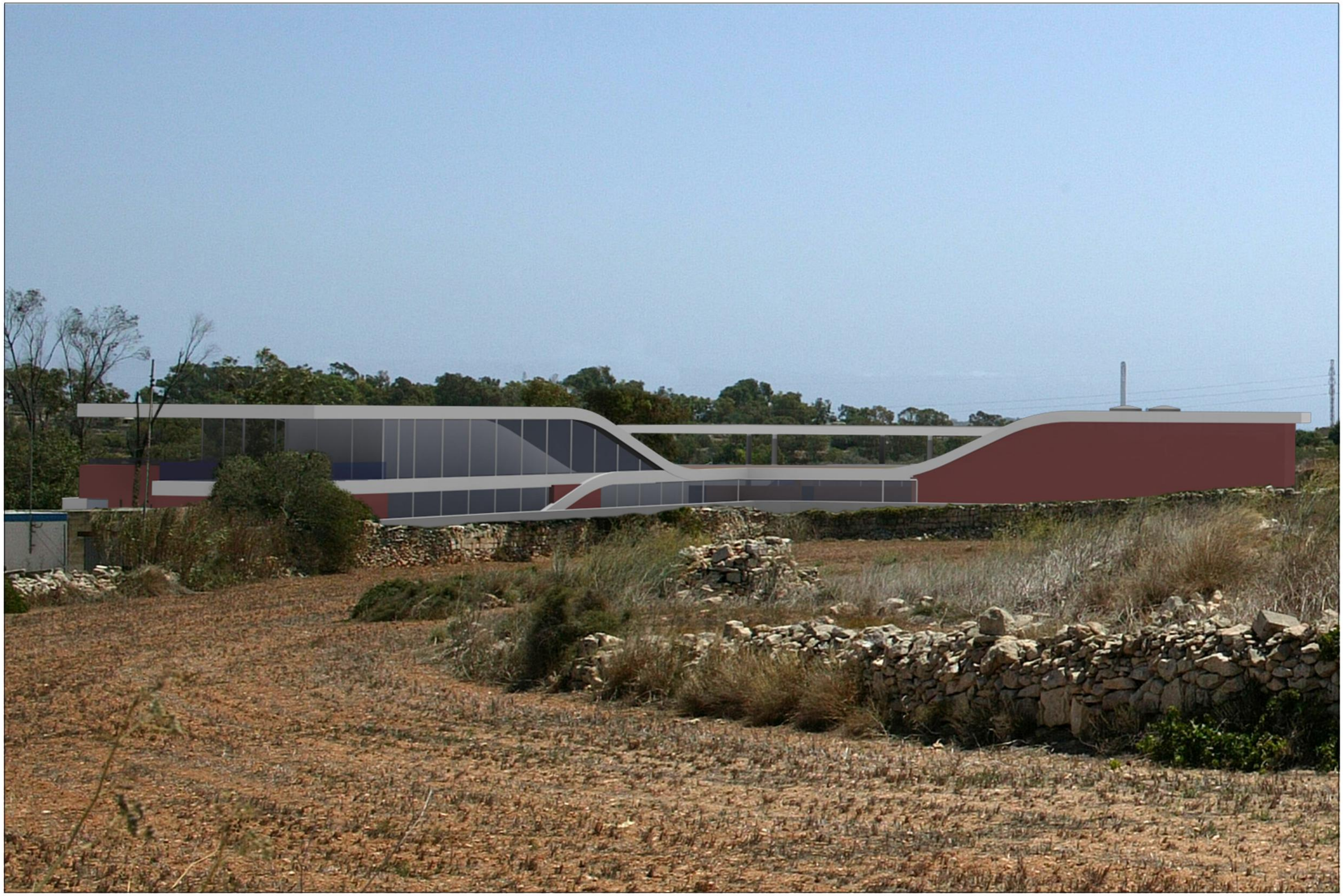
PROPOSED VIEW; This image must be viewed at a comfortable arm's length

Viewpoint 3 – Base photo

VIEWPOINT REFERENCE 03 Year 0 Distance to proposed development: 140m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1128 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 11

EXISTING VIEW ; This image must be viewed at a comfortable arm's length

Viewpoint 3 – Photomontage



VIEWPOINT REFERENCE 03 Year 0 Distance to proposed development: 140m Camera height: 1.5m Date / time of photograph: 06-Aug-16; 1128 Camera type: EOS 1DS; VFOV: 18.2deg HFOV: 27deg Sheet number: 12

PROPOSED VIEW; This image must be viewed at a comfortable arm's length

ADi ASSOCIATES

TN160087

Demolition of Existing Structures and Construction of Fuel Filling Depot including Ancillary Offices, Facilities and Widening of Access Road, At Ħas-Saptan, Off Vjal l-Avjazzjoni, Ħas-Saptan, Għaxaq

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Technical Appendix 7

AIR DISPERSION MODEL

Prepared by David Harvey (ADM Ltd)

Supporting Documents for

Environmental Planning Statement

Signed Declaration in accordance with Regulation 28 (3)

Attn: Director of Environment Protection (MEPA)

I, David Harvey, who carried out the Air dispersion Model for the EIA for the demolition of existing structures and construction of fuel filling depot including ancillary offices, facilities and widening of access road, at Ħas-Saptan, off Vjal l-Avjazzoni, Ħas-Saptan, Għaxaq, hereby declare that such study was solely carried out by me on behalf of Adi Associates Environmental Consultant ADM Ltd.

1st August 2016

Date

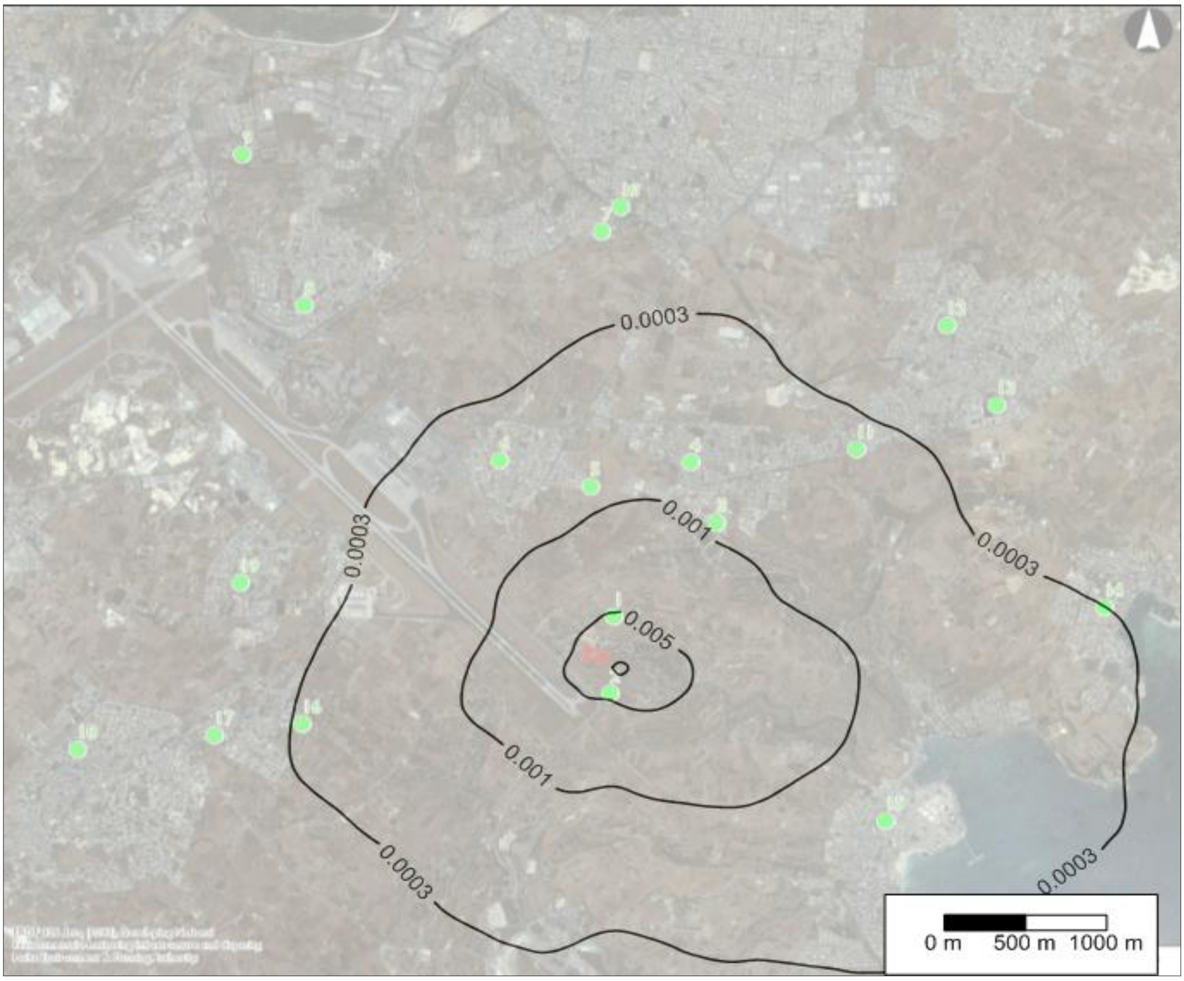
Signature

AERMOD Predicted Annual Average Concentraton of Benzene (µg/m3)

Receptor			2011	2012	2013	2014	2015	Maximum
1	455708	3966255	0.00595	0.00499	0.00398	0.00503	0.00384	**0.00595**
2	455685	3965753	0.00588	0.00575	0.00635	0.00564	0.00640	**0.00640**
3	456339	3966866	0.00086	0.00080	0.00071	0.00075	0.00063	**0.00086**
4	456182	3967263	0.00069	0.00056	0.00044	0.00049	0.00042	**0.00069**
5	455565	3967104	0.00079	0.00069	0.00057	0.00062	0.00053	**0.00079**
6	455005	3967274	0.00045	0.00037	0.00038	0.00038	0.00035	**0.00045**
7	455633	3968770	0.00020	0.00016	0.00013	0.00015	0.00013	**0.00020**
8	453801	3968288	0.00014	0.00013	0.00012	0.00013	0.00010	**0.00014**
9	453420	3969271	0.00009	0.00008	0.00008	0.00008	0.00007	**0.00009**
10	455749	3968930	0.00019	0.00015	0.00012	0.00014	0.00012	**0.00019**
11	457202	3967346	0.00036	0.00033	0.00030	0.00026	0.00023	**0.00036**
12	457761	3968157	0.00019	0.00018	0.00016	0.00015	0.00012	**0.00019**
13	458066	3967636	0.00022	0.00019	0.00017	0.00015	0.00014	**0.00022**
14	458728	3966314	0.00030	0.00026	0.00015	0.00021	0.00017	**0.00030**
15	457383	3964920	0.00058	0.00059	0.00048	0.00041	0.00054	**0.00059**
16	453788	3965552	0.00032	0.00025	0.00026	0.00020	0.00028	**0.00032**
17	453248	3965478	0.00021	0.00017	0.00017	0.00013	0.00019	**0.00021**
18	452405	3965387	0.00013	0.00010	0.00011	0.00008	0.00012	**0.00013**
19	453407	3966474	0.00018	0.00018	0.00018	0.00021	0.00018	**0.00021**
	Maximum		**0.00595**	**0.00575**	**0.00635**	**0.00564**	**0.00640**	**0.00640**

Note: Central contour is 0.02 µg/m3

AERMOD Predicted Annual Average Concentraton of Benzene (µg/m3), 2011 Meteorological Data



AERMOD Predicted Annual Average Concentraton of Benzene (µg/m3), 2015 Meteorological Data